2002 FEIS HAWAII
KALOKO-HONOKOHAU BUSINESS PARK
2 OF 2

MAY 23 2003

ORIGINAL

FILE COPY

Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDICES

Honokohau, North Kona District, Hawai`i Island, State of Hawai`i
TMK (3rd): 7-4-8:13 (por.) and 30

LAND USE COMMISSION
STATE OF HAWAII
2002 MAY -2 A 8:50

Prepared for:
Lanihau Properties, LLC
3465 Waialae Ave., Suite 260
Honolulu HI 96816

Prepared by:
Geometrician Associates
HC 2 Box 9575
Kea`au HI 96749

March 2002

Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDICES

Honokohau, North Kona District, Hawai`i Island, State of Hawai`i
TMK (3rd): 7-4-8:13 (por.) and 30

March 2002

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APPENDIX 3	Impact on Water Resources Report
APPENDIX 4	Assessment of Effects to Marine and Pond Environments
APPENDIX 5	Toxic Substances/Pollution Prevention Plan
APPENDIX 6	Botanical Survey
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APPENDIX 9	Market Study and Economic Impact Report
APPENDIX 10	Cultural Impact Assessment
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Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 1

Conservation District Use Permit

RECEIVED AS FOLLOWS

MAILED ORIGINAL
DEL. [illegible]
[illegible] 7/15/66

JOHN A. BURNS
GOVERNOR OF HAWAII

1966 JUL 13 AM 7:30

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

July 13, 1966

J. M. Tanaka Construction Inc.
P. O. Box 1111
Honolulu, Hawaii

Gentlemen:

The Board of Land and Natural Resources, at its July 8, 1966 general meeting, approved your request for quarrying operation (removal and processing of natural material) on 261.723 acres of land within the Conservation District, identified as portion of TMK 7-4-08-05, Honokahau, North Kona, Hawaii.

This approval is subject, however, to Paragraph C (Conditions GU Conservation Subzone) and Paragraph F (Compliance with Statutes, etc.) of Section 2, Regulation No. 4, Department of Land and Natural Resources.

Please feel free to call me should you have any questions concerning this matter.

Very truly yours,

Sunao Kido

SUNAO KIDO, Deputy
for Jim P. Ferry, Chairman & Member
Board of Land and Natural Resources

RECEIVED AS FOLLOWS

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Honolulu, Hawaii

July 8, 1966

Board of Land and
Natural Resources
State of Hawaii
Honolulu, Hawaii

Gentlemen:

Conservation District Application
(HA-66/6/13-35)

APPLICANT: J. M. Tanaka Construction, Inc.
P. O. Box 1111
Honolulu, Hawaii

LOCATION: TMK: 7-4-08-05 (portion), Hawaii
Conservation District Map HA-Keahole Point

AREA: 261.723 acres

USE REQUESTED: Excavation and quarrying operation: Removal and processing of natural material.

BACKGROUND: J. M. Tanaka Construction, Inc., is requesting permission for the use of 261.723 acres of land, identified as portion of TMK 7-4-08-05, Hawaii, for quarrying operation, including removal and processing of natural material and uses appurtenant to quarrying operation.

ANALYSIS: In accordance with the Conservation District Map HA-Keahole Point, approximately 231.723 acres are within the "General Use" subzone of the Conservation District and the remaining 30 acres are within the Agricultural District. The requested use may be permitted under Section 2B(1)(j) of Regulation No. 4, Department of Land and Natural Resources.

On the 20.723 acre section, the following uses are proposed:

1) Portable rock crusher;

2) Two structures for office work and machine repair;

3) Space for stock piling of finished material.

ITEM F-2

RECEIVED AS FOLLOWS

On the remaining 241 acres, pit quarrying will be conducted only in areas lying mauka of the boundary 2,000 feet from the proposed extension of Kailua-Kawaihae Road. The area between the proposed extension of Kailua-Kawaihae Road and the boundary 2,000 feet mauka from this road will be limited only to surface removal. After completing the removal of rock from any given area, the surface of the ground will be made reasonably smooth and in condition to facilitate the later development of the area for other purposes. The intended use of this site will be for 40 years. Operation will commence about 3 months after approval of this project.

Staff is of the opinion that the proposed use is compatible and appropriate within the Conservation District. No adverse comments have been received from our State and County agencies. No serious problems relating to recreation and scenic resources are anticipated.

RECOMMENDATION: It is recommended that this request for quarrying operation (removal and processing of natural materials) be approved subject to Paragraph C (Conditions GU Conservation Subzone) and Paragraph F (Compliance with Statutes, etc.) of Section 2, Regulation No. 4, Department of Land and Natural Resources.

Respectfully submitted,

PAUL T. TAJIMA, Program
Planning Coordinator

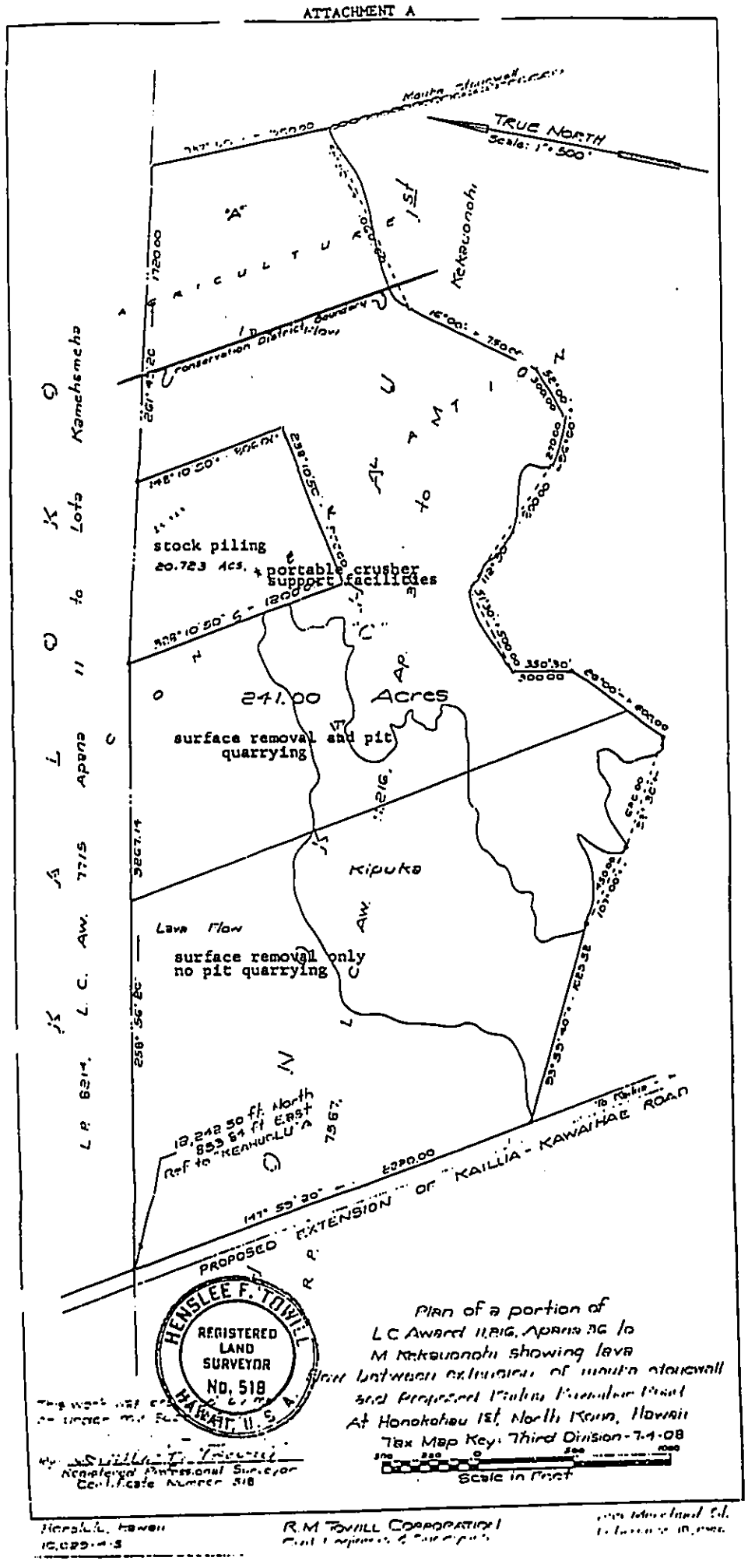
attach.

RECOMMENDED FOR APPROVAL:

JIM P. FERRY, Chairman

RECEIVED AS FOLLOWS

ATTACHMENT A



Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 2

Comments and Responses to EISPN

Dear Participant:

Attached for your review is a Environmental Impact Statement Notice of Preparation (EISPN) which was prepared pursuant to the EIS law (Hawaii Revised Statutes, Chapter 343) and the EIS rules (Administrative Rules, Title 11, Chapter 200).

Project Name: Kaloko-Honokohau Business Park
Location: Island: Hawaii District: North Kona
Tax Map Key Number: (3rd): 7-4-8:13 (por.) and 30
Applicant or Agency Action? Applicant

Your comments must be received or postmarked by: July 8, 2000

Please send original comments to the:

Applicant:	Lanihau Partners, L.P., c/o Tsukazaki, Yeh and Moore	
Address:	100 Paushi Street, Suite 204 Hilo, Hawaii 96720	
Contact:	Michael Moore	Phone: 961-0055

Copies of the comments should be sent to:

Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

and the following:

Approving Agency/ Accepting Authority:	Hawaii State Land Use Commission P.O. Box 2359 Honolulu, Hawaii 96804-2359	
Contact:	Esther Ueda	Phone: 587-3822
Consultant:	GeoMetrician Associates	
Address:	HC 2 Box 9575 Keaau HI 96749	
Contact:	Ron Terry	Phone: 982-5831

If you no longer need the EISPN, please recycle it. Thank you for your participation in the EIS process.

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 27, 2000

Ms. Esther Ueda, Executive Officer
State Land Use Commission (DBEDT)
P.O. Box 2359
Honolulu HI 96813
Attn: Russell Kumabe

Dear Ms. Ueda:

Subject: **Comment Letters/Responses to Comment Letters for Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park**

Attached is a copy of each letter on the EISPN received by our team, as well as our response to each letter. If you have any questions, you may call me at 982-5831.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
William L. Moore Planning

PHONE (808) 594-1888

FAX (808)

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

June 19, 2000

Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawai'i 96720
Attn: Michael Moore

EIS# 398

Subject: EISPN for Kaloko-Honokohau Business Park; Reclassification of Land in the Conservation District; TMK: 7-4-8:13 (por.) and 30

Dear Mr. Moore,

Thank you for the opportunity to respond to the above-referenced document. Since the archaeological inventory survey is still being reviewed by the State Historic Preservation Division and the cultural resources and impacts study won't be available until the Draft EIS, the Office of Hawaiian Affairs would like to reserve our comments until we have reviewed the Draft EIS.

If you have any questions, please call Ken R. Salva Cruz, Policy Analyst. at 594-1847.

Sincerely,

Colin C. Kippen, Jr.
Deputy Administrator

cc: Board of Trustees
OEQC
LUC
GeoMetrician Associates
Kona CAC
File

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Colin C. Kippen, Jr., Deputy Administrator
Office of Hawaiian Affairs
711 Kapi'olani Blvd., Suite 500
Honolulu Hl 96813

Dear Mr. Kippen:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of June 19, 2000, commenting on the EISPN , in which you stated that you would reserve comment until your office has reviewed the Draft EIS. We expect to issue the Draft EIS within the next few months, and we look forward to your comments.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

United States Department of the Interior

GEOLOGICAL SURVEY
Hawaiian Volcano Observatory
P. O. Box 51
(Courier address: 1 Crater Rim Drive)
Hawaii National Park, HI 967
U. S. A.18
Voice: (808) 967-8863 or 967-7328
Fax: (808) 967-8819 or 967-8890
E-mail: donswan@usgs.gov

June 20, 2000

Michael Moore
Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, HI 96720

Dear Mr. Moore:

I have read the EISPN for the Project Kaloko-Honokohua Business Park and, from the standpoint of lava-flow and earthquake hazards, have nothing to add to the description given on p. 4-2 and 4-3. The EISPN correctly states that "there is minor risk of lava inundation over relatively short time scales." I agree with the conclusion that "geologic conditions impose no constraints on the project."

Sincerely yours,

Donald A. Swanson

Donald A. Swanson
Scientist-in-Charge

JUN 26 2000

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Dr. Donald A. Swanson, Scientist in Charge
United States Geological Survey
Hawaiian Volcano Observatory
Hawaii National Park, HI 96718-0051

Dear Dr. Swanson:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of June 20, 2000, commenting on the EISPN , in which you state that you agree with our evaluations of lava flow and earthquake hazards. We appreciate your review of the EISPN.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII
25 AUPUNI STREET • HILO, HAWAII 96720
TELEPHONE (808) 961-8660 • FAX (808) 961-8657

June 27, 2000

Lanihau Partners, L.P.
c/o Tsukazuki Yeh & Moore
Attorneys at Law
100 Pauahi Street, Suite 204
Hilo, HI 96720

ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN) FOR KALOKO-HONOKOHAU BUSINESS PARK
TAX MAP KEY: 7-4-008:PORTION OF 013 AND 030

We have reviewed the subject EISPN and have the following comments.

Submit the anticipated maximum daily water usage as recommended by a registered engineer and a master plan of the water system improvements in accordance with the 1991 Hawaii County Water Use and Development Plan indicated in Item 4.3, Chapter 4, page Nos. 4-14 of the EISPN for our review and approval.

Should there be any questions, please call our Water Resources and Planning Branch at 961-8665.

Sincerely yours,

Milton D. Pavao, P.E.
Manager

WA:gms

copy - OEQC
Hawaii State Land Use Commission

JUN 28 2000

... Water brings progress...

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Mr. Milton Pavao, Manager
Hawaii County Dept. Of Water Supply
25 Aupuni Street
Hilo, HI 96720

Dear Mr. Pavao:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of June 27, 2000, commenting on the EISPN , in which you request that we supply your Department with the anticipated maximum daily water usage as recommended by a registered engineer and a master plan of water system improvements. We will supply your agency with the requested information, and will include this and other water system information in the Draft EIS.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Stephen K. Yamashiro
Mayor

County of Hawaii
OFFICE OF HOUSING AND COMMUNITY DEVELOPMENT

50 Wailuku Drive • Hilo, Hawai'i 96720-2484
V/TT (808) 961-8379 • FAX (808) 961-8685

June 21, 2000

Lanihau Partners, L. P.
C/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawai'i 96720

Subject: Kaloko-Honokohau Business Park
North Kona, Hawai'i
TMK: 7-4-8:13(por.) and 30

The Office of Housing and Community Development (OHCD) acknowledges receipt of the Environmental Impact Statement Notice of Preparation for the subject property.

Thank you for providing us with the opportunity to review and comment. The OHCD has no comments to offer at this time.

Edwin S. Taira
Assistant Housing Administrator

C: Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

Esther Ueda
Hawai'i State Land Use Commission
P. O. Box 2359
Honolulu, Hawai'i 96804-2359

Ron Terry
GeoMetrician Associates
HC 2 Box 9575
Kea'au, Hawai'i 96749

EQUAL HOUSING OPPORTUNITY
"AN EQUAL OPPORTUNITY EMPLOYER"

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Mr. Edwin S. Taira, Administrator
Hawaii County Off. Hous. Comm. Dev.
50 Wailuku Drive
Hilo, HI 96720

Dear Mr. Taira:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of June 21, 2000, commenting on the EISPN , in which you stated that you had no comments on the EISPN. Unless we hear from you otherwise, we will not be sending a Draft EIS to your office.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

GENEVIEVE SALMONSON
DIRECTOR

June 27, 2000

Ms. Esther Ueda
Executive Director
State Land Use Commission
235 South Beretania Street, 4th Floor
Honolulu, Hawaii 96813

Dear Ms. Ueda:

Subject: EISPN for Kaloko-Honokohau Business Park

Thank you for the opportunity to review and comment on the subject document. We have the following comments.

1. The Draft EIS should include a full assessment of the water source, transmission and storage facilities for the full build-out.

2. What is the status of Kealakehe Parkway? Where does Hina Lani Drive connect with Kealakehe Parkway?

3. In preparing the cultural resources and impacts study, please consider the Environmental Council's Guidelines for Assessing Cultural Impacts.

4. Section 2.3 of the EISPN, refers to a "Master Plan." Please describe the referenced "Master Plan."

5. The Draft EIS should include an assessment of the impact of dust and other air emissions from the expansion of the quarry uphill of the industrial/commecial mixed use area. How does the wind pattern affect the transport of dust and air pollution. What is the impact to nearby communities?

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson
Director

c: Lanihau Partners
GeoMetrician Associates

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

Dear Ms. Salmonson:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of June 27, 2000, commenting on the EISPN. Our responses to your individual comments are as follows:

1. *Water Facilities.* The Draft EIS will include a full discussion of water source, transmission, and storage facilities.
2. *Kealakehe Parkway.* We have coordinated with the Hawaii State Department of Transportation to gain the best estimate of what segments of the proposed extension are expected to be completed during various phases of our project. We will discuss this in the Traffic Impacts section of the Draft EIS.
3. *Cultural Impacts Guidelines.* Our cultural impacts consultant has used these guidelines in developing his report, which will be included and fully discussed in the Draft EIS.
4. *Master Plan.* The Master Plan, which is conceptual in nature, is fully contained in the table and map included in Figure 2-1. A more complete discussion of the components of the Master Plan will be contained in the Draft EIS.
5. *Impact of Quarry on Air Quality.* Air quality impacts, including those from the quarry, will be fully discussed in the Draft EIS.

Again, we thank you for your detailed comments.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

TIMOTHY E. JOHNS, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JANET E. KAMELA

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

June 30, 2000

Mr. Michael Moore
Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suit 204
Hilo, Hawaii 96720

LOG NO: 25667
DOC NO: 0006PM25

Dear Mr. Moore:

SUBJECT: Environmental Impact Statement Preparation Notice
Honokohau, North Kona, Hawaii Island
TMK: 7-4-8: 13 (Por.) and 30

This is in response to the request for comments on the subject document, which was received in our office on June 19, 2000.

The applicant seeks to use the above referenced location for mixed light industrial and commercial uses, and to allow the retention and expansion of the existing quarry and quarry-related uses.

The subject parcels were part of an archaeological inventory survey of 803 acres of land conducted by Cultural Surveys Hawaii in 1992. A draft report was submitted for review in 1993. A second draft report was submitted in 1998. We now have a third draft which was received earlier this year. This latest draft is still under review, so there is still no agreement on the number of significant historic sites in the proposed project area, how many sites will require mitigation and what kind of mitigation.

The EISPN indicates that the Draft EIS will contain an expanded discussion of the archaeological survey and recommended mitigation treatments. We look forward to reviewing that document.

JUL 1 :: 2000

If you or your staff should have any questions about the archaeological inventory survey report please contact our Hawaii Island archaeologist, Patrick McCoy (692-8029).

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

PM:amk

c. Director, Office of Environmental Quality Control

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Mr. Don Hibbard
State Historic Preservation Division
Hawaii Department of Land and Natural Resources
601 Kamokila Blvd., Room 555
Kapolei HI 96707

Dear Mr. Hibbard:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of June 30, 2000, commenting on the EISPN, in which you state that the archaeological reports for the subject area are still under review and that you look forward to reviewing the Draft EIS. We expect to issue the Draft EIS within the next few months, and we look forward to your comments.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Ecoregion
300 Ala Moana Blvd, Rm 3-122
Box 50088
Honolulu, HI 96850

JUL - 7 2000

In Reply Refer To: JAK

Mr. Michael Moore
Lanihau Partners, L.P.,
c/o Tsuzaki, Yeh, and Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

Re: Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park, Honokohau, North Kona, Hawaii

Dear Mr. Moore:

The U.S. Fish and Wildlife Service (Service) has reviewed the EISPN for the Kaloko-Honokohau Business Park, Honokohau, North Kona, Hawaii. The project sponsor is Lanihau Partners, L.P. The proposed project involves a petition for the reclassification and rezoning of 336 acres in the Conservation District to "Urban" to allow for development of commercial and mixed light industrial uses. The Service offers the following comments for your consideration.

Based on our review of the information provided and in our files, the federally endangered Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian duck (*Anas wyvilliana*), and Hawaiian coot (*Fulica alai americana*), as well as two candidate shrimp species, *Metabetaeus lohena* and *Palaemonella burnsi* are known to occur at two anchialine ponds located within the Kaloko-Honokohau National Park (Park) makai (west) and downslope of the petition area. In addition, the two ponds may support the following candidate endangered shrimp species, including: *Antecaridina lauensis*, *Calliasmata pholidota*, *Procaris hawaiana*, and *Vetacaris chaceorum*. The two ponds are hydrologically connected to groundwater and the ocean by a permeable aquifer. The freshwater component of the groundwater flow in the Park is an important component in sustaining suitable nesting and feeding habitat for the above-mentioned species.

Based on these considerations, the Service recommends that the Draft EIS address any potential impacts which may result from construction and operation of the proposed project and evaluate alternatives to avoid and minimize any potential impacts to the pond and marine environment which support federally endangered and candidate species.

If you have questions regarding these comments, please contact Fish and Wildlife Biologist James Kwon by telephone at (808) 541-3441 or by facsimile transmission at (808) 541-3470.

Sincerely,

for Paul Henson
Field Supervisor
Ecological Services

cc: Director, OEQC
E. Ueda, State Land Use Commission
R. Terry, GeoMetrician Associates

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Paul Henson, Field Supervisor
Ecological Services, Pacific Island Ecoregion
U.S. Fish and Wildlife Service
P.O. Box 50088
Honolulu HI 96850

Dear Mr. Henson:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 7, 2000, commenting on the EISPN , in which you list the endangered species found in the region and recommend that we address impacts and evaluate alternative and mitigation for these impacts. This information will be included in the Draft EIS, which we expect to issue the Draft EIS within the next few months. We look forward to your comments.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

(P)1341.0

JUL 10 2000

Mr. Michael Moore
Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

Dear Mr. Moore:

Subject: Kaloko - Honokohau Business Park
Environmental Impact Statement Preparation Notice
(EISPN)

We have reviewed the EISPN for the subject project. The following are our comments:

1. The Housing and Community Development Corporation of Hawaii (HCDCH) should be included in the Draft Environmental Impact Statement (DEIS) review process as they are a principal landowner of the neighboring Villages of Laiopua subdivision.

2. Belt Collins Hawaii (BCH) is involved with planning work in the Keahuolu subdivision (which is located to the south of the subject property) for the Queen Liliuokalani Trust (QLT). These organizations (BCH and QLT) should be included in the review of the DEIS.

3. The DEIS shall include information regarding any impact on the neighboring Keahuolu subdivision. The Department of Accounting and General Services is proposing to locate a Civic Center complex in the this subdivision and is concerned about any adverse effects (e.g. noise, dust, traffic) resulting from the subject project's land use reclassification.

If there are any questions regarding the above, please have your staff call Mr. Tyler Fujiyama of the Planning Branch at 586-0492.

Sincerely,

GORDON MATSUOKA
Public Works Administrator

TBF:mo
c: Belt Collins Hawaii
Queen Liliuokalani Trust
Office of Environmental Quality Control
Hawaii State Land Use Commission
GeoMetrician Associates
HCDCH

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Gordon Matsuoka, Public Works Administrator
Hawaii Dept. of Accounting and General Services
P.O. Box 119
Honolulu HI 96810

Dear Mr. Matusoka:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 10, 2000, commenting on the EISPN. Our responses to your individual comments are as follows:

1-2. *Include HCDCH and Belt-Collins in Draft EIS Distribution List.* We will provide them a copy of the Draft EIS.

3. *Impacts to Keahuolu Subdivision.* We will assess the potential impacts to this subdivision in the Draft EIS and propose mitigation measures should there be any adverse impacts.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Geneviève Salmonson, Office of Environmental Quality Control

Received Jul-19-00 10:40am from 808 9691531 → GEO page 1
07/19/2000 10:38 FAX 808 9691531 TTH ATTYS-AT-LAW 001

BENJAMIN J. CAYETANO
GOVERNOR

SHARYN L. MIYASHIRO
ACTING EXECUTIVE DIRECTOR

ROBERT J. HALL
ACTING EXECUTIVE ASSISTANT

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT AND TOURISM
HOUSING AND COMMUNITY DEVELOPMENT CORPORATION OF HAWAII
677 QUEEN STREET, SUITE 300
Honolulu, Hawaii 96813
FAX (808) 587-0600

IN REPLY REFER TO:
001.FEO/FI722

July 7, 2000

Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

Attn: Michael Moore

Dear Mr. Moore:

Re: Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

We have reviewed the subject EISPN and have no comments to offer at this time.

Thank you for the opportunity to comment.

Sincerely,

SHARYN L. MIYASHIRO
Acting Executive Director

c: Director, Office of Environmental Quality Control
Esther Ueda, State Land Use Commission
Ron Terry, GeoMetrician Associates

JUL 11 2000

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Ms. Sharyn L. Miyashiro, Acting Executive Director
Housing and Community Development Corp. of Hawaii
677 Queen Street, Suite 300
Honolulu HI 96813

Dear Ms. Miyashiro:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 7, 2000, commenting on the EISPN, in which you state that you have no comments at this time.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Stephen K. Yamashiro
Mayor

Edward Bumatay
Fire Chief

Russel M. Miyao
Deputy Fire Chief

County of Hawaii
FIRE DEPARTMENT
777 Kilauea Avenue • Mail Lane, Room 6 • Hilo, Hawaii 96720-4229
(808) 961-8297 • Fax (808) 961-8296

July 10, 2000

Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, HI 96720

Attention: Michael Moore

Re: Kaloko-Honokohau Business Park
North Kona, Hawaii
Tax Map Key: (3rd) 7-4-8:13 (por.) and 30

We have no comments on the Environmental Impact Statement Notice of Preparation for the above-referenced project.

EDWARD BUMATAY
Fire Chief

EB/mo

cc: Director, Office of Environmental Quality Control
Esther Ueda, Hawaii State Land Use Commission
✓Ron Terry, GeoMetrician Associates

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Edward Bumatay, Chief
Hawaii County Fire Department
777 Kilauea, Mall Lane, Room 6
Hilo, Hawaii 96720-4239

Dear Chief Bumatay:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 10, 2000, commenting on the EISPN, in which you state that you have no comments.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

BENJAMIN J. CAYETANO
GOVERNOR

MAJOR GENERAL EDWARD L. CORREA, JR.
DIRECTOR OF CIVIL DEFENSE

EDWARD T. TEIXEIRA
VICE DIRECTOR OF CIVIL DEFENSE

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

PHONE (808) 733-4300
FAX (808) 733-4287

July 17,2000

TO: Mr. Michael Moore
Lanihau Partners, L.P.
c/o Tsukazaki Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

FROM: Edward T. Teixeira
Vice Director of Civil Defense

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT NOTICE OF PREPARATION FOR THE KALOKO-HONOKOHAU BUSINESS PARK

We appreciate the opportunity to comment on the Environmental Impact Statement Notice of Preparation for the Kaloko-Honokohau Business Park, Honokohau, North Kona, island of Hawaii, State of Hawaii, TMK 7-4-08: 13 (por) and 30.

Request that the developer add a siren using solar power with 117 Dbc omni directional speaker array. It is also suggested that the siren be installed in a central location adjacent to Kamanu Street near "Road A." At the present time, the closest siren to this project is located at Honokohau Harbor and offers no coverage to this project location.

State Civil Defense technicians and planners are available to assist and answer any questions you may have. If there are any further questions, please have your staff contact Mr. Norman Ogasawara of my staff at 733-4300.

c: Director
Office of Environmental Quality Control
235 S. Beretania Street, Suite 702
Honolulu, Hawaii 96813

Hawaii State Land Use Commission
P. O. Box 2359
Honolulu, Hawaii 96804-2359
Attn: Esther Ueda

✓GeoMetrician Associates
HC 2 Box 9575
Keaau, HI 96749
Attn: Ron Terry

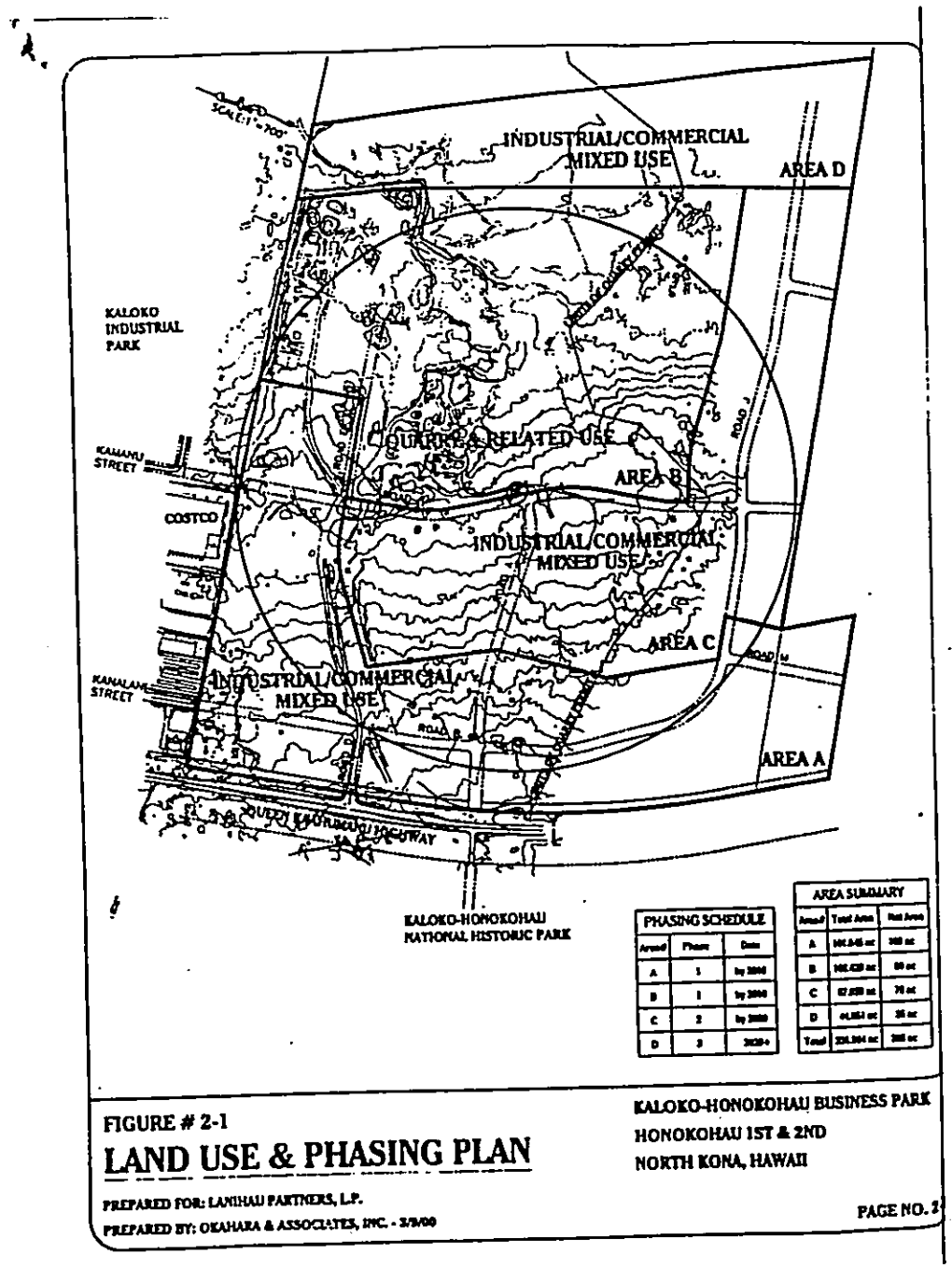


FIGURE # 2-1

LAND USE & PHASING PLAN

KALOKO-HONOKOHAU BUSINESS PARK
HONOKOHAU 1ST & 2ND
NORTH KONA, HAWAII

PREPARED FOR: LANIHAU PARTNERS, L.P.
PREPARED BY: OKAHARA & ASSOCIATES, INC. - 3/9/00

PAGE NO. 2

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Edward T. Texeira,
Vice-Director of Civil Defense
Hawaii Department of Defense
3949 Diamond Head Rd.
Honolulu HI 96816-4495

Dear Mr. Texeira:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 17, 2000, commenting on the EISPN, in which you request that the developer add a siren using solar power with a 117 Dbc omni-directional speaker array, and suggest that it have a central location. We agree to the installation of the siren, and will work with Civil Defense to identify the proper location.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

United States Department of the Interior

NATIONAL PARK SERVICE
KALOKO-HONOKOHAU NATIONAL HISTORICAL PARK
73-4786 Kanalani St., #14
Kailua-Kona, Hawaii 96740

L76

July 20, 2000

Mr. Bill Moore
Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

Dear Mr. Moore:

Thank you for the opportunity to comment on the Environmental Impact Statement Preparation Notice for the Kaloko-Honokohau Business Park. The National Park Service is charged with preserving cultural and natural resources found within nearby Kaloko-Honokohau National Historical Park. Developments on mauka lands have the potential to affect park resources.

We have a number of concerns with mauka development. Primary is the appropriate disposal of waste and storm water. Studies completed by the US Geological Survey in Kaloko-Honokohau NHP (Ground Water Resources in Kaloko-Honokohau National Historical Park, Island of Hawaii, and Numerical Simulation of the Effects of Ground-Water Withdrawals, U.S. Geological Survey Water-Resources Investigation Report 99-4070) indicate that water resources in the park are vulnerable to groundwater contamination upgradient of the park. These resources include fishponds, anchialine ponds, and marine waters. Current development mauka of the park contains inadequate systems for removing contaminants from waste and or storm water prior to its entry into the groundwater system. Park biological and cultural resources are being adversely affected. The park contains significant water resources with unique ecosystems. Waters in the park are home to a number of threatened or endangered species and species of concern. These include the endemic Hawaiian stilt and coot. Contamination of these ecosystems by water entering the park is a threat to these federally protected species. The appropriate disposal of waste and storm water runoff would be off-site at the Hawaii County sewer treatment plant. Therefore sewer and storm water drainage systems need to be addressed in detail in the Environmental Impact Statement (EIS).

The above mentioned groundwater study as well as one for the entire Kona area (Geohydrology and Numerical Simulation of the Ground-Water Flow System of Kona, Island of Hawaii; U.S. Geological Survey Water-Resources Investigations Report 99-4073) addresses the potential for decreases in ground water levels due to increased water withdrawal. Decreasing ground water levels could change salinity levels in the fishponds and anchialine ponds, adversely affecting the species that inhabit these areas. How the Kaloko-Honokohau Business Park would alter ground water levels also needs to be addressed in the EIS.

Water quality also affects cultural resources within the park. Degradation of fishpond waters may affect the cultural practice of fish harvesting and utilization. Kahinihiniula, also known as the Queen's Bath, could be adversely affected by negative changes to water quality. Overall, it is difficult to separate natural from cultural resources when they are as strongly integrated as in Hawaiian culture.

The Kaloko-Honokohau Business Park will create traffic coming into the complex and increase traffic on Queen Kaahumanu Highway. We would like to see information in the EIS on the estimated increase in traffic and measures planned to alleviate traffic congestion.

Finally, changes in the landscape can adversely affect the viewscape of a cultural park. We recognize that development will occur mauka of the park, and that visual elements of the park have been and will continue to be affected by this development. Appropriate plantings would reduce these impacts. The park has developed a Vegetation Management Plan that addresses landscaping and we would be glad to act as a resource in helping you choose appropriate plants for this project.

Again, we appreciate the opportunity to comment on this project at such an early date. The park wishes to be a consulting party in the EIS process. We look forward to further communications that might benefit all residents of the Kona area.

Mahalo,

Geraldine K. Bell
Superintendent

cc:
Director, State Office of Environmental Quality Control
Hawaii Sate Land Use Commission
✓GeoMetrician Associates

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 882-5831

September 28, 2000

Ms. Geraldine Bell, Superintendent
Kaloko-Honokohau National Historic Park
73-4786 Kanalani St., Ste. 14
Kailua-Kona HI 96740

Dear Ms. Bell:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 20, 2000, commenting on the EISPN. Our responses to your individual comments are as follows:

1. *Water Quality Issues.* We agree that preservation of water quality is essential for the health of the park's fishponds, anchialine ponds, marine waters, wildlife, and cultural values and practices. The Draft EIS will include an assessment of the project's potential effects to groundwater, Kaloko and Aimakapa ponds, and nearshore marine waters. Measures to minimize any impacts are also discussed, including Best Management Practices (BMPs) that would be implemented to minimize the transfer of contaminants from the project site to these waters. Furthermore, the assessment includes an analysis of impacts to groundwater resources, and calculates the impacts of groundwater withdrawals on potable use quality and quantity, and recharge of the basal lens. This assessment includes consideration of nearby existing and planned projects. Our consultants have reviewed the study you reference and have incorporated the findings in their study.
2. *Traffic.* The Draft EIS will discuss the estimated impact of the proposed project on the principal roadways in the vicinity, including Queen Kaahumanu Highway, and identify any mitigation measures that may be required.
3. *Landscaping.* Landscaping is an important part of our design plans. Landscaping will be implemented to develop the design theme, to provide beauty and variety in the landscape, and to minimize or screen any visual impacts from the project. The landowners and/or tenants of the individual lots will be required to provide and maintain on-site landscaping in accordance with landscaping criteria developed for the project.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Stephen K. Yamashiro
Mayor

Wayne G. Carvalho
Police Chief

James S. Correa
Deputy Police Chief

County of Hawaii
POLICE DEPARTMENT

349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-2702

July 5, 2000

Mr. Michael Moore
Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

Dear Mr. Moore:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE
KALOKO-HONOKOHAU BUSINESS PARK
NORTH KONA, HAWAII
TAX MAP KEY: (3RD): 7-4-8:13 (POR.) AND 30

We will reserve our comments on the above-referenced Environmental Impact Statement preparation notice until we have had an opportunity to review the traffic study, which will be published within the EIS.

Sincerely,

WAYNE G. CARVALHO
POLICE CHIEF

THOMAS J. HICKCOX
ASSISTANT POLICE CHIEF
FIELD OPERATIONS BUREAU

DAF:lk

cc: Office of Environmental Quality Control
Hawaii State Land Use Commission
GeoMetrician Associates

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Chief Wayne Carvalho
Hawaii County Police Department
349 Kapiolani St.
Hilo HI 96720

Dear Chief Carvalho:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 5, 2000, commenting on the EISPN, in which you state that you will reserve comment until the Draft EIS, when our traffic findings will be published. We expect to issue the Draft EIS within the next few months, and we look forward to your comments.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

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

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND DIVISION
STATE PARKS
WATER RESOURCE MANAGEMENT

JUL - 3 2000

REF:PB:LT

File No.: 00-183
HA-035

Mr. Michael Moore
Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

Dear Mr. Moore:

Subject: Environmental Impact Statement Preparation Notice (EISPN) for the Kaloko-Honokohau Business Park; TMK: (3) 7-4-08: por. 13 and 30, North Kona, Hawaii

We have reviewed the subject document and offer the following comments:

In 1967, the Board of Land and Natural Resources approved Conservation District Use Permit HA-035. At the time, Regulation No. 4, Revised Laws of Hawaii 1955, as amended, provided for quarrying activities as a land use and the economic conditions of the North Kona area made the use compatible with other activities. As a result, over the years, the quarry was expanded and related businesses engaging in light-industrial activities were developed.

Currently, the use is more appropriate in an industrial-commercial mixed use area. Further, we note that the Office of State Planning in the State's Land Use District Boundary Review recommended that the project area be reclassified from Conservation to Urban as part of the proposed Keahole to Kailua Urban area.

We support the proposed reclassification and rezoning efforts by Lanihau Partners, L.P.

Aloha,

Dean Uchida, Administrator

c: SLUC, OEQC
GeoMetrician Associates

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Dean Uchida, Administrator
Land Division
Hawaii Department of Land and Natural Resources
P.O. Box 621
Honolulu HI 96809

Dear Mr. Uchida:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 3, 2000, commenting on the EISPN , in which you outline the land use and land classifications for the area. We agree with your assessment that given the existing quarry permit, adjacent land uses, past recommendations from the Office of State Planning, and other factors, our proposed use is appropriate.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Stephen K. Yamashiro
Mayor

Virginia Goldstein
Director

Russell Kokubun
Deputy Director

County of Hawaii
PLANNING DEPARTMENT
25 Aupuni Street, Room 109 • Hilo, Hawaii 96720-4252
(808) 961-8288 • Fax (808) 961-8742

July 24, 2000

Michael Moore, Esq.
Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, HI 96720

Dear Mr. Moore:

Environmental Impact Statement Notice of Preparation (EISPN)
Kaloko-Honokohau Business Park
Applicant: Lanihau Partners, L.P.
Tax Map Key: 7-4-8:13 (Por.) and 30

Thank you for the opportunity to review and comment on the EISPN for the Kaloko-Honokohau Business Park project. We have the following comments to offer:

1. The goals, policies, standards and courses of action of the General Plan and the applicability to the proposed project should be discussed in the Draft Environmental Impact Statement (DEIS).

2. The Keahole to Kailua Development Plan discusses the sewerage plan for the North Kona area. This plan should be incorporated and addressed in the DEIS, including an assessment of connecting to the County's Kealakehe Wastewater Treatment Plant.

3. The General Plan and the Keahole to Kailua Development Plan propose the construction of a mid-elevation lateral connection between Palani Road and Ka'iminani Drive. The DEIS should include discussion relating to said mid-elevation roadway as it appears to be in the vicinity of the project area.

4. The DEIS should also discuss and address the project's location in relations to the Kealakehe School complex.

5. The State Department of Transportation and the Department of Education should be consulted in the review of the DEIS.

Should you have any questions, please feel free to contact Alice Kawaha of this department at 961-8288.

Sincerely,

VIRGINIA GOLDSTEIN
Planning Director

AK:pak
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xc: Ms. Genevieve Salmonson, Director, OEQC
Ms. Esther Ueda, Executive Director, LUC
Mr. Ron Terry
West Hawaii Office

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Virginia Goldstein, Director
Hawaii County Planning Department
25 Aupuni Street, Room 109
Hilo HI 96720

Dear Ms. Goldstein:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 24, 2000, commenting on the EISPN. Our responses to your individual comments are as follows:

1. *General Plan Goals, Policies, etc.* A discussion of the applicable goals, policies, objectives, and standards will be included in the Draft EIS.
2. *Sewerage Plan.* This plan and subsequent plans for dealing with wastewater in the Keahole to Kailua region will be discussed in the Draft EIS.
3. *Mid-Level Arterial Roads.* The Draft EIS will discuss the estimated impact of the proposed project on the principal existing and planned roadways in the vicinity, including Queen Kaahumanu Highway, and identify any mitigation measures that may be required, for the Full and Partial Build-Out scenarios.
4. *Kealakehe School.* The Kealakehe School complex will be considered in the Draft EIS.
5. *Consultation with the Departments of Transportation and Education.* These agencies will be sent a copy of the Draft EIS, and we will coordinate with them further as appropriate.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

BENJAMIN J. CAYETANO
GOVERNOR
SEIJI F. NAYA, Ph.D.
DIRECTOR
PHILIP J. BOSSERT
DEPUTY DIRECTOR
DAVID W. BLANE
DIRECTOR, OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-8716

July 24, 2000

Lanihau Partners, L.P.
c/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

Attn: Mr. Michael Moore

Gentlemen:

Subject: Kaloko-Honokohau Business Park
Environmental Impact Statement Preparation Notice (EISPN)
North Kona, Hawaii
TMK: 7-4-8: Por. 13, and 30
Land Use Commission Docket No. A00-730

We have reviewed the EISPN to develop the 337-acre project area for a mix of light industrial and commercial uses and to allow the retention and expansion of the existing quarrying and quarry-related uses. The Property is currently within the Conservation Land Use District, and the County of Hawaii General Plan designates the project area as Industrial and Urban Expansion.

The proposed project is located mauka of the Kaloko-Honokohau National Historic Park separated by Queen Kaahumanu Highway. We note that the offshore waters have been classified Class AA by the Department of Health. There are significant aquatic resources (fishponds) in the National Historic Park area which may be impacted by pollutants from industrial activities entering the groundwater due to the porous lava. Increased industrial activities may also impact the nearby State facilities of the Natural Energy Laboratory of Hawaii (NELH) and the Hawaii Ocean Science and Technology (HOST) Park which rely on the pristine quality of the seawater along the Kona coast.

The Land Use Commission has also received a Petition (Docket No. A00-732) by TSA International, Limited adjacent and to the north for similar uses. The cumulative impacts from both of these projects should be thoroughly assessed regarding infrastructure such as roads,

water, sewer, drainage and power, as well as cultural and natural resources associated with the Kaloko-Honokohau National Historic Park.

For wastewater disposal, the DEIS should include a discussion of the treatment of industrial as well as domestic waste from both projects.

Thank you for the opportunity to comment. Should you have any questions, please call Lorene Maki at 587-2888.

Sincerely,

David W. Blane
Director
Office of Planning

cc: Esther Ueda, LUC
OEQC
✓Geometrician Associates

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Kaaau, Hawaii 96749
(808) 982-5831

September 28, 2000

David Blane, Director
Office of Planning
Hawaii State Department of
Business, Economic Development & Tourism
P.O. box 2359
Honolulu HI 96804

Dear Mr. Blane:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 24, 2000, commenting on the EISPN. Our responses to your individual comments are as follows:

1. *Water Quality.* The Draft EIS will include an assessment of the project's potential effects to groundwater, Kaloko and Aimakapa ponds, and nearshore marine waters, and waters used by NELH. Measures to minimize any impacts are also discussed, including Best Management Practices (BMPs) that will be implemented to minimize the transfer of contaminants from the project site to these waters. Furthermore, the assessment includes an analysis of impacts to groundwater resources, and calculates the impacts of groundwater withdrawals on potable use quality and quantity, and recharge of the basal lens. This assessment includes consideration of nearby existing and planned projects.
2. *Cumulative Impacts Considering Related Projects.* The Draft EIS considers the TSA project as well as other related projects in its treatment of water quality and other natural resources as well as infrastructure needs.
3. *Wastewater.* The Draft EIS will include a discussion of the potential impacts of the project's sewer and storm water drainage system may have on surface and ground water within the Kaloko-Honokohau National Historic Park and environs. The generation and disposal of solid and hazardous waste will also be discussed. Measures to avoid, minimize or compensate for impacts will be discussed.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Lee
Communications, Inc.
Public Affairs • Community Involvement Specialists

July 24, 2000

To: Lanihau Partners, L.P.,
C/o Tsukazaki, Yeh and Moore
100 Pauahi Street Suite 204
Hilo, Hawaii 96720

Fr: Herb Lee, Jr.

Re: Comments on the EISPN re the proposed Kaloko-Honokohau Business Park.

Thank you for the opportunity to review the EISPN. I am responding as an individual based on my experience as President of the Waikalua Loko Fishpond Preservation Society in Kane'ohe, O'ahu and as a member of the Na Kokua Kaloko Honokohau Group.

My comments primarily go to the impact and protection of the Kaloko and 'Ai'makapa Fishponds.

Within the ahupua'a system, the location of these two fishponds are part of zone that allows the mixing of fresh water (through underground flows) with sea water. Both of these sources of water are critical to the health of the ponds. Maintaining the integrity of these sources of water should be foremost when considering any sort of development, mauka and within the ahupua'a of Kaloko and Honokohau.

EISPN:

Part 4.2.1 Water Resources and Drainage.

This section appears to cover all of the possible points to assess the potential impact makai of the proposed project site including the fishponds and coastal waters.

However, here are some further specifics that should be included:

Suggestion: Need to assess current water quality condition of the two fishponds. It does not specifically identify the fishponds rather as "Kaloko-Honokohau systems."

P.O. Box 1917 / Kailua, HI 96734-8917
(808) 262-3261 FAX (808) 261-0347

JUL 25 2000

This will allow the establishment of baseline data and assess the conditions present in the pond including nutrient levels, etc. Water chemistry analysis should include the broadest spectrum possible to ascertain what is currently contained in the water. The fishponds and coastal area should be designated as continuing water quality monitoring stations before, during and after construction. Any mitigation should include long term monitoring long after the project is complete.

Mauka of proposed project site:

Because there is generally low rainfall in this part of the ahupua'a, we must assume that the a majority of the fresh water is percolating and flowing from the more upper reaches of Hualalai. I would further suggest that the EIS include some sort of analysis of fresh water (underground) flowing through the site (if any) immediately mauka of the project site as a control. This will help to determine the quality of the water entering the project area and assessing possible impacts flowing makai of the project area. The EIS only mentions assessing chemistry and biological water analysis makai of the project. Because there are no known surface water or water wells in the vicinity, this might be more of a challenge to do.

Part 4.3.2 Cultural, Archaeological and Historic Resources

This section also appears to be inclusive in studying the surrounding areas with specific mention of the involving community "stakeholders" including Na Kokua and others. This part of the consultation process will be key in educating the importance of the loko i'a to the park and perpetuating Hawaiian cultural practices. Suggest that the Kekaha region be defined, since it appears that knowledge of its boundaries sometime vary.

Support the idea that a cultural resources and impact study will be done.

General concerns:

1. Method of wastewater disposal.
2. Non-point source pollution (especially due to porous nature of the area)
3. Underground Injection control permit

All of these items may or may not have some impact on the health of the ponds.

Suggest that communication occur early and often with project representatives so that concerns are clearly stated, properly and satisfactorily addressed.

I would like to officially request to be a "consulted party" throughout this process.

Mahalo for letting me share my mana'o on this important subject.

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Kaaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Herb Lee, Jr.
Lee Communications
P.O. Box 1917
Kailua HI 96734-8917

Dear Mr. Lee:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 24, 2000, commenting on the EISPN. Our responses to your individual comments are as follows:

1. *Water Quality.* The Draft EIS will include an assessment of the project's potential effects to groundwater, Kaloko and Aimakapa ponds, and nearshore marine waters. Measures to minimize any impacts are also discussed, including Best Management Practices (BMPs) that will be implemented to minimize the transfer of contaminants from the project site to these waters. Furthermore, the assessment includes an analysis of impacts to groundwater resources, and calculates the impacts of groundwater withdrawals on potable use quality and quantity, and recharge of the basal lens. This assessment includes consideration of nearby existing and planned projects.
2. *Specific Study of the fishponds at Kaloko-Honokohau.* The Draft EIS will specifically deal with these fishponds, along with other surface and groundwater entities, from the standpoints of water quality, biology, and cultural uses.
3. *Analysis of Groundwater.* The Draft EIS contains an extensive and detailed discussion of groundwater, including consideration of all nearby wells, both mauka and makai of the project.
4. *Definition of Kekaha Region.* The Draft EIS will include a discussion of this concept.
5. *Impact of Wastewater Disposal, Non-Point Source Pollution, and Underground Injection on Water Quality of Ponds.* The Draft EIS will discuss these aspects of water quality, and as stated above, will propose mitigation measures to avoid or minimize adverse impacts.
6. *Request to be a Consulted Party.* We welcome the opportunity to continue to meet with your organization. As requested, Na Kokua Kaloko Honokohau will be retained on the list of parties to be consulted throughout the EIS process.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Statement of Na Kokua Kaloko Honokohau

Na Kokua Kaloko Honokohau is a community consortium of educators, cultural practitioners, environmentalists, and business people, whose purpose is to give advise to the Kaloko Honokohau National Historical Park in its Congressional authorization "to provide a center for the preseration, interpretation, and perpetuation of traditional native Hawaiian activities and culture".

In 1974, after years of profound and exhaustive research, The Kaloko Honokohau Study Advisory Commission in partnership with the National Park Service completed the study report called "The Spirit of Kaloko Honokohau", providing a basis for the 1978 enactment of Public Law 95-625 authorizing the establishment of Kaloko-Honokohau National Historical Park.

AUG 2000

The motivation for the "Spirit of Kaloko Honokohau" is an inherited Mo'o Ku'auhau-the genealogy that expresses a millennium of harmonious kinship with the natural environment and the cultural imperative that we be efficient stewards for our precious island resources.

Our history and traditions remind us that we are blessed with winds that caress us, fills our sails, and gives us encouragement. It allows us to see the stars that give us 'ike (insight) and understanding, that we may travel many miles and transverse countless generations. Our customs and practices remind us of our relationship to the seas that sustain us, and the waters that comfort us.

Of particular concern, are the unique and sacred fishponds of Kaloko-Honokohau. Historically, they were vital economic and political resources. Today, they remain critical elements to the perpetuation of Hawaiian cultural practices and contribute to the overall quality of life in our multi-cultural community.

These cultural motivations compel us to defend our Wahi Pana-our Sacred Places. It demands that we assert our customary and traditional right to protect the cultural resources at Kaloko-Honokohau. Three paramount features of Kaloko-Honokohau are: 1. Kaloko Loko Kuapa, an 11 acre fishpond that is a natural embayment with a man-made sea wall; 2. 'Aimakapa Loko Pu'uone, a 15 acre fishpond that is a natural pond formed behind a natural barrier; and , 3. 'Ai'opio , which is a 1.7 acre Loko I'a, an area enclosed by a wall of stone and coral with an opening to the sea which is closed with a net thus entrapping fish within the Loko. At high tide, fish enter this enclosure and when the opening is then closed, with a net, they are entrapped.It is for this reason that it does not have a Makaha (a sluice gate) and is called a fish trap.

These ponds were vital economic and political resources in historical times and now they remain critical elements to the perpetuation of Hawaiian cultural practices, and contribute to the overall quality-of-life in our multicultural society.

It is extremely important to maintain the integrity of the fishpond complex. All stakeholders who share these common resources must be good stewards over these precious assets that are ours to maintain, and are bound to each other in a symbiotic relationship; and we must have the maturity to know that damage to one party will cause irreparable harm to the whole community.

The Kaloko Industrial Park expansion area to the South, North and mauka (towards the mountain) of the Kaloko-Honokohau Cultural Park, threatens to indiscriminately pollute the water quality of the fishpond; they also pose an imminent danger to ocean and near shore marine environments that would adversely affect subsistence and commercial fishing activities.

Na Kokua proposes a new and innovative mechanism to mitigate negative impacts and avoid litigative actions. Na Kokua proposes that the stakeholders form a consortium to discuss alternatives to implement fair and just planning prerogatives.

Options should include, but not be limited to, the feasibility of incorporating a community based economic development project to capture, process, and reuse waste-water and other waste fluids to eliminate run-off pollution to the neighboring community and its precious environment. To promote safe and responsible planning, this partnership should encourage citizen participation with Federal, State and County administrative agencies and share successes with other communities in similar circumstances; with commitment, foresight, and measurable accomplishments combining jointly with our

enthusiasm to improve the quality of life by creating healthy, safe, and prosperous conditions enjoyed for countless ages by our Kupuna, pollution could be avoided, or at the least, mitigated.

Na Kokua's proposed initiatives offers opportunity for environmental justice and multi-cultural appreciation. We submit that the developers will be the new source of pollution problems unless they are sensitive and cooperate with the community that stands to be impacted by the pollution and by developing a means of addressing this problem with proper application of recycle and reusable practices. Na Kokua believes this kind of concern would be best served by the development of a community based management system in cooperation with Federal, State, and County agencies who would be accountable for monitoring the program.

Also, Na Kokua Kaloko Honokohau believes that the National Park Service has a meaningful investment in Kaloko Honokohau to the extent of over 63 million dollars. Therefore it must protect and promote this historical treasure for our citizens, their children, their grandchildren, and generations to come.

Na Kokua Kaloko Honokohau further finds that it is imperative that the Hawaiians and Citizens at large honor and respect the final resting place of our Na'I Aupuni-Kamehameha 'Akahi, together with all that comprises our rich heritage that is Hawaii.

Finally, Na Kokua Kaloko Honokohau requests that developer grant Na Kokua a "Consulting Party" status in order to facilitate full participation in the planning process.

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

David K. Roy, Jr.
Na Kokua Kaloko-Honokohau Inc.
P.O. Box 596
Kailua-Kona HI 96745

Dear Mr. Roy:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for the *Statement of Na Kokua Kaloko Honokohau* commenting on the proposed expansion of the existing Kaloko Light Industrial Area and the proposed construction of the Kaloko-Honokohau Business Park. As the letter, we received the on August 3, 2000, appears to be in response to our EISPN, we would like to acknowledge receipt and address the comments made in the letter.

1. *Background of Na Kokua.* Thank you for providing this information.
2. *Concern for Fishponds and Nearshore and Marine Water Quality.* We agree that study of the fishponds and preservation of water quality is essential. The Draft EIS will include an assessment of the project's potential effects to groundwater, Kaloko and Aimakapa ponds, and nearshore marine waters. Measures to minimize any impacts are also discussed, including Best Management Practices (BMPs) that will be implemented to minimize the transfer of contaminants from the project site to these waters. Furthermore, the assessment includes an analysis of impacts to groundwater resources, and calculates the impacts of groundwater withdrawals on potable use quality and quantity, and recharge of the basal lens. This assessment includes consideration of nearby existing and planned projects.

3-4 *Proposal for Stakeholder Consortium and Request to be a Consulted Party.* We acknowledge Na Kokua's proposal of a consortium to address the individual and cumulative effects of the various existing and proposed projects in the vicinity. We welcome the opportunity to continue to meet with your organization. As requested, Na Kokua Kaloko Honokohau will be retained on the list of parties to be consulted throughout the EIS process. We will send Na Kokua a Draft EIS and continue to consult with your organization. We sincerely appreciate your thoughtful response and ideas for creative approaches to wastewater use.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

AUG 16 2000

Leading Hawaii Into The New Millennium
1959 2000+

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
BRIAN K. MINAAI
GLENN M. OKIMOTO

IN REPLY REFER TO:
HWY-PS
2.9670

Mr. Michael Moore
Lanihau Partners, L.P.
C/o Tsukazaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

Dear Mr. Moore:

Subject: Environmental Impact Statement Preparation Notice
Kaloko-Honokohau Business Park, North Kona, TMK: 7-4-8: Por. 13, 30

We will reserve comment on impacts upon the State highway until we have received and reviewed the traffic impact analysis report mentioned in your notice.

Very truly yours,

KAZU HAYASHIDA
Director of Transportation

c: OEQC
DBED&T-State Land Use Commission
GeoMetrician Associates

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Kazu Hayashida, Director
Hawaii State Department of Transportation
869 Punchbowl Street,
Honolulu, Hawaii 96813-5097

Dear Mr. Hayashida:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of August 16, 2000, commenting on the EISPN, in which you state that you will reserve comment until you receive the TIAR that will be included with the Draft EIS. We expect to issue the Draft EIS within the next few months, and we look forward to your comments.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

MOKU LOA GROUP, SIERRA CLUB

c/o P. O. BOX 1315

KURTISTOWN, HAWAII 96760

July 6, 2000

Ron Terry
GeoMetrician Associates
HC 2 Box 9575
Keaau, HI 96749

RE: KALOKO-HONOKOHAU BUSINESS PARK

The Sierra Club, Moku Loa Group has the following comments on the proposal to reclassify 337 acres from the Conservation district to the Urban District for an industrial/business park:

* Any consideration to urbanize an area "strategically located halfway between the Kona International Airport at Keahole and Kailua-Kona along Queen Kaahumanu Highway" should start with an examination of Nimitz Highway by the Honolulu Airport. Do we want to repeat the same mistakes Honolulu has made? Commentators lament the ugly, industrial strip of car lots and warehouses that greet tourists upon their arrival. Hawaii County has already taken the first step at replicating the Honolulu experience with the adjacent Kaloko Industrial Area. Should we continue on that path?

* The petition area adjoins the stunningly beautiful Kaloko-Honokohau National Historic Park. The wilderness quality, including the scenic beauty, must be preserved. Views of warehouses, neon lights, and other tall structures are simply inappropriate.

Because of these concerns, the Land Use Commission should adopt strict standards to protect viewplanes. The LUC should not defer adoption of these standards to the county because (1) these are legitimate state interests; and (2) the county has demonstrated its inability and unwillingness to protect scenic viewplanes (See e.g. Yuen v. Board of Appeals, in which a state circuit court found the Planning Commission and Planning Department improperly failed to consider the impact of a cellular tower on the scenic beauty of Maulua Gulch; and the Friends of Red Road, in which a circuit court found that the county simply relied on the representations of private consultants instead of independently reviewing the environmental impacts)..

Therefore, the Sierra Club recommends that if the LUC is inclined to approve this petition, it do so with the following conditions.

1) A no build (except for roads and sidewalks) buffer be created from Queen Kaahumanu Highway mauka 300 feet.

2) Heights be limited to 25 feet. Walls on the makai side shall be restricted to 12 feet of uninterrupted wall height.

3) Use of mirrored glass, reflective sun screens or other highly reflective materials for exterior windows shall be prohibited. Except for any flat roof, roof coverings shall be of non-reflective material and of a color and tone compatible with the area surroundings. No illuminated signs shall be allowed.

5) Landscaping shall be used to help all structures blend in with the surrounding environment and to mitigate the visual impacts of development on public views. Native plants and trees instead of exotic plants shall be used unless impractical.

In addition to these conditions intended to preserve the character of the national park and visitor experience, the Sierra Club Moku Loa Group recommends these additional conditions:

6) All significant pre-contact archaeological sites shall be preserved in their entirety (including a buffer area). At a minimum, these should include burials, petroglyphs, the entire network of trails, agricultural complexes, habitation sites, boundary walls and ahu. With the exception of the burial site, other archaeological sites should be identified with interpretative signs. Until more complete information is provided in the DEIS, we will reserve judgment as to how best to protect all the historic resources.

7) All native trees shall be preserved. Given the rareness of native dryland forest, it makes sense to preserve as much of our biological heritage as possible. The DEIS should include a map that identifies where the various native trees are located. It may be possible to identify an archaeological/botanical preserve in the project area.

8) It is essential that the outstanding water quality off of the National Park be protected. This project is likely to produce polluted runoff (including oil, heavy metals from the industrial area, and sediments). Moreover, given the porous nature of the volcanic rock, polluted water is likely to drain through the lava down into the ocean. It is insufficient for the DEIS to claim that the project shall comply with all pollution laws. The fact is, there are no enforceable laws to prevent polluted runoff from contaminating coastal waters. Nor, does the Department of Health have the regulatory authority to ensure that underground injection wells do not contaminate coastal waters. Finally, experience in Kaka'ako on O'ahu and other industrial areas demonstrates that compliance with the few DOH standards that do exist is far from universal.

The only way to protect water quality from a development like this is to incorporate clear standards in any LUC approval. These standards must include precise technology requirements. For example, all runoff -- instead of simply draining into an underground injection hole -- should be treated on site. Underground injection should be prohibited. The use of hazardous substances (except for those used by automobiles driving in the area) in the area should be prohibited. It is essential that conditions such as this be required now since DOH does not have the authority to require them.

Finally, we would like to request that the DEIS carefully examine the issue of energy. The expansion of the Keahole power plant (down the road) has been an extremely divisive issue for the community. How much more energy will this project consume? More importantly, the DEIS should study whether it would be economical to include photovoltaic cells on the top of all flat roofs. By incorporating photovoltaic cells into building design early in the planning process, we believe that the developer could make money, while reducing Hawaii's dependence on fossil fuels. Electricity from solar energy could be used to power the entire business park, with surplus being sold to HELCO.

We look forward to a full discussion of these issues in the DEIS.

Sincerely,

Roberta Lynn Brashear
Moku Loa Group Chair

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Ms. Roberta Brashear, Chair
Moku Loa Group, Sierra Club
P.O. Box 1137
Hilo, HI 96721

Dear Ms. Brashear:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of July 6, 2000, commenting on the EISPN. In general, it is important to recognize that urbanization of the area between the Kona International Airport at Keahole and Kailua-Kona is consistent with the designation of new urban concentrations and urban growth areas as shown on State and County land use plans, including the State Office of Planning's *Five Year Boundary Review* (1992), the *West Hawaii Regional Plan* (1991), the County of Hawaii's General Plan Land Use Patterns Allocation Guide Map (LUPAG) (1989), and the County's *Keahole to Kailua Development Plan* (1991).

1. *Comparison with Nimitz Highway.* One of the prime goals of our project design has been to ensure that our design is aesthetically and environmentally compatible with natural scenery of North Kona. The Draft EIS will present these design ideas.
2. *Kaloko-Honokohau National Historic Park.* We agree that the wilderness quality and scenic beauty of the park is important and our design seeks to mitigate the impacts of adjacent urban uses. We would note just for accuracy that views mauka from the park already include warehouses, neon lights, and tall structures of adjacent industrial areas.
3. *No-Build Zone 300 Feet Mauka of Queen Ka'ahumanu Highway.* We are currently determining the width, shape and characteristics of a buffer zone which we propose between the highway and the first row of structures in the development. The Draft EIS will present the details of this.
4. *Height Limit.* The Hawaii County Zoning Code sets the height limits of buildings in the Mixed Light Industrial and Commercial district. Further limits upon building heights will be determined by a combination of factors including aesthetic considerations, topography and placement within the development.
5. *Mirrored Glass and Illuminated Signs.* Architectural design criteria that minimize adverse visual impacts will be developed for the project. These will address many aspects of building design including profiles, materials, color, surface treatment, reflectivity, lighting, sign standards, and landscaping. These will be implemented as part of the development covenants.
6. *Landscaping.* Landscaping is an important part of our design plans. Landscaping will be implemented to develop the design theme, to provide beauty and variety in the landscape, and to minimize or screen any visual impacts from the project. The landowners and/or tenants of the high visibility lots will be required to provide and maintain on-site landscaping in accordance with landscaping criteria developed for the project For a number of reasons, native plants will be included in the palette of plants.
7. *Archaeological Site Preservation.* We are working with the State Historic Preservation Division on the identification and treatment of significant historic sites, and will present this information in the Draft EIS. We note your recommendation.
8. *Native Trees.* We note your recommendation.
9. *Water Quality.* The Draft EIS will include an assessment of the project's potential effects to groundwater, Kaloko and Aimakapa ponds, and nearshore marine waters. Measures to minimize any impacts are also discussed, including Best Management Practices (BMPs) that would be implemented to minimize the transfer of contaminants from the project site to these waters. Furthermore, the assessment includes an analysis of impacts to groundwater resources, and calculates the impacts of groundwater withdrawals on potable use quality and quantity, and recharge of the basal lens. This assessment includes consideration of nearby existing and planned projects.
10. *Energy.* We would like to explore this idea with you further, and will be in contact with your Group and the Sierra Club, Hawaii Chapter Director on this.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

BRUCE S. ANDERSON, PH.D., R.N.H.
DIRECTOR OF HEALTH

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

IN REPLY, PLEASE REFER TO
FILE:

September 7, 2000

00-122/epo

Mr. Michael Moore
Lanihau Partners
c/o Tsukazaki, Yeh & Moore
100 Pauahi Street, Suite 204
Hilo, Hawaii 96720

Dear Mr. Moore:

Subject: Environmental Impact Statement Preparation Notice
Kaloko-Honokohau Business Park
North Kona, Hawaii
TMK: 7-4-08:13

Thank you for allowing us to review and comment on the subject project. We have the following comments to offer:

Please address in the Draft Environmental Impact Statement air quality issues.

Wastewater

The subject project is located in the non-critical wastewater disposal area as determined by the Hawaii County Wastewater Advisory Committee.

On-site individual wastewater systems will be allowed for only domestic and domestic-like wastewater. Facilities generating non- domestic wastewater will be required to treat their wastewater prior to disposal. We would recommend that the project connect to the existing County wastewater facility, the Kealakehe Wastewater Treatment Plant, if at all possible.

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems", and must be reviewed and approved by the Department of Health, prior to construction.

Should you have any questions, please contact the Planning/Design Section of the Wastewater Branch at telephone (808)586-4294.

SEP 22 2000

Mr. Michael Moore
September 7, 2000
Page 2

We would like to receive a copy of the Draft Environmental Impact Statement. Thank you.

Sincerely,

GARY GILL
Deputy Director
Environmental Health Administration

c: CAB
WWB

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Keaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Gary Gill, Deputy Director
Environmental Health Administration
Hawaii State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Gill:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of September 7, 2000, commenting on the EISPN. Our responses to your individual comments are as follows:

1. *Air Quality.* Air quality will be addressed in the Draft EIS.
2. *Wastewater.* The Draft EIS will include a discussion of the issues concerning the timing of connection to the Kealakehe Wastewater Treament Plan, along with other potential options for treating wastewater. The applicable provisions of the Department of Health's Administrative Rules will be cited and discussed.

We expect to issue the Draft EIS within the next few months, and we look forward to your comments.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Stephen K. Yamashiro
Mayor

Jiro A. Sumada
Deputy Chief Engineer

County of Hawaii
DEPARTMENT OF PUBLIC WORKS
25 Aupuni Street, Room 202 • Hilo, Hawaii 96720-4252
(808) 961-8321 • Fax (808) 961-8630

September 19, 2000

Lanihau Partners, L.P.
c/o Tsukuzaki, Yeh and Moore
100 Pauahi Street, Suite 204
Hilo, HI 96720

Atten: Michael Moore

Subject: Kaloko-Honokohau Business Park
Environmental Impact Statement Preparation Notice
Honokohau, North Kona, HI
TMK: 7-4-8:13 (por.) and 30

We reviewed the subject notice and apologize for the tardiness of our response. The Keahole to Kailua Development Plan, dated April 19, 1991, shows the 80-foot wide collector, "Main Street," traversing the subject property in a north-south direction. Main Street will be an important traffic facility for the growth and circulation between developments in the area. We defer to the Planning Director regarding the specific location of this facility, but urge its inclusion and discussion in the final EIS.

We appreciate the opportunity to comment. If you have any questions, please feel free to contact Kiran Emler of our Kona office.

Galen Kuba, Division Chief
Engineering Division

KE

c: Hawaii State Land Use Commission Atten.: Esther Ueda
Director-Office of Environmental Control
GeoMetrician Associates Atten.: Ron Terry
Engineering-Hilo
Engineering- Kona
Planning Director

GEO METRICIAN
Ron Terry, Ph.D.

HC 2 Box 9575
Kaaau, Hawaii 96749
(808) 982-5831

September 28, 2000

Galen Kuba, Division Chief
Engineering Division
Hawaii County Department of Public Works
25 Aupuni Street
Hilo, Hawaii 96720

Dear Mr. Kuba:

Subject: Comment Letter in Response to Environmental Impact Statement Preparation Notice (EISPN) for Kaloko-Honokohau Business Park

Thank you for your letter of September 19, 2000, commenting on the EISPN, in which you state that the Draft EIS should consider the 80-foot wide collector "Main Street" that was shown in the Keahole to Kailua Development Plan. The Draft EIS will discuss the estimated impact of the proposed project on the principal existing and planned roadways in the vicinity, including those illustrated in plans for the region, and will identify any mitigation measures that may be required, for the Full and Partial Build-Out scenarios.

Sincerely,

Ron Terry

cc: Lanihau Partners/ c/o Tsukazaki, Yeh and Moore
Esther Ueda, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 3

Impact on Water Resources

Assessment of the Potential Impact on Water Resources of the Proposed Kaloko-Honokohau Business Park in North Kona, Hawaii

Prepared for:

Lanihau Partners, LP
Kaimuku Plaza - Suite 260
3465 Waialae Avenue
Honolulu, Hawaii 96816

Prepared by:

Tom Nance Water Resource Engineering
680 Ala Moana Boulevard - Suite 406
Honolulu, Hawaii 96813

March 1, 2002

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Introduction

This report presents the basis and results of an assessment of the potential impact on water resources of the proposed Kaloko-Honokohau Business Park in North Kona, Hawaii. The project site consists of approximately 337 acres situated on the mauka side of Queen Kaahumanu Highway. The Kaloko Industrial Park is on the north side of the site and the Honokohau Business Park is to the south (refer to Figure 1). The southern half of the Kaloko-Honokohau National Historical Park is located directly across Queen Kaahumanu Highway. Data on which this assessment is based were collected in May-June 2000, December 2001, and during previous assessments for other projects in 1994 and 1996.

Specifics of the Development Proposal

Development of the Business Park for industrial and commercial uses and for the retention and expansion of ongoing quarrying activities is envisioned to occur in three phases over a period of more than 20 years. Table 1 *presents the anticipated development schedule.* Of the site's 337 acres, 285 acres or 85 percent would be for various commercial and industrial mixed uses. The remainder would be in roadways and unused areas.

For the analysis of the project's potential impact on water resources, the following aspects of the development need to be assessed: (i) the use of groundwater for potable supply; (ii) the manner and location of wastewater disposal; (iii) the manner of stormwater disposal; and (iv) the potential for irrigation return flow to reach underlying groundwater. Each of these is briefly discussed below.

Potable Water Supply. It is intended that potable water supply would be provided from the Department of Water Supply's (DWS) North Kona system. Estimated water use at the project's full build-out, based on the quarry's present water use and actual water use of industrial-commercial mixed uses in the adjacent Kaloko Industrial Park, is 0.367 MGD (also in Table 1). Although the specific DWS wells that would provide this supply have not been identified, they will undoubtedly be one or more of the recently developed high level wells located above Mamalahoa Highway and inland from the project site. Since leakage from this high level aquifer is one of the most important sources of recharge for the basal lens in the coastal area, the potential reduction of this source of recharge must be addressed.

Wastewater Disposal. At present, all wastewater from the commercial and industrial development in the Kaloko-Honokohau area and from the residential development in the mauka areas is disposed of in cesspools or other individual wastewater disposal systems. All wastewater percolating downward from these individual disposal systems ultimately reaches the underlying groundwater, providing a source of local recharge with the potential to influence the quality of the underlying groundwater.

It is expected that sewer service will be extended to areas north of the County's Kealakehe Wastewater Treatment Plant (WWTP) sometime in the next four to five years (Peter Boucher, County Wastewater Division, personal communication). When this extension of sewer service is in place, wastewater generated by the Business Park will be conveyed to the WWTP for treatment. However,

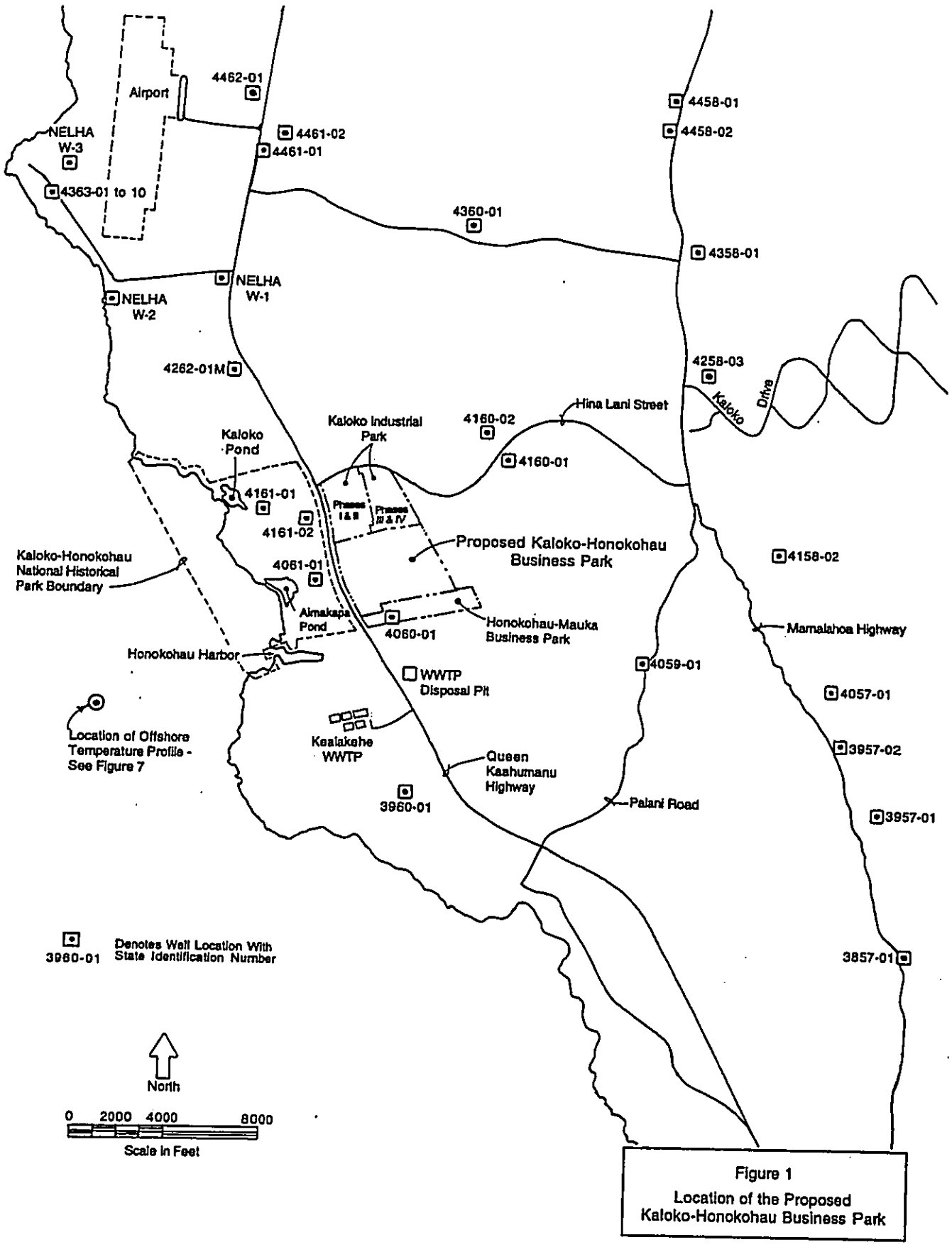


Figure 1
Location of the Proposed
Kaloko-Honokohau Business Park

Table 1

Land Uses, Development Schedule, and Estimated Water Use for the Kaloko-Honokohau Business Park

Area			Development Phase	Completion Date	Land Uses	Estimated Water Use	
Designation	Gross Acres	Net Acres				Use Rate (GPD/Net Acre)	Amount (MGD)
A	101.845	100	1	2010	Light Industrial/ Commercial Mixed Use	1,500	0.150
B	102.429	80	1	2010	Quarry and Quarry Related Industrial	Actual Current Use	0.060
C	87.859	70	2	2020	Light Industrial/ Commercial Mixed Use	1,500	0.105
D	44.851	35	3	After 2020	Light Industrial/ Commercial Mixed Use	1,500	0.052
Totals	336.984	285	All Phases	--	--	--	0.367

Notes: 1. Use rates for light industrial/commercial mixed use based on data provided by the Department of Water Supply for Kaloko Industrial Park.

2. Use rate for the quarry operation reflects its current average use.

there may be an interim period when the Business Park's development precedes the availability of sewer service. During this period, wastewater generated on site would be disposed of in individual, enhanced septic tank-leach field systems. Percolate from these leach fields would ultimately reach groundwater.

Surface Water Drainage. Stormwater disposal will occur entirely onsite in drywells and sumps. Essentially all surface runoff would percolate to the underlying groundwater with potential water quality consequences which need to be assessed.

Irrigation and Wash Water. On the order of 10 to 20 percent of water used for landscape irrigation and other miscellaneous uses outside of buildings will percolate to the underlying groundwater as a source of local recharge with possible water quality impacts.

Description of Water Resources in Kaloko-Honokohau

General Overview. Due to high permeabilities of the natural ground surface across the project site and on the upslope lands, surface runoff does not occur even during the most intense rainfalls. As a result, no natural gulches or waterways has been created. Queen Kaahumanu Highway in this general area has two culverts, a pipe arch culvert at the north end of the Kaloko Industrial Park and twin pipes at the north end of the project site. However, it does not appear that either of these has ever conveyed more than a minimal amount of localized runoff from the paved surface of the highway. This being the case, the discussion of the area's water resources and the project's potential impact on these resources focuses exclusively on groundwater.

Knowledge of groundwater conditions comes primarily from the wells shown on Figure 1 and listed in Table 2. These depict two distinctly different modes of groundwater occurrence. From the shoreline inland to Mamalahoa Highway, groundwater occurs in a thin and brackish basal lens in hydraulic contact with saltwater at depth and seawater at the shoreline. Somewhere in a generally linear alignment approximately coincident with Mamalahoa Highway, there is an abrupt transition from basal to high level groundwater of exceptionally low salinity. High level groundwater is a relatively recent (1990) discovery in North Kona. The geologic feature which causes groundwater to be impounded to high levels behind it is not yet known. In addition to it creating a substantial reservoir of potable quality water, this feature also controls the location and manner of groundwater movement into the downgradient basal lens. While the hydraulic relationship between the two groundwater bodies is not yet understood, it is undoubtedly the reason for the anomalous characteristics of basal groundwater in the area.

Description of Basal Groundwater Occurrence in the Kaloko-Honokohau Area. Salinity, temperature, water level, and water quality data from basal wells in the area all indicate that the flow rate is low compared to areas to the north and south, that saltwater circulation at depth exerts considerable influence on temperature, that formation permeabilities are exceptionally high, and that development in the area has affected groundwater quality. Each of these aspects is expanded upon in the discussion below.

Table 2

Available Data on Wells in the Kaloko-Honokohau Area

Well		Owner or Developer	Year Drilled	Ground Elevation (Feet MSL)	Groundwater Level		Chloride Concentration		Water Temperature (° F)	Present Use
State No.	Name				Level (Ft. MSL)	Date Measured	Value (MG/L)	Date Sampled		
Basal Wells of Brackish Salinity										
3960-01	--	Queen Liliuokalani Trust	1982	40			3,400	1982		Irrigation
4059-01	Palani	DWS	1958	800	1.72	1958	3,475	1958	67.5	None
4060-01	Quarry			120			2,214	Nov. 1995	66.7	None
4061-01	KAHO-1	National Park Service	1996	38	1.20	May 2000			68.6	Monitoring
4160-01	Kaloko Irr. 1	TSA International	1985	566	2.59	3-31-93	940	7-16-85	64.3	None
4160-02	Kaloko Irr. 2	TSA International	1985	543	2.45	4-26-95	955	11-25-85	64.6	None
4161-01	KAHO-3	National Park Service	1996	24	1.37	May 2000			67.4	Monitoring
4161-02	KAHO-2	National Park Service	1996	57	2.37	May 2000			66.6	Monitoring
4262-01M	Ooma	Kahala Capital	1992	90	1.68	March 1996	2,500	1993	66.0	Monitoring
4360-01	Kalaoa	DLNR-DOWALD	1968	863	2.54	4-26-95	740	9-27-68	69.2	None
4363-01 to 10	--	Uwajima					15,000		68.0	Aquaculture
4461-01	--	Alika Cooper	1990	165			2,600		71.6	Irrigation
4461-02	--	HELCO	1993	210			5,900	6-24-93	69.5	Future Cooling Water Supply
4462-02	--	State DOT-Airports	1993				3,825	1-28-93		None
--	W-1	NELHA	1988	105	0.81	6-18-91				Monitoring
--	W-2	NELHA	1988	8	1.25	6-18-91				Monitoring
--	W-3	NELHA	1988	21	0.95	6-18-91				Monitoring
Basal Wells of Potable Quality										
4458-01	Kau 1	Nansay	1991	1799	10.1	4-26-95	17	5-30-90	72.0	None
4458-02	Kau 2	Nansay	1992	1799	10.5	4-26-95	15	7-15-91	78.0 (?)	None
Wells Tapping High Level Groundwater										
3857-01	Waiaha	DWS	1993	1542	62	1993				Pump stuck in well; to be Abandoned
3957-01	Keopu Mauka	HASEKO	1993	1674	47	1993	10	1-22-93	70.0	None
3957-02	USGS-Keopu	USGS/DWS	1991	1600	42.8	1-20-93				Monitoring
4057-01	QLT-1	Queen Liliuokalani Trust	1994	1720	189	1-19-94	5.6	5-26-00	69.4	DWS Potable Use
4158-02	Honokohau	DWS	1992	1675	98.2	4-26-95	6.7	5-26-00	72.3	DWS Potable Use
4258-03	Hualalai	DLNR-DOWALD	1993	1681	288.6	4-26-95	5.0	10-12-93		DWS Potable Use
4358-01	North Kalaoa	DLNR-DOWALD	1991	1799	236	1991	6.5	5-26-00	73.8	DWS Potable Use

- The basal lens between the Old Kona Airport and Keahole Point is relatively saline, preventing it from being a significant source of irrigation supply. Immediately downgradient of the project site, salinities in the three monitor wells within the National Park (Nos. 4061-01, 4161-01, and 4161-02 on Figure 1) are in the range of 5.3 to 9.4 parts per thousand (PPT), equivalent to chlorides in the range of 2500 to 5000 milligrams per liter (MG/L). Basal wells further inland have chlorides of 950 MG/L (Wells 4160-01 and 02) to 3475 MG/L (Well 4059-01). Relative to the distances of these wells from the shoreline, their chloride levels are substantially higher than found in wells at similar inland distances elsewhere in North Kona and South Kohala.

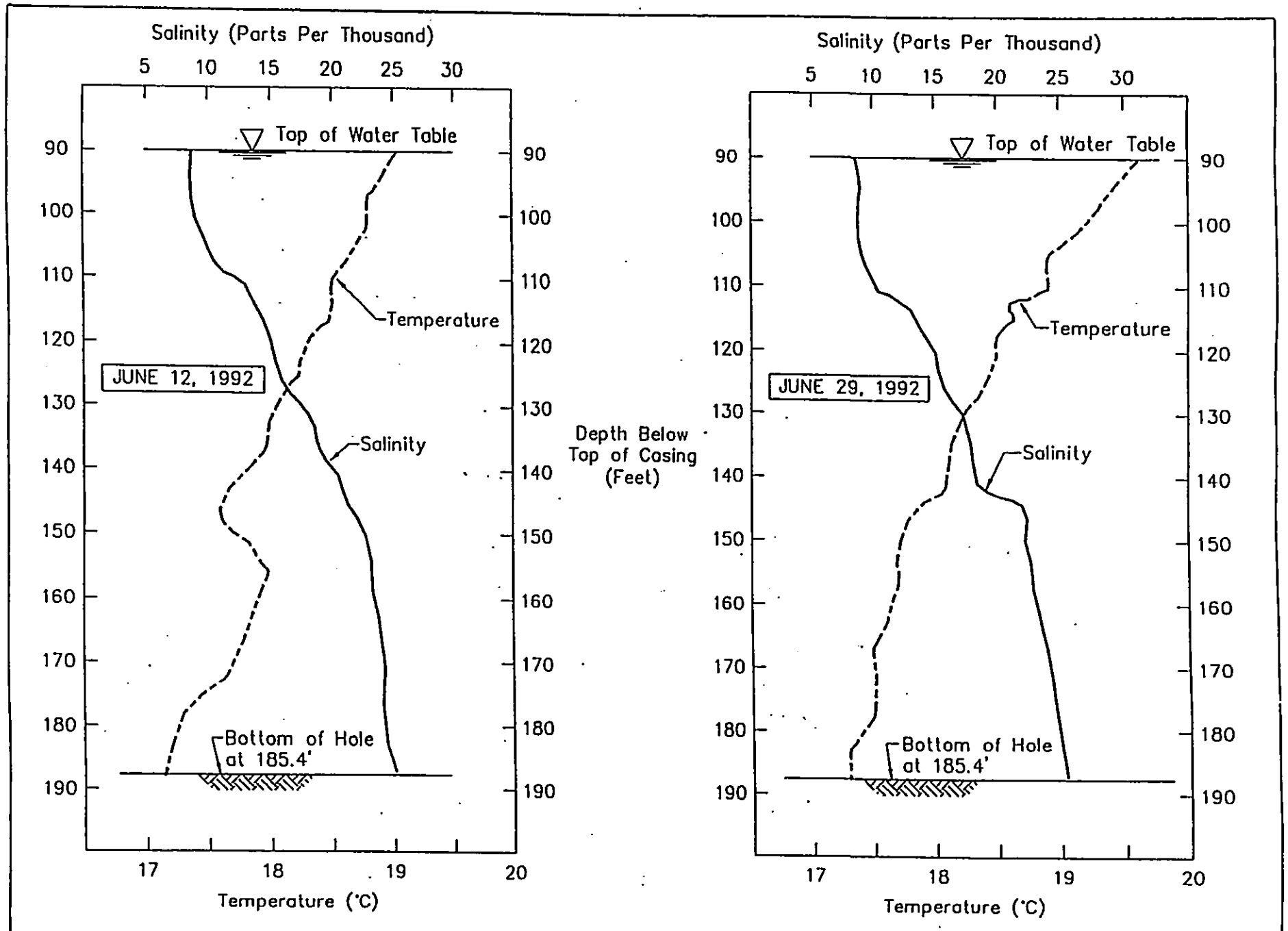
- The brackish basal lens is relatively thin and its transition zone is comparatively wide and gradual. This is illustrated by the profiles through the water column of Well 4262-01M on Figure 2. The thin lens and diffuse transition zone are indicative of a low flow rate with significant saltwater mixing.

- Temperatures are anomalously cold and decrease progressively with depth into groundwater, a characteristic exhibited in all of the accessible basal wells (also shown on Figure 2). Typical surface temperatures in basal groundwater are 64° to 68° F. This is 5° to 10° colder than the temperature of the high level wells directly inland. This difference, along with the progressive decrease in temperature with depth, show that the source of the low temperature is the saline groundwater beneath the basal lens. However, equivalent temperatures in the ocean offshore can only be found at a depth of more than 700 feet (Figure 3). This means that cold seawater is drawn inland at depth and returns seaward at mid-depth, mixing with and cooling the basal groundwater enroute. Basal groundwater temperatures this low are unique along the West Hawaii coastline.

- Permeabilities of lavas in the nearshore area are very high, resulting in considerable tidal variation in wells at significant distances inland. Figure 4 illustrates recently collected water level recordings for the three wells in the National Park compared with the tide in Honokohau Harbor. Tidal amplitudes and lags for basal wells in the region are quantified on Table 3. The magnitude of the tidal amplitudes relative to inland distances is greater than most other areas along the West Hawaii coastline.

- Table 4 is a compilation of water quality data from basal wells in the area. The quality of the water in the high level wells listed at the top of the table is presumably inland of the influence of man's activities. The relatively high nitrogen and phosphorus levels in these wells appear to simply be a natural occurrence in the region. In comparison to these background levels, the higher nutrient levels in the downgradient brackish basal wells reflect inputs to groundwater by intervening development.

- Since 1993, most of the effluent from the Kealakehe WWTP has been disposed of in a pit on the mauka side of Queen Kaahumanu Highway (its location is shown on Figure 1). The present rate of disposal is on the order of 1.0 million gallons per day (MGD). In the absence of unknown and unlikely geologic control, most of this percolating effluent ultimately enters Honokohau Harbor.



Note: Measurements made with a YSI Type 33 SCT Meter and downhole probe.

Figure 2

O'oma Test Well, State No. 4262-01M

FIGURE 3. COMPARATIVE OCEAN AND GROUNDWATER TEMPERATURE PROFILES

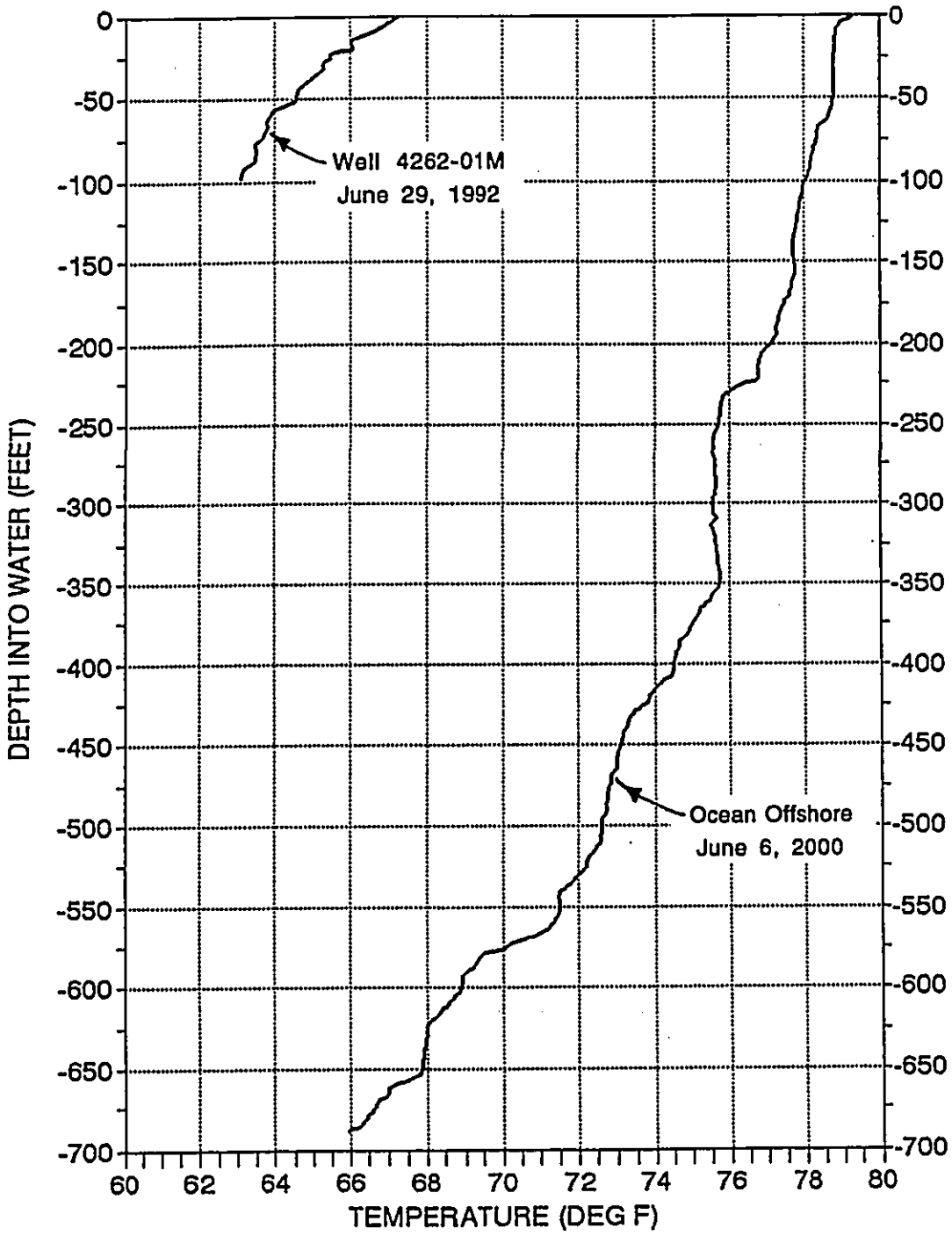


FIGURE 4. TIDAL VARIATIONS IN THE KAHO MONITOR WELLS, DECEMBER 3 TO 10, 2001

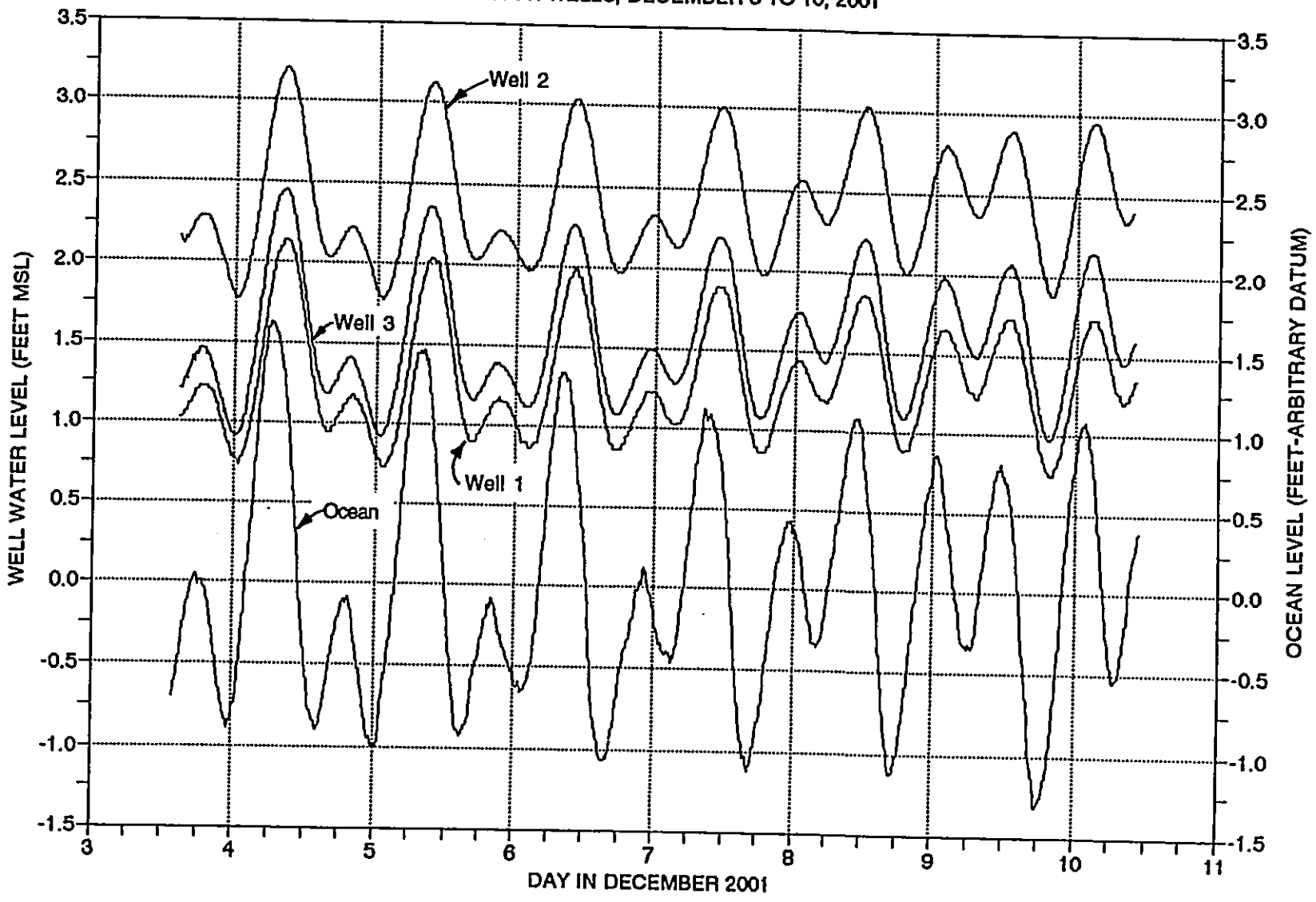


Table 3

Tidal Amplitudes and Lags in Basal Aquifer Wells and Kaloko and Aimakapa Fishponds

Name	State No.	Measuring Point Elevation (Feet MSL)	Period of Recording	Average Water Level (Feet MSL)	Distance Inland (Feet)	Tidal Response	
						Amplitude (% of Ocean Tide)	Lag (Hours)
KAHO-3	4161-01	24.21	May 19-26, 2000	1.37	1,450	56	0.80
			Dec. 3-10, 2001	--	1,450	51	1.49
KAHO-1	4061-01	37.83	May 19-26, 2000	1.20	1,800	49	0.95
			Dec. 3-10, 2001	1.31	1,800	45	1.32
KAHO-2	4161-02	57.06	May 19-26, 2000	2.37	3,550	51	0.84
			Dec. 3-10, 2001	2.42	3,550	46	1.70
Oona	4262-01M	90.50	Mar. 15-22, 1996	1.68	5,500	42	1.23
HELCO	4461-02	Not Available	Mar. 15-22, 1996	--	8,900	28	2.06
Kaloko Irr-2	4160-02	544.00	Mar. 15-22, 1996	2.34	11,600	16	3.25
Kalaoa	4360-01	680.80	Mar. 15-22, 1996	2.46	16,000	9	4.92
Aimakapa Fishpond		Not Available	May 19-26, 2000	--	150	31	3.40
		2.02	Dec. 3-10, 2001	1.30	150	27	3.05
Kaloko Fishpond		Not Available	May 19-26, 2000	--	Negligible	52	2.36

Notes:

1. Measuring point elevations for the three wells in the National Park provided by the U.S. Geological Survey. The top of KAHO-3 was recently modified and has not been resurveyed.

2. Measuring point in Aimakapa Fishpond is a temporary benchmark with its elevation surveyed relative to KAHO-1 by Tom Nance Water Resource Engineering.

3. Measuring point elevations for the other wells provided by Glenn Bauer of the Commission on Water Resource Management.

4. Tidal responses are based on comparison with the recorded water level in Honokohau Harbor.

Table 4

Representative Groundwater Quality From Wells and at Other Locations in the Kaloko-Honokohau Area

Sampling Site	Date Sampled	Salinity (PPT)	Silica (µM)	Forms of Nitrogen (µM)				Forms of Phosphorus (µM)		
				NO_3	NH_4	TON	Total N	PO_4	TOP	Total P
High Level Potable Quality Wells										
4057-01	5-26-00	0.109	801	86.0	0.0	14.7	100.7	3.76	0.08	3.84
	7-20-01	0.079	776	85.1	0.0	35.1	120.2	3.83	3.16	6.99
4158-02	10-23-94	0.212	697	74.2	0.0	13.4	87.6	3.59	0.00	3.59
	5-26-00	0.144	844	80.1	0.0	14.5	94.6	3.64	0.20	3.84
4258-03	6-02-00	0.165	833	70.2	1.2	19.4	90.8	3.85	0.50	4.35
4358-01	3-22-96	0.256	856	75.2	0.1	3.6	78.9	3.50	0.08	3.58
	5-26-00	0.182	908	71.8	0.0	11.9	83.7	3.40	0.24	3.64
	7-20-01	0.116	831	79.2	0.0	35.3	114.5	4.32	3.68	8.00
Basal Wells of Brackish Quality										
4061-01 : Top	5-26-00	9.464	334	55.0	0.3	24.8	80.2	1.84	0.20	2.04
: Top	6-10-00	9.463	304	56.2	3.5	32.1	91.8	1.44	2.96	4.40
: Top	12-19-01	8.657	40	38.4	5.7	20.4	64.5	0.20	0.45	0.65
: Bottom	5-26-00	12.298	490	21.3	1.3	65.9	88.5	1.92	4.44	6.36
: Bottom	6-10-00	10.655	477	54.4	1.4	38.2	94.0	2.64	3.36	6.00
: Bottom	12-19-01	9.156	169	51.8	3.3	37.2	92.3	0.70	1.55	2.25
4161-01 : Top	5-26-00	6.259	672	75.0	0.2	14.8	90.0	4.36	0.04	4.40
: Top	6-10-00	6.325	701	76.9	1.6	43.2	121.7	4.64	2.64	7.28
: Top	12-19-01	6.305	652	79.4	4.2	0.1	83.7	4.35	0.07	4.42
: Bottom	5-26-00	6.548	694	77.3	0.3	16.0	93.6	4.52	0.08	4.60
: Bottom	6-10-00	6.601	709	76.4	1.5	31.4	109.3	5.28	2.24	7.52
: Bottom	12-19-01	6.413	629	76.3	1.8	5.4	83.5	4.05	0.20	4.25
4161-02 : Top	5-26-00	5.399	653	87.2	0.5	22.8	110.4	4.08	0.56	4.64
: Top	6-10-00	5.361	691	104.3	5.1	42.2	151.6	9.04	2.88	11.92
: Top	12-19-01	5.401	616	86.5	1.9	2.0	90.4	4.30	0.05	4.35
: Bottom	5-26-00	5.522	671	89.0	0.2	17.7	106.9	4.32	0.24	4.56
: Bottom	6-10-00	5.883	696	89.7	0.6	32.5	122.8	5.20	2.32	7.52
: Bottom	12-19-01	5.289	632	85.5	1.8	5.6	92.9	4.35	0.35	0.70
4160-02	5-15-94	1.734	670	68.6	0.3	2.9	71.8	5.89	0.03	5.92
	3-22-96	1.773	671	78.1	0.3	8.2	86.6	4.42	0.70	5.12
4262-01M: Top	3-15-96	7.962	661	81.8	0.2	15.8	97.8	3.08	0.16	3.24
: Top	6-02-00	7.783	672	89.7	1.5	26.6	117.8	5.30	0.75	6.05
: Top	6-10-00	7.850	741	91.4	1.0	35.8	128.2	3.60	0.72	4.32
: Bottom	6-02-00	16.224	547	55.4	3.2	27.9	86.4	2.25	1.00	3.25
4461-02	3-15-96	4.946	752	79.4	0.3	12.3	92.0	3.84	0.04	3.88
Basal Wells of Saline Quality										
3960-01	10-23-94	25.543	318	28.1	0.3	4.9	33.3	1.49	0.02	1.15
	6-02-00	25.698	356	30.5	1.6	22.5	54.6	1.40	0.70	2.10
4363-04	6-02-00	26.695	291	65.6	0.9	21.6	88.1	3.80	0.50	4.30
	6-10-00	26.836	287	72.3	1.4	32.8	106.5	4.08	0.56	4.64
Groundwater Discharge at the Shoreline										
Honokohau Harbor	6-03-00	20.987	373	39.7	0.0	4.2	43.9	2.30	0.07	2.37
	7-20-01	20.431	380	40.4	0.3	10.7	51.4	2.31	2.25	4.56
	9-03-01	20.362	341	38.1	0.3	2.7	41.1	2.05	0.27	2.32
Kaloko Fishpond	6-10-00	9.899	650	63.3	3.0	51.8	118.1	3.84	3.68	7.52
	6-10-00	8.566	665	64.0	1.3	38.4	103.7	3.76	3.44	7.20
South of Kaloko Pond	6-03-00	16.530	523	50.3	1.0	16.4	67.7	2.80	0.65	3.45
	6-10-00	14.254	601	57.0	1.8	25.8	84.6	3.20	2.64	5.84
South of Aimakapa Pond	6-10-00	17.373	472	49.6	2.7	32.6	85.0	2.48	2.96	5.44
	6-10-00	13.309	388	64.2	12.4	77.0	153.6	15.12	1.76	16.88
Kealakehe WWTP Effluent										
	5-26-00	1.701	643	271.0	7.6	139.7	418.2	101.92	3.24	105.16
	6-02-00	1.694	667	330.8	32.8	217.8	581.4	120.40	4.00	124.40
	6-10-00	1.680	771	296.5	10.1	134.8	441.4	116.88	6.24	123.12
	12-19-01	1.935	728	303.5	35.0	138.5	477.0	140.00	1.00	141.00
	12-19-01	1.935	692	242.5	41.5	110.0	394.0	142.00	1.00	143.00

Note: All samples collected by Tom Nance Water Resource Engineering (Tom Nance) and/or Marine Research Consultants (Steve Dollar) and analyzed by Marine Analytical Specialists (Ted Walsh).

Specific Attributes of Basal Groundwater in the Kaloko-Honokohau National Historical Park (KAHO). The southern half of KAHO is essentially directly downgradient of the proposed Business Park. Basal groundwater, as it exposed in anchialine pools or discharges into fishponds or the nearshore marine environment, is an important resource for KAHO. Some specific characterizations or basal groundwater in KAHO, based on field data compiled for this report, are as follows:

- At the location of the monitor well directly inland of Aimakapa Fishpond (KAHO Well 1, State No. 4061-01), the basal lens is quite thin. As shown on Figure 5, the transition zone begins just three feet into the lens.

- Tidal amplitudes and lags in the fishponds, particularly Aimakapa Pond, are considerably smaller and delayed in comparison to KAHO's monitor wells (refer back to Table 3). Part of this is due to the difference between the volume of water in the ponds compared to the water volume in the adjacent volcanic formation (100% water in the ponds versus 10% to 20% effective porosity in the lava). However, the almost impermeable beach berm on the makai side of Aimakapa Fishpond is also a factor. Relative to the movement of groundwater through permeable lava, there is essentially no flow through the beach berm.

- At Aimakapa Pond, the difference in tidal phase in the pond and in groundwater in the adjacent volcanic formation around the pond is so pronounced that it causes a gradient reversal between the pond and surrounding groundwater on virtually all changes of the tide (Figure 6). When the groundwater level is higher than the level in the pond, groundwater flows into the pond. Several hours later, the pond level is higher than groundwater and water flows out of the pond back into the surrounding volcanic formation.

- In addition to the relatively longer pond residence time due simply to differences in water volume, the flow reversal in and out of Aimakapa Pond reduces the net input of "new" groundwater on each tidal reversal, thereby further adding to the residence time. This effect is reflected in the following properties of the pond:

  - The temperature of the pond water at its inland margin shows no evidence of the inflow of cool (66° F.) "new" groundwater. As shown on Figure 7, pond water temperatures depend on the time of day and not phase of the tide (ie. there is no evidence of the inflow of colder groundwater on any phase of the tide). Pond water temperatures are 10° to 15° higher than the ambient groundwater.

  - As shown on Figures 8A and 8B, there is very little stratification of salinity or temperature throughout the pond, indicating that the water column is well mixed by long residence times. (Note: the lower salinities in the mud at the bottom of the pond are due to an interference with the meter, not an actual reduced salinity of the water). The only actual salinity stratification evident was a slight salinity increase in the makai profile on Figure 8A.

FIGURE 5. SALINITY PROFILES THROUGH
KAHO WELL 1 (NO. 4061-01)

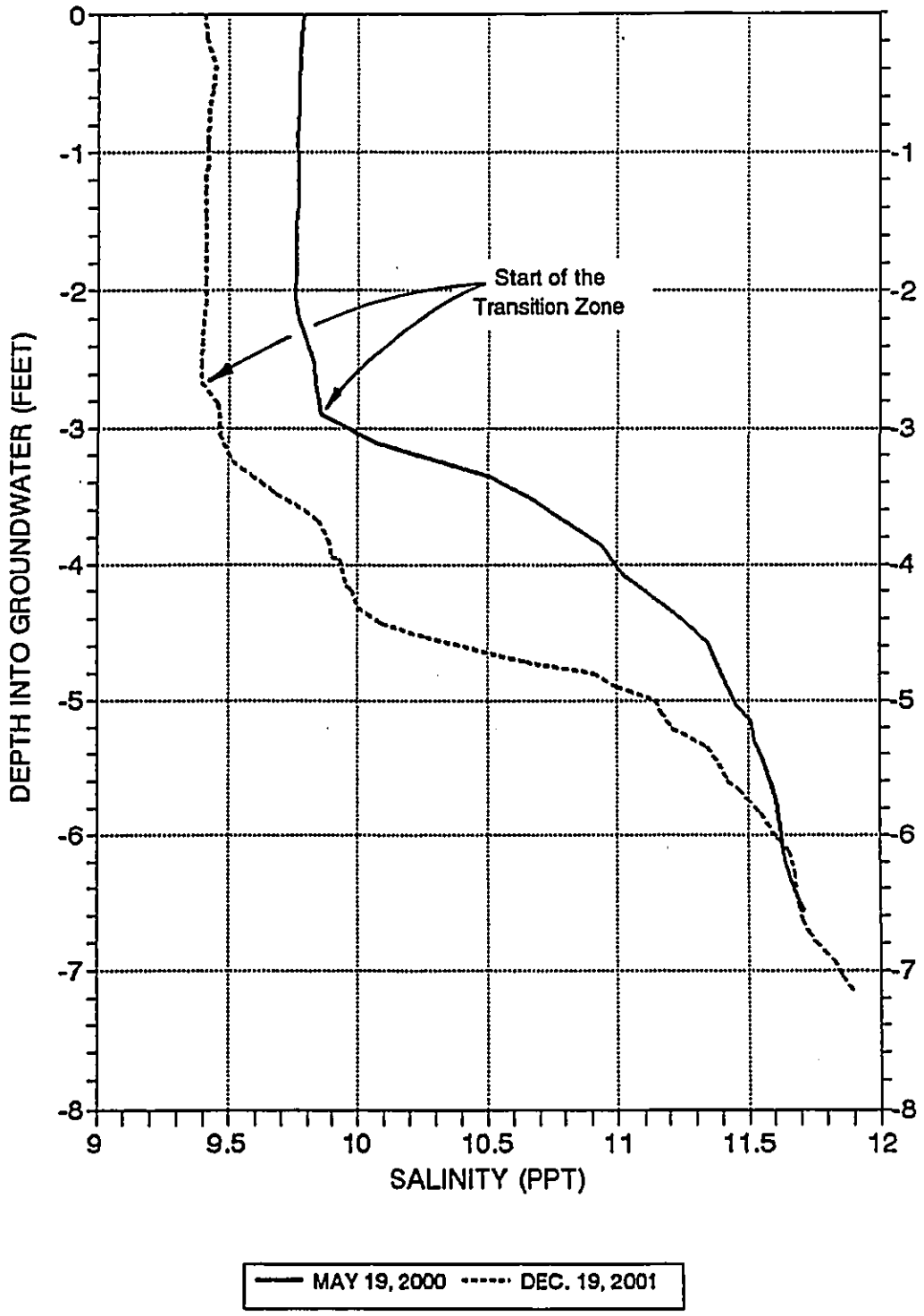


FIGURE 6. WATER LEVELS IN KAHO WELL 1
AND AIMAKAPA POND, DEC. 3 TO 10, 2001

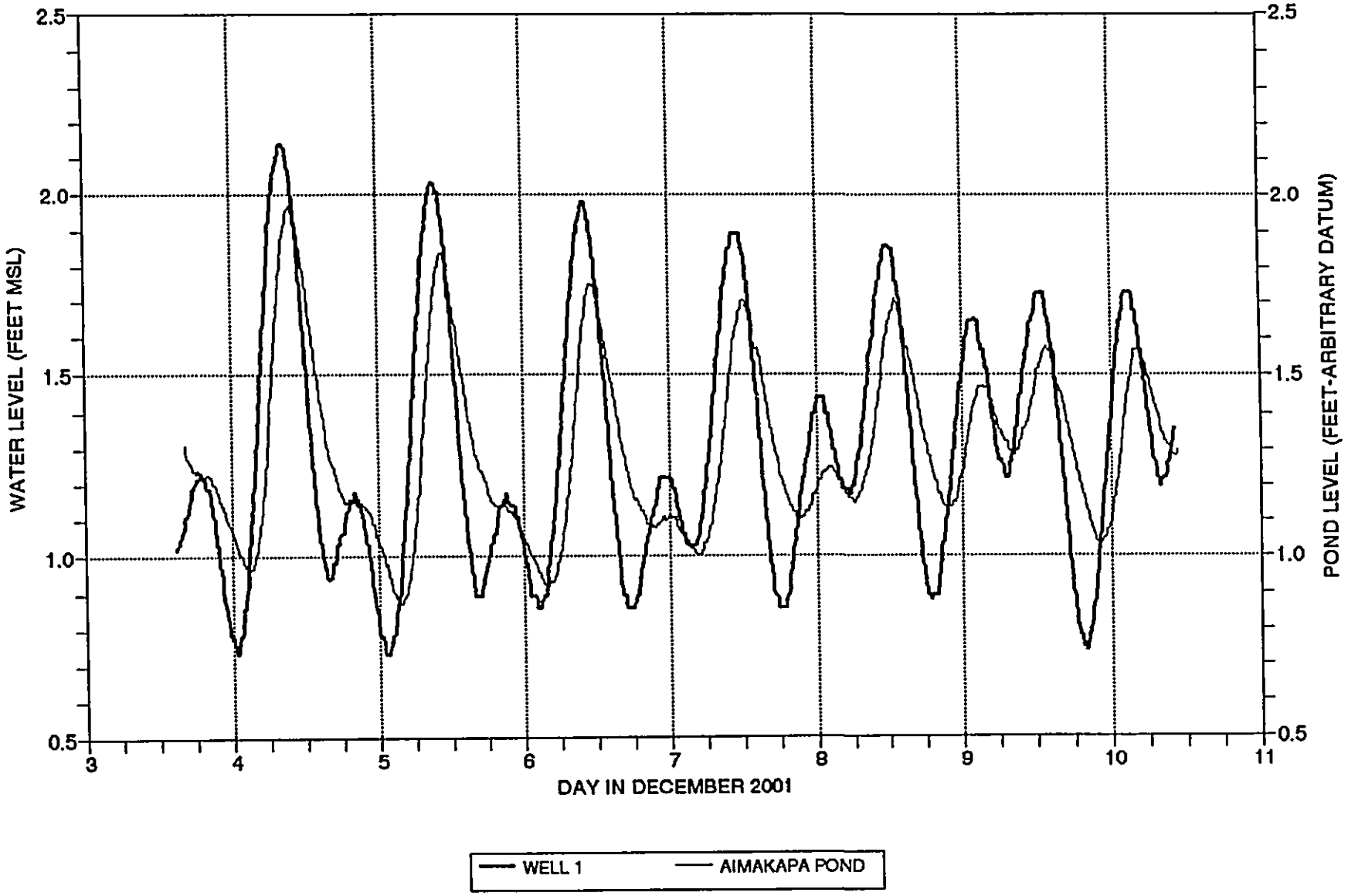
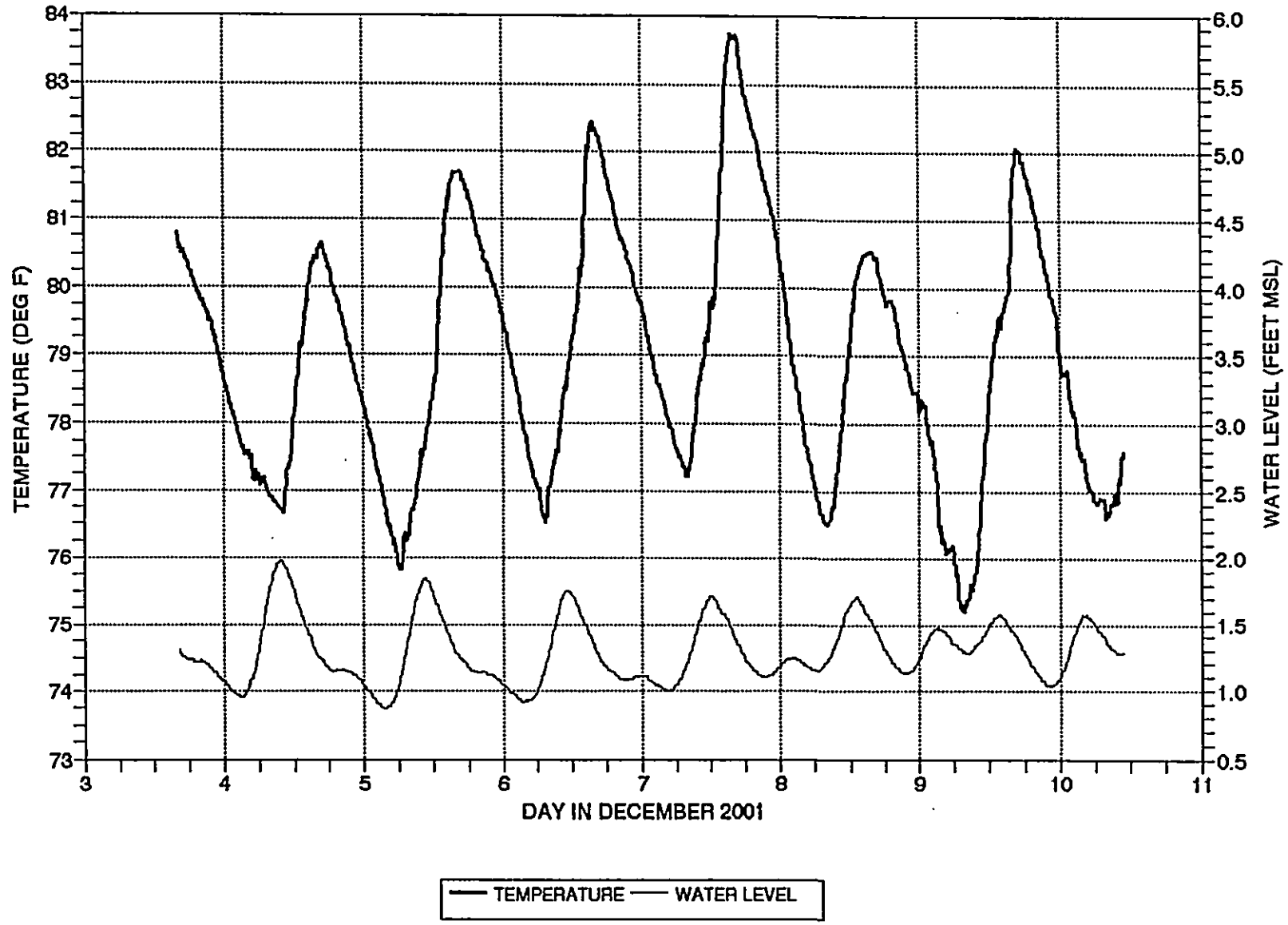


FIGURE 7. TEMPERATURE VARIATION AT THE INLAND MARGIN OF AIMAKAPA POND



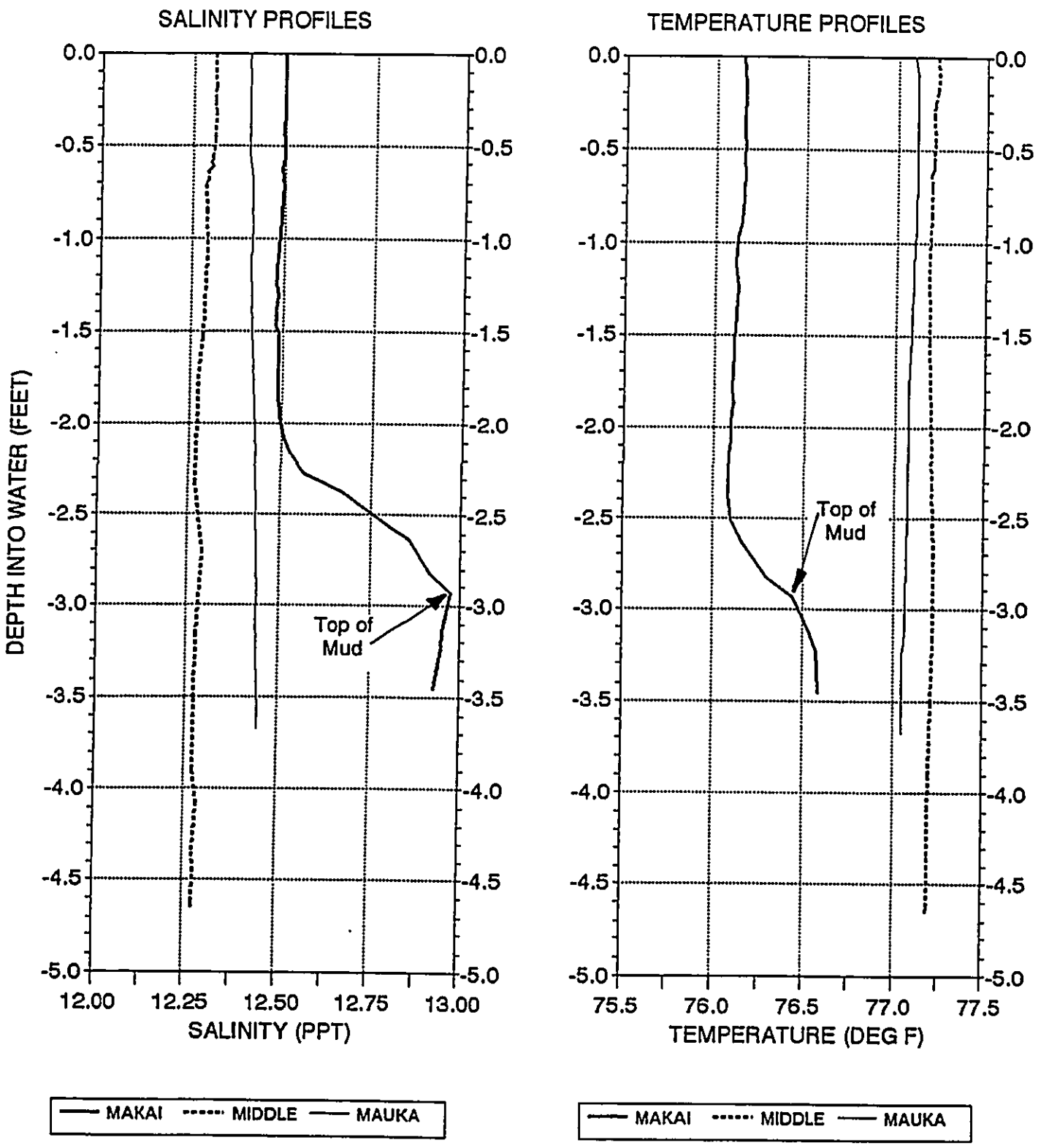


Figure 8A

Salinity and Temperature Profiles in
Aimakapa Pond Along a Mauka-Makai Transect,
December 19, 2001

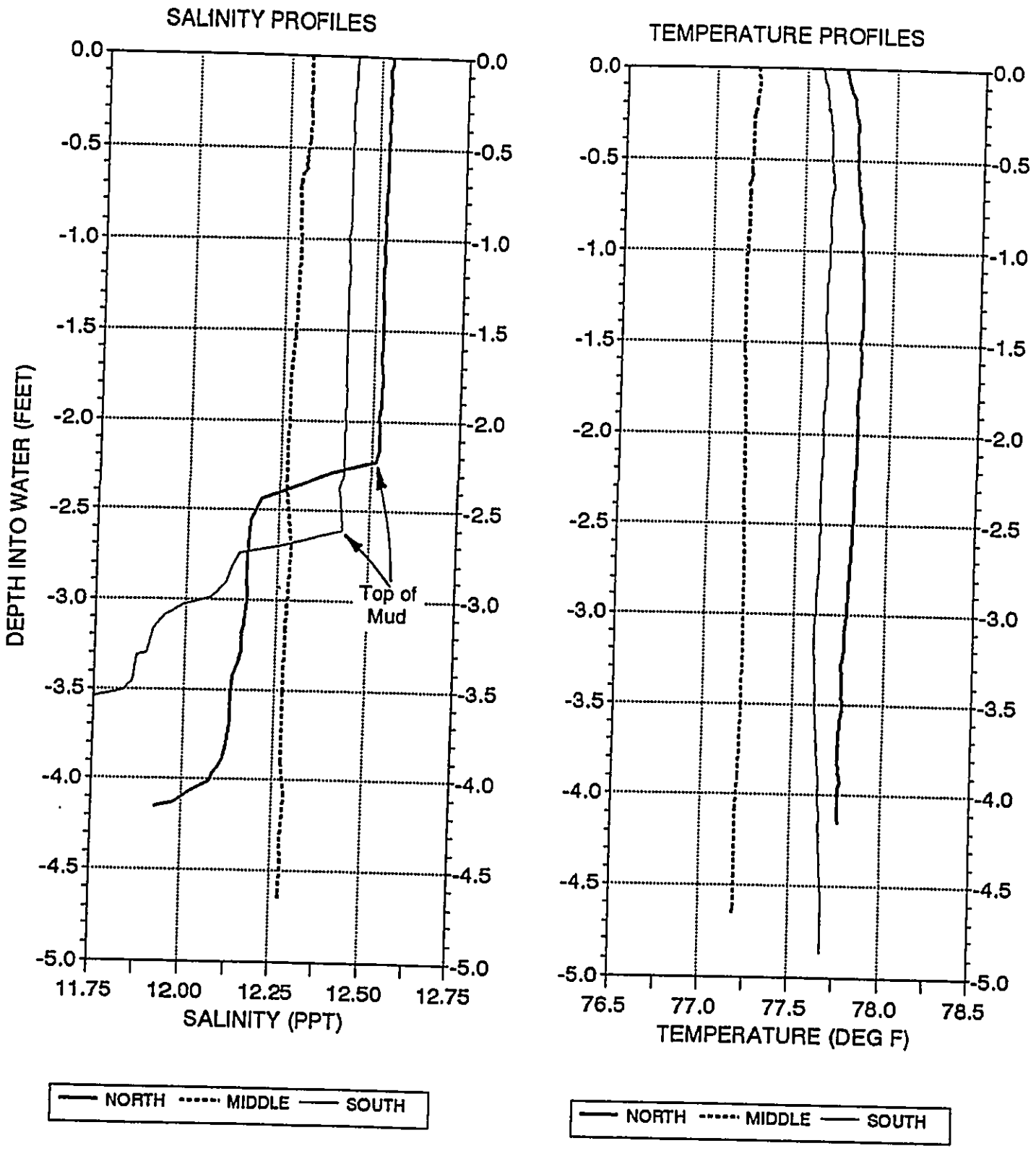


Figure 8B

Salinity and Temperature Profiles in
Aimakapa Pond Along a North-South Transect,
December 19, 2001

- The influence of the flow reversal into and out of Aimakapa Pond appears to reach as far inland as the KAHO-1 monitor well which is approximately 900 feet away. Water in the KAHO-1 well is significantly warmer than in KAHO's other two monitor wells (Figure 9). Also, nitrate and phosphate levels in the KAHO-1 well are anomalously low compared to the other two monitor wells and other basal wells in the region (Figures 10 and 11).

Attributes of High Level Groundwater in the Kaloko-Honokohau Area. Since the discovery of high level groundwater inland of Keauhou Bay in 1990, more than 16 wells have been completed above Mamalahoa Highway in North and South Kona. All of these wells encountered groundwater standing between 40 and 1280 feet above sea level (Oki, 1999:29 provides a good summary of water level data for most of these). Seven of these high level wells are within the area depicted on Figure 1 and are generally upgradient of the project site. Four of the seven have been outfitted with permanent pumps and are connected to DWS' North Kona system. Their use to date has been limited by the transmission capacity of DWS' system along Mamalahoa Highway. However, when the mauka-makai transmission link is completed along Hina Lani Street, greater use of the high level wells will be possible. Attributes of high level groundwater inland of the project site, as demonstrated by these seven wells, are as follows:

- Water levels range from 40 to 292 feet above sea level, with no consistent pattern which might show a direction of high level flow to the north or to the south (refer to Table 2).

- Chloride levels are typically less than 10 MG/L, essentially the same as found in rainwater (also in Table 2).

- Compared to basal groundwater downgradient, temperatures are relatively warm, ranging from 69.4° to 73.8° F.

- Based on pump test results, permeabilities are less than found in the nearshore lavas but still sufficient to accommodate high capacity pumps of 350 to 1400 gallons per minute (GPM).

DWS' use of high level wells in this area began in 1994 with the North Kalaoa Well (No. 4358-01). The Queen Liliuokalani Trust Well (No. 4057-01) was added in January 1997 and the two others (Nos. 4158-02 and 4258-03) in late 1998. DWS' pumpage of these wells has averaged about 1.5 MGD since 1997. Groundwater responses when these wells are ultimately used to their full capacity may shed light on still unknown aspects of this groundwater occurrence, including the geologic feature which creates the high level water, the hydraulic relationships among the differing high level groundwater compartments, and where and how high level groundwater drains into the basal lens.

FIGURE 9. TEMPERATURE PROFILES OF THE KAHO MONITOR WELLS, MAY 19, 2000

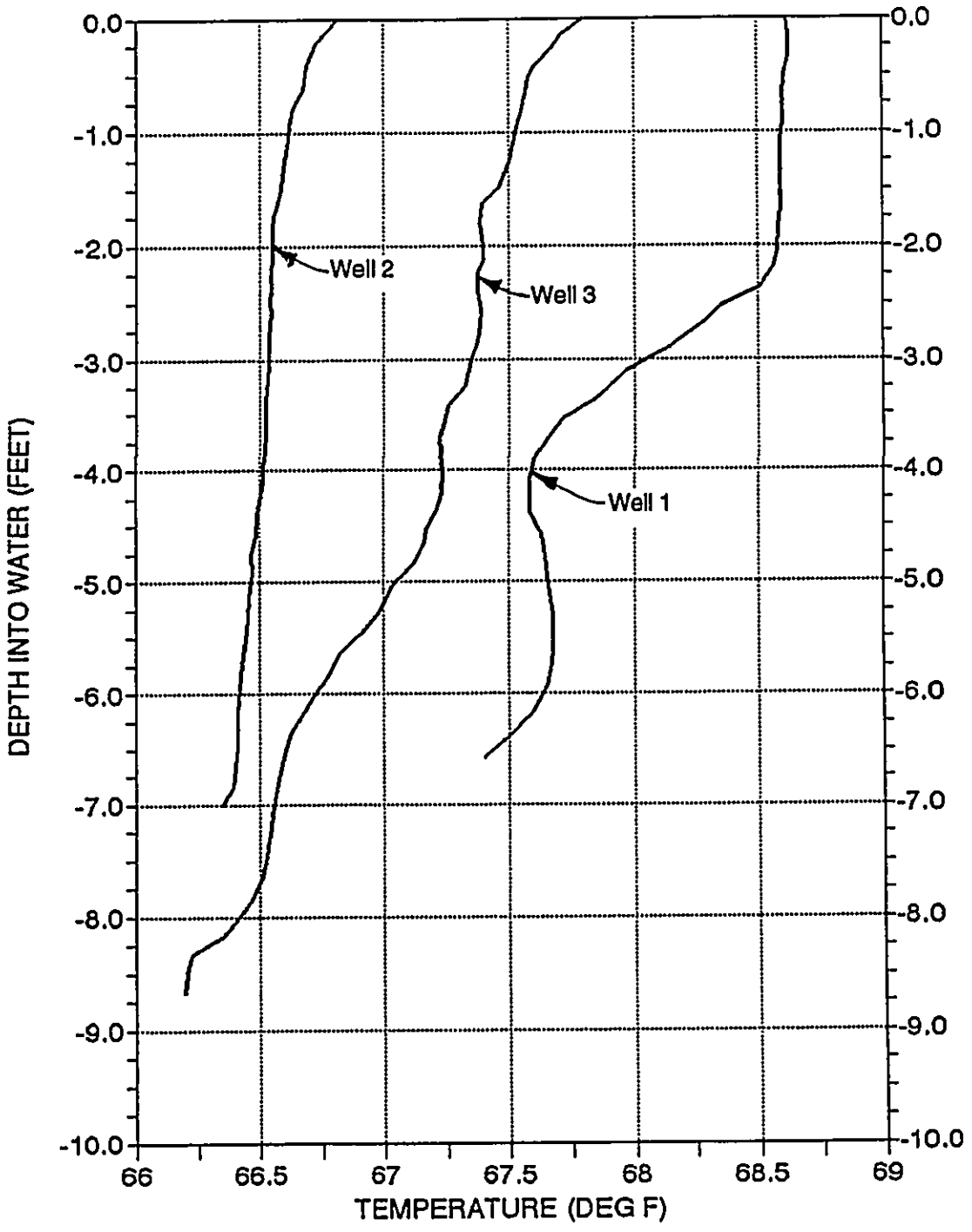


FIGURE 10. NITRATE CONCENTRATIONS IN
THE KAHO MONITOR AND OTHER BASAL WELLS

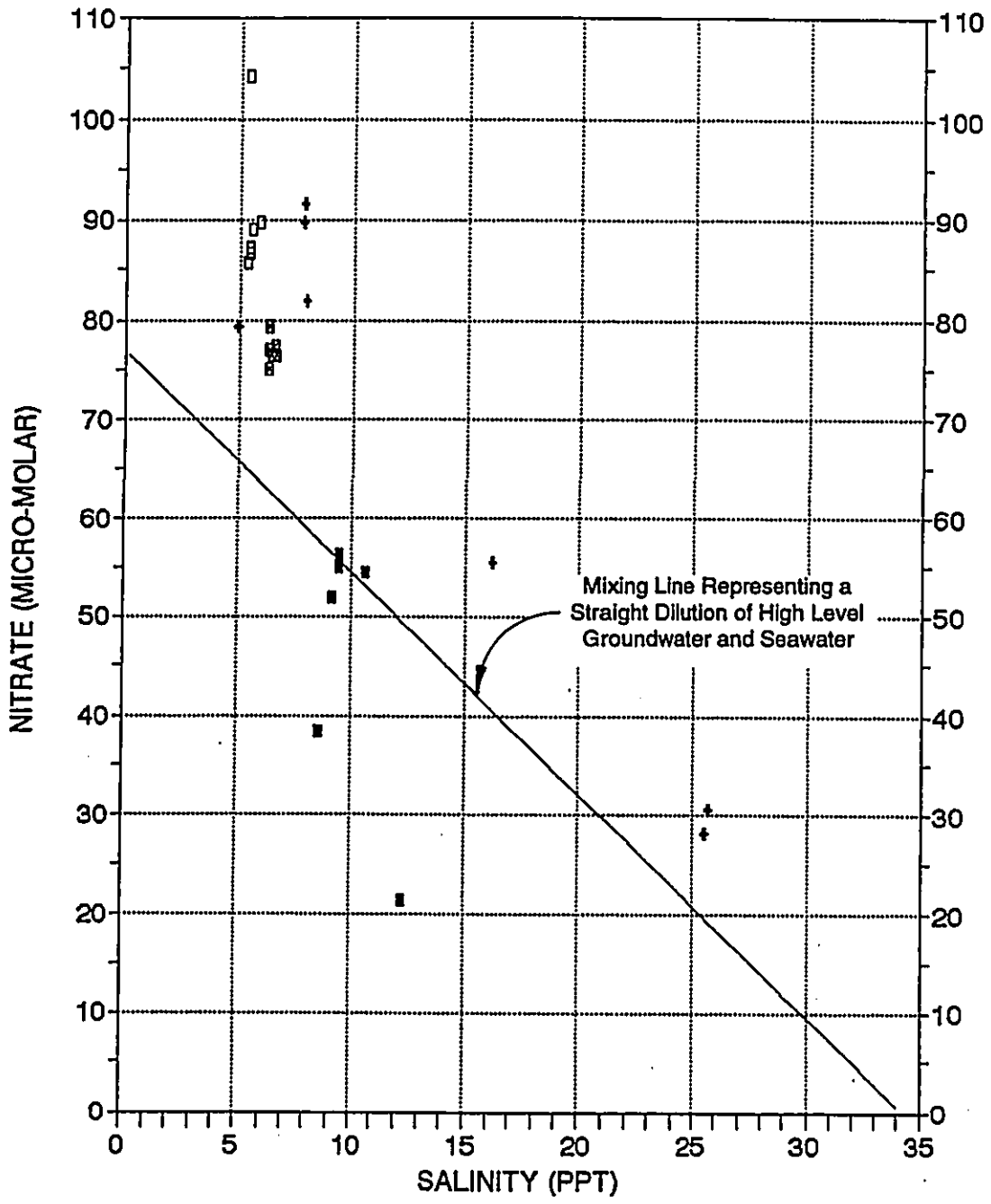
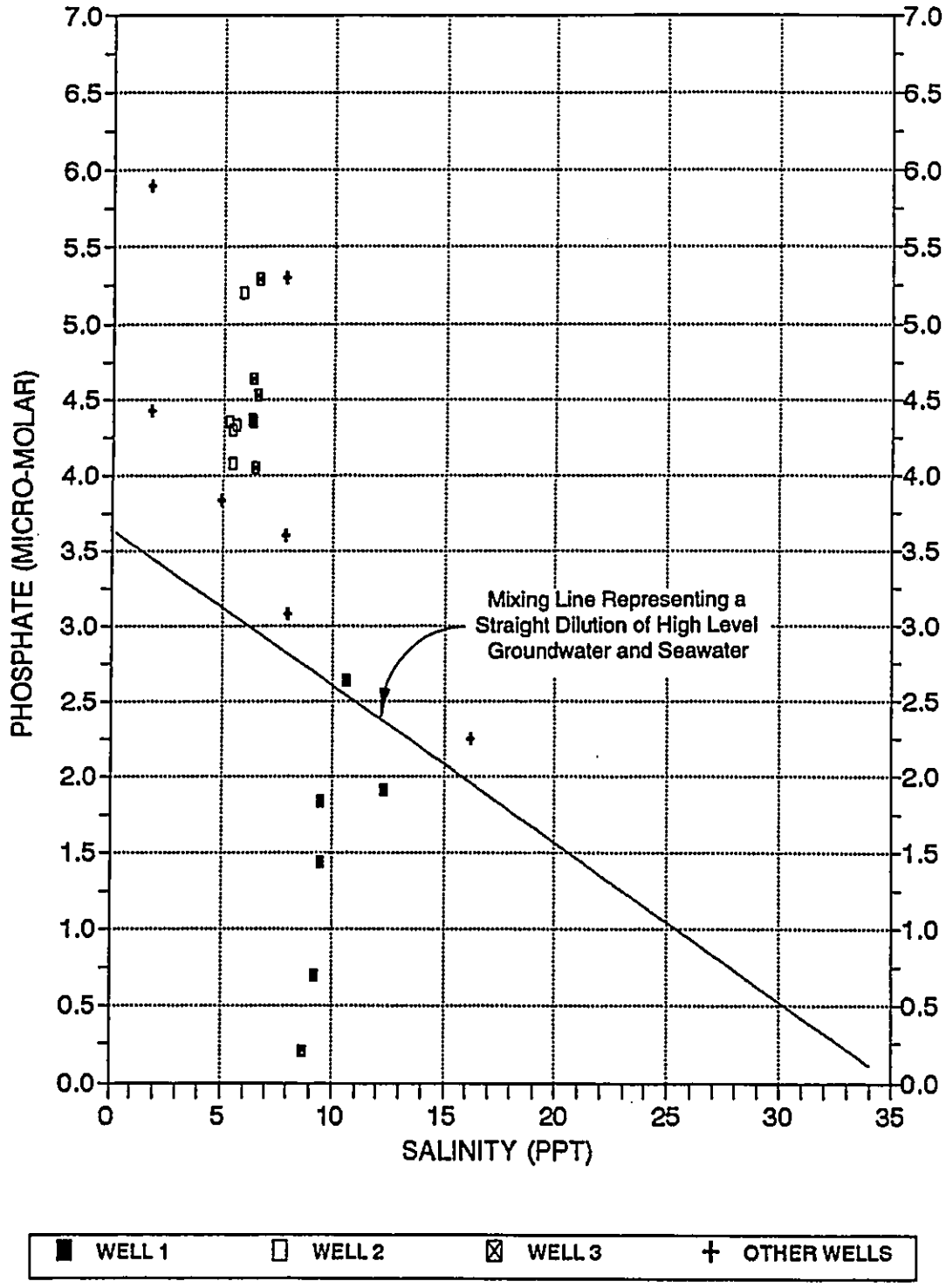


FIGURE 11. PHOSPHATE CONCENTRATIONS IN THE KAHO MONITOR AND OTHER BASAL WELLS



Assessment of the Project's Potential Impact on Water Resources

As indicated in the review of the proposed development at the start of this report, there are four aspects of the project which have the potential to impact water resources: (1) drawing potable supply from inland wells will diminish the rate of leakage from the high level aquifer into the basal lens; (2) during an interim period before sewer service is available, percolate from enhanced septic tank-leach field systems will reach groundwater; (3) stormwater disposed of in dry wells will enter the basal lens as local recharge with potential water quality consequences; and (4) excess landscape irrigation and other miscellaneous external water uses which percolate downward will also impact groundwater quality.

Due to types of land use and the high salinity of basal groundwater in the Kaloko-Honokohau area, there is very little direct use of this resource. Current uses are limited to a small amount of irrigation water pumped from Well 4461-01 and larger amounts of saline groundwater pumped for aquaculture use from Wells 4360-01 to 10 in NELHA and Well 3960-01 in the Queen Liliuokalani Trust property. However, basal groundwater plays an important role in maintaining the ecosystem of the anchialine ponds within and outside the National Park. For this reason, the assessment of potential impacts on water resources focuses on potential changes to the flowrate and quality of basal groundwater moving beneath the project site, passing through the National Park, and discharging into the nearshore environment.

Assessment of Groundwater Withdrawals for Potable Use. For the purpose of this assessment, it is assumed that the project's 0.367 MGD potable supply will come from one or more DWS' four high level wells in the Kaloko-Honokohau area (these four are shown on Figure 1 and listed in Table 2). Withdrawals from any of these wells diminish leakage of high level groundwater into the downgradient basal lens. Results of the groundwater modeling in Oki (1999) for the entire Kona area and in Oki, Tribble, Souza, and Bolke (1999) which focused more specifically on groundwater in KAHO provide the most accurate available quantification of the potential reduction of recharge to the basal lens. The following findings and conclusions from these two studies are relevant for this assessment:

- The unknown geologic feature which creates the abrupt change from basal to high level groundwater in the vicinity of Mamalahoa Highway has been modeled by the USGS as a buried dike complex. This causes some of the high level water to flow around rather than through the geologic feature.

- The basal groundwater flowrate in Kaloko-Honokohau is computed to be approximately 3 MGD per coastal mile. For this average rate, 2.0 MGD would be flowing directly beneath the 3600-foot wide project site and 6.5 MGD would be discharging along KAHO's 2.1-mile long shoreline.

- Owing to the presence of the buried dike complex, model results indicate that the flow of basal groundwater through KAHO is reduced by approximately 15 percent of the amount pumped by the upgradient high level wells that would provide supply to the project [derived from Table 7 and Figure 21 of Oki, Tribble, Souza, and Bolke (1999)].

Based on the USGS' numerical modeling results, supplying 0.367 MGD of high level groundwater for potable use by the project would reduce the flow of groundwater through KAHO by approximately 0.055 MGD (15% of 0.367 MGD). This would reduce the 2.1 MGD groundwater flow through KAHO by 2.6 percent. Such a change would not be significant. As shown on Figure 12, the natural variations of groundwater level caused by long-term ocean level variations (which carry basal groundwater up and down with it) are far greater than would be the change due to a reduction of 2.6 percent of the flowrate.

Assessment of Interim Onsite Disposal of Wastewater. When County sewer service becomes available in about five years, all of the project's wastewater will be delivered to the Kealakehe WWTP for treatment and disposal. Until that time, any lots that are occupied would handle wastewater with individual enhanced septic tank-leach field systems. The effect on groundwater of such disposal during the interim period has been assessed with the series of assumptions and calculations described below.

- It is assumed that 15 percent of the project would be built upon and occupied prior to the availability of County sewer service. Wastewater production, which is typically about 60 percent of the potable water use rate, would amount to 55,000 gallons per day at 15 percent of full build-out.

- For raw wastewater, total nitrogen of 30 to 40 MGL and total phosphorus of 4 to 15 MG/L are expectable. The upper ends of these ranges have been used for the calculations herein.

- Nitrogen and phosphorus removal rates used for the assessment are tabulated below. For enhanced septic systems, nitrogen removals are in the range of 50 to 80 percent. The low end of the range has been used herein.

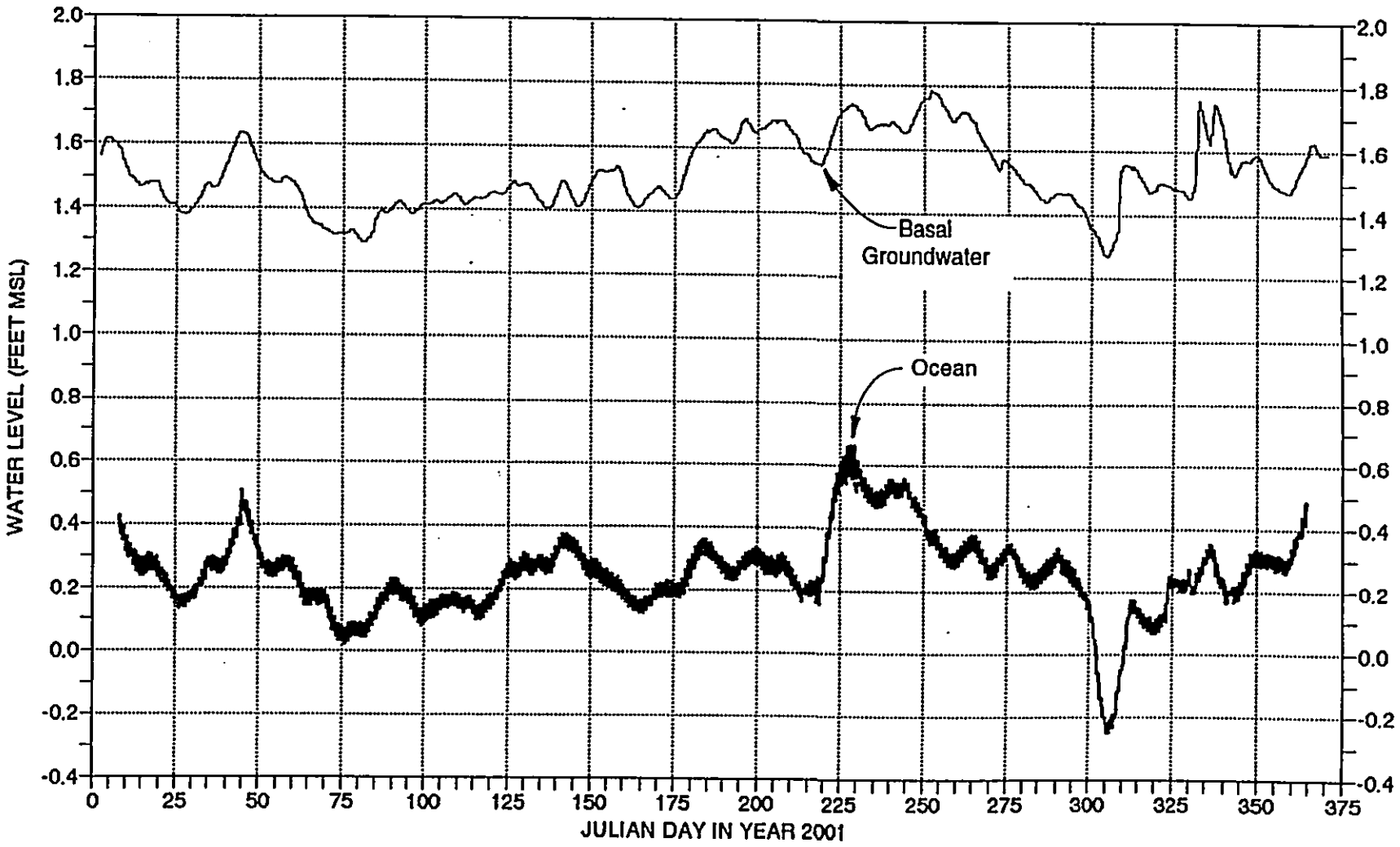
Nutrient Removal Rates Used for This Assessment

Component	Nitrogen (%)	Phosphorus (%)
Enhanced Septic System	50	00
Leach Field	80	90
Vertical Travel in Vadose Zone and Lateral Travel in Groundwater	83*	94*

* As calculated for Kealakehe WWTP effluent travel from the disposal pit to Honokohau Harbor.

- In the tabulation above, nutrient removal rates in the vertical travel from the leach field down to the groundwater and then lateral travel with groundwater to the shoreline were estimated using data from the County's disposal of effluent in its open pit upgradient of Honokohau Harbor. Computations of these removal rates were made as follows:

FIGURE 12. BASAL GROUNDWATER MOVEMENT
IN RESPONSE TO OCEAN LEVEL CHANGES



- The water discharging into the upper end of Honokohau Harbor is a mixture of basal groundwater, the County's R-2 effluent discharged into its open pit on the mauka side of Queen Kaahumanu Highway, and intruded seawater. Its quality is the average of the three samples from the upper end of the harbor on Table 4: 20.6 PPT salinity; 45.5 µM total nitrogen; and 3.08 µM total phosphorus.

- Based on the inland projection of the harbor and the rate of flow through the basal lens developed by the USGS' modeling, the groundwater component of the total discharge into the harbor is likely to be in the range of 1.0 to 2.5 MGD.

- The effluent disposal rate into the pit is about 1.0 MGD. At least half, if not all, of this effluent ultimately discharges into the harbor, meaning that this component of the discharge into the harbor is in the range of 0.5 to 1.0 MGD.

- The quality of the R-2 effluent delivered to the sump is the rounded average of the data at the bottom of Table 4: 1.7 PPT salinity; 480 µM total nitrogen; and 115 µM total phosphorus.

- The quality of the underlying groundwater, generally based on averages of upgradient Well 4160-02 and downgradient Well 4161-02, adjusted for salinity, is as follows: 4.0 PPT salinity; 110 µM total nitrogen; and 6.9 µM total phosphorus.

- Seawater has a salinity of 34 PPT, total nitrogen of 7.0 µM, and total phosphorus of 0.4 µM (average values of surface seawater at NELH).

- For these assumptions, the ratio of groundwater to effluent in the discharge into the harbor could vary from 5:1 to 1:1. For these ratios and the nitrogen and phosphorus concentrations cited above, computed nutrient removal rates are not very sensitive to the assumed flowrate ratios: 83 to 97 percent removal for nitrogen; and 94 to 95 percent removal for phosphorus. The low ends of these ranges have been used herein.

For the various removal rates tabulated above, resulting nitrogen and phosphorus loading to the downgradient southern half of KAHO is presented in Table 5. The series of calculations indicate that the onsite disposal of wastewater during the interim period would result in additional nitrogen and phosphorus loading of 0.5 percent in the southern half of KAHO, respectively. Once sewer service is implemented, onsite disposal would be terminated and the nutrient loading would end.

Assessment of Stormwater Disposal. The land surface of the 337-acre site is comprised of bare a'a lava with some areas of gravel and cinder soil with scrub growth. With no surface runoff, all rainfall which is not lost to the atmosphere via evaporation or plant evapotranspiration becomes groundwater recharge. This amount is estimated to be one-third to one-half of the 15 to 20 inches of rain each year, an amount consistent with the recharge calculations in Oki (1999:44 to 46). Over the 337-acre site, this is equivalent to approximately 0.15 MGD.

Table 5

Estimated Nitrogen and Phosphorus Loading to Groundwater Flowing Beneath the Southern Half of the Kaloko-Honokohau National Historical Park During the Interim Period of Onsite Wastewater Disposal

Point in the Process	Nitrogen			Phosphorus		
	Removal Rate (%)	Concentration (MG/L)	Loading (Lbs/Day)	Removal Rate (%)	Concentration (MG/L)	Loading (Lbs/Day)
Raw Wastewater to Septic Tank	--	40	18.3	--	15	6.87
Leaving the Enhanced Septic Tank	50	20	9.2	0	15	6.87
Percolating Below the Leach Field	80	4.0	1.83	90	1.5	0.69
Arriving at Ponds and Pools in KAHO	83	0.68	0.24	94	0.09	0.025
Present Groundwater Flow	--	1.54	41.69	--	0.22	5.85
Combined With Project's Wastewater	--	1.53	41.88	--	0.22	5.88
% Increase by the Project			0.5			0.5

Notes:
1. The wastewater flowrate at 15% of full build-out is 0.033 MGD. Natural groundwater flow through the southern half of KAHO is 3.25 MGD.
2. Present concentrations of nitrogen and phosphorus in groundwater beneath KAHO are taken to be the average of the top samples of the KAHO-2 monitor well given in Table 4.

Development of the site will convert some of the permeable land surface to impermeable roadways, roof tops, parking areas, and other asphalt and concrete surfaces. On a local scale, this will create surface runoff. However, it will be collected and disposed of in dry wells, seepage pits, or open areas. None will leave the site as surface runoff; all will percolate to the basal lens. As a first order approximation, it is assumed that the amount of stormwater reaching basal groundwater after development will be essentially unchanged. However, a change in nutrient levels and the addition of petroleum products are possible. The potential effects of petroleum products are addressed in a separate assessment by others.

To assess the possible changes in nutrient concentrations, stormwater runoff samples were collected from eight locations in the nearby Kaloko Industrial Park on December 30, 2001 and January 29, 2002. Sample site locations are identified on Figure 13 and the laboratory results are compiled on Table 6. As shown in the comparison of these runoff samples with high level and basal groundwater below, the stormwater runoff samples are fresher, have far less silica, are 35 to 50 percent lower in nitrogen, and have comparable levels of phosphorus.

Comparative Nutrient Concentrations

Sample	Salinity (PPT)	Silica (µM)	Nitrogen (µM)				Phosphorus (µM)		
			NO_3	NH_4	TON	Total N	PO_4	TOP	Total P
Stormwater Runoff	0.086	67.3	7.2	7.5	45.7	60.4	5.06	0.58	5.64
High Level Groundwater	0.158	818	77.7	0.2	18.5	96.4	3.74	0.99	4.73
Basal Groundwater	5.387	653	92.7	2.5	22.3	117.5	5.81	1.16	6.97

Notes:
1. Stormwater runoff values are the average concentrations on the bottom line of Table 6.
2. High level groundwater values are the average of all high level wells at the top of Table 4.
3. Basal groundwater values are the average of the three "top" samples from Well 4161-02 in Table 4.

To illustrate the possible impact that stormwater runoff from the project may have on groundwater, it is arbitrarily assumed that percolating rain water on the undeveloped site has nutrient levels that are half that of high level groundwater. For this assumption, the stormwater runoff values given above, and the same subsurface removal rates calculated previously, percolating runoff from the fully developed site would add 0.04 and 0.008 pounds per day of nitrogen and phosphorus, respectively. Compared to the present amounts of nitrogen and phosphorus in groundwater moving through the southern half of KAHO, these would represent increases of about 0.1 percent.

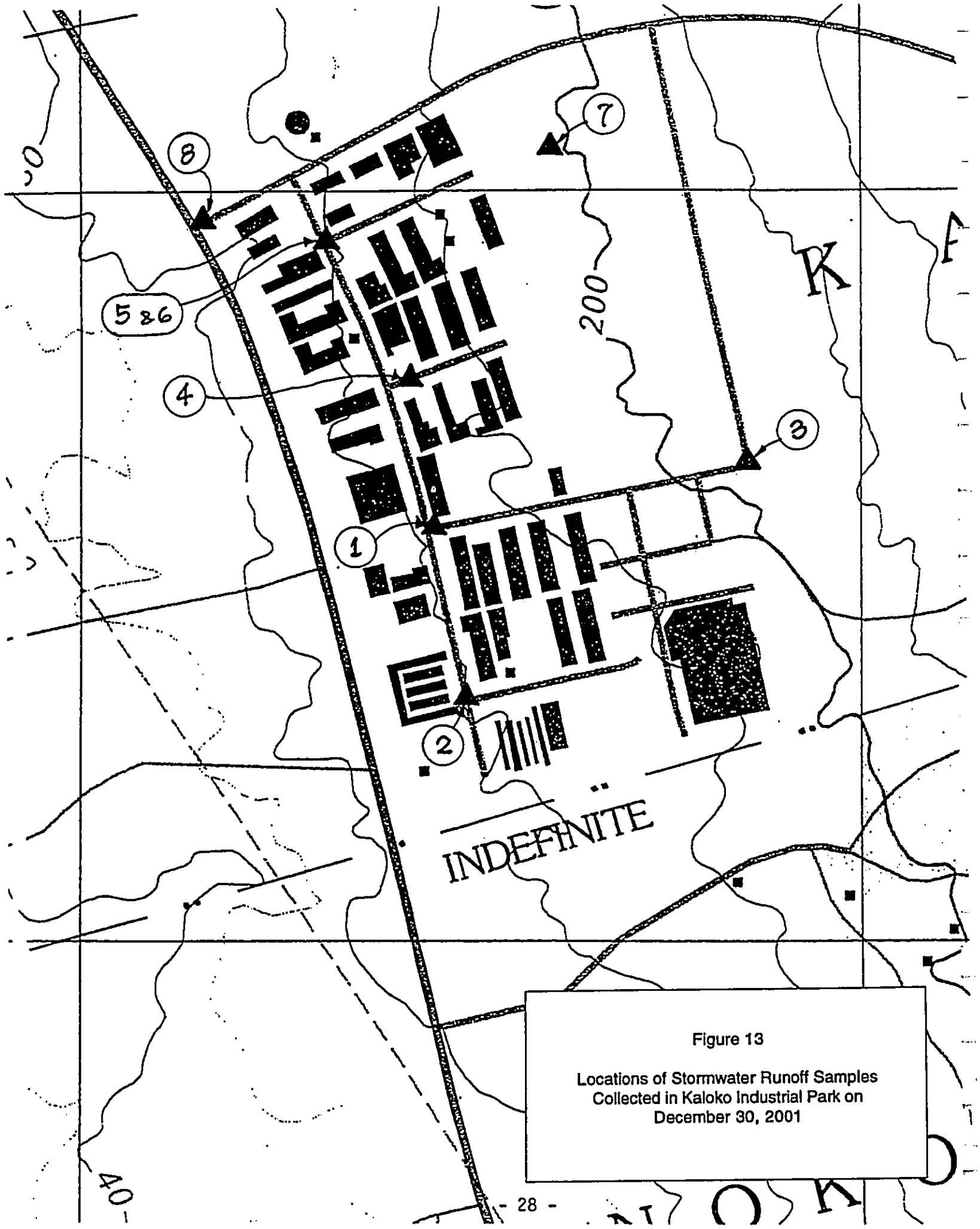


Figure 13

Locations of Stormwater Runoff Samples Collected in Kaloko Industrial Park on December 30, 2001

Table 6

Water Quality of Stormwater Runoff Samples Collected in Phases I and II of the Kaloko Industrial Park on December 30, 2001 and January 29, 2002

Sample Site No.	Sample Date	Salinity (PPT)	Silica (µM)	Forms of Nitrogen (µM)				Forms of Phosphorus (µM)		
				NO_3	NH_4	TON	Total N	PO_4	TOP	Total P
1	12-30-01	0.084	66.7	4.4	0.7	66.7	71.8	5.27	0.23	5.50
	1-29-02	0.074	16.7	6.0	3.9	31.0	41.0	3.20	0.38	3.58
2	12-30-01	0.140	107.2	3.1	0.7	66.9	70.7	6.10	1.31	7.41
	1-29-02	0.063	15.2	2.8	9.3	28.4	40.5	2.70	0.52	3.22
3	12-30-01	0.070	55.9	8.5	26.7	78.7	113.9	9.19	0.49	9.68
	1-29-02	0.056	11.1	4.0	7.9	21.5	33.4	2.32	0.18	2.50
4	12-30-01	0.077	70.5	3.1	5.1	72.0	80.2	4.34	1.12	5.46
	1-29-02	0.084	45.7	5.0	5.6	75.0	85.5	8.30	0.90	9.20
5	12-30-01	0.074	54.0	9.4	5.5	37.3	52.2	2.03	0.67	2.70
	1-29-02	0.154	144.3	17.3	11.2	32.3	60.8	3.08	0.62	3.70
6	12-30-01	0.130	96.7	12.9	8.7	48.9	70.5	5.03	0.46	5.49
	1-29-02	0.088	104.4	12.5	6.1	35.4	54.1	3.44	0.38	3.82
7	12-30-01	0.049	50.3	3.9	19.2	37.1	60.2	2.70	0.06	2.76
	1-29-02	0.063	47.3	4.9	6.0	22.4	33.3	19.82	0.68	20.50
8	12-30-01	0.088	158.1	6.8	1.0	47.8	55.6	1.74	0.62	2.36
	1-29-02	0.077	130.0	10.8	2.1	30.0	42.9	1.76	0.58	2.34
Maximum		0.154	158.1	17.3	26.7	78.7	113.9	19.82	1.31	20.50
Minimum		0.049	11.1	2.8	0.7	21.5	33.3	1.74	0.06	2.34
Average		0.086	67.3	7.2	7.5	45.7	60.4	5.06	0.58	5.64

Note: Samples collected by Matthias Kusch and analyzed by Marine Analytical Specialists (Ted Walsh).

Assessment of Landscape Irrigation and Other Miscellaneous External Water Uses. Most potable supply that does not become wastewater would be used for landscape irrigation and dust control. A lesser amount would also be used for washdowns of pavement areas and other miscellaneous uses outside of buildings. Most of this water would be lost to plant evapotranspiration or direct evaporation, but some would percolate to groundwater. Its impact can be approximated with the following assumptions: 40 percent of the potable supply is used outside of buildings; 20 percent of this water will reach groundwater; and its nutrient levels will be approximately twice that of the potable water supply. For those assumptions, nitrogen and phosphorus loading would amount to 0.29 and 0.03 pounds per day just below the ground surface. Again applying the subsurface removal rates, the amounts reaching the southern half of KAHO would be 0.064 and 0.0018 pounds per day of nitrogen and phosphorus. These represent loading increases to groundwater moving beneath the southern end of KAHO of 0.14 and 0.03 percent, respectively.

Potential Long-Term Cumulative Impacts. Based on the pattern of development in the Kailua to Keahole area over the last 10 years, it appears that most of the area adjacent to and mauka of the Kaloko-Honokohau Business Park will ultimately be developed. Some projects are in various stages of planning or obtaining government approvals. For most of the area, however, specific land use planning has not taken place. Any assessment of the potential impacts of this future, unplanned development will be unavoidably less specific than the preceding assessment of the Business Park. The four types of potential impacts to groundwater by this future development as discussed in general terms in the paragraphs following.

(1) Groundwater Withdrawals for Potable Use. The undeveloped area around and mauka of the Kaloko-Honokohau Business Park is likely to ultimately require on the order of 1.5 to 2.0 MGD of potable supply at full build-out. All of this is likely to come from high level wells mauka of Mamalahoa Highway. Using the results of groundwater modeling in Oki (1999), this will cause a reduction of groundwater flow through KAHO of about 15 percent of the water withdrawn from the high level wells or about 0.2 to 0.3 MGD. This would amount to a reduction of the total basal groundwater flow through KAHO of 10 to 15 percent.

(2) Treatment and Disposal of Wastewater. In the long-term, projects of significant size or density are likely to be required to connect to the County's sewerage system. Most of the wastewater conveyed to the County WWTP will ultimately be treated to R-1 quality for irrigation reuse. Based on the County's present and longer-term plans, irrigation reuse will occur around and directly mauka of the WWTP. Percolation of a portion of this reuse water to the basal lens, because of the location of its application, would not be likely to impact groundwater beneath KAHO.

(3) Stormwater Disposal. As with the rest of Kona, stormwater disposal is likely to continue to be collected and disposed of onsite. Over the 1000 to 1500 acres that may ultimately be developed upslope of KAHO, this source of groundwater recharge may account for 0.4 to 0.8 MGD of the 2.1 MGD flowing beneath KAHO. If the runoff samples collected in Kaloko Industrial Park are representative, small increases in nitrogen and phosphorus levels would occur as a result of development. Applying the identical

computational method to this larger area that was presented previously for the project site, the nitrogen increase would be less than one percent and the phosphorus increase would be on the order of one percent.

(4) Landscape Irrigation and Other External Uses of Water. If the same assumptions and computational methods are applied to the 1000 to 1500 acres of future development that were used for the project site, the results for this aspect of water use would be as follows:

- The 2.1 MGD of groundwater flowing beneath KAHO would be increased by 0.12 to 0.16 MGD. This would offset about half of the reduction in groundwater flow due to withdrawals from high level wells for potable use.

- Although the changes in nutrient concentrations in groundwater would be virtually imperceptible, the increase in flow would cause an increase in loading: about 1.6 to 2.1 percent for nitrogen and 0.5 to 0.7 percent for phosphorus.

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Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 4

Assessment of Effects to Marine and Pond Environments

AN ASSESSMENT OF POTENTIAL EFFECTS TO THE MARINE AND POND ENVIRONMENTS IN THE VICINITY OF THE KALOKO-HONOKOHAU BUSINESS PARK, NORTH KONA, HAWAII

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March 2002

1.0 PURPOSE

Planning is underway to prepare an Environmental Impact Statement (EIS) to reclassify approximately 337 acres of land currently in the State Conservation District into the Urban District in order to develop the Kaloko-Honokohau Business Park. The parcel of land is located mauka of the Queen Kaahumanu Highway between Honokohau Harbor and the Kona International Airport at Keahole in North Kona on the Island of Hawaii. The proposed project includes a mix of light industrial and industrial-commercial mixed use activities. The proposed project includes a mix of light industrial and industrial-commercial mixed use activities. Development of the Business Park for these industrial and commercial uses, as well as the retention and expansion of ongoing quarrying activities, is envisioned to occur in three phases over a period of more than 20 years. None of the proposed land uses includes any alteration of the coastal areas or nearshore waters.

A somewhat unique characteristic of the project is the location relative to the Kaloko-Honokohau National Historical Park, which lies directly to the west of the project site on the makai side of Queen Kaahumanu Highway. The National Parks and Recreation Act of 1978 provided for the establishment of the Kaloko-Honokohau National Historical Park to preserve the integrity of the many archaeological features and fishponds found in the area. Kaloko Pond and Aimakapa Pond are large brackish bodies of water separated from the ocean by a basaltic rock wall (Kaloko) and a sand beach berm (Aimakapa). At the present time, the rock wall at Kaloko Pond is being reconstructed, and the new wall incorporates channels which afford a direct connection between the pond and ocean.

Water in the ponds is brackish, consisting of a mixture of low salinity groundwater, and seawater. As a result, water chemistry in the ponds can potentially be influenced by changes in groundwater composition and runoff of surface water. Leaching of materials such as fertilizer nutrients and pest control agents to groundwater could alter pond water chemistry. In addition, as pond water exchanges with ocean water in the nearshore area, there is also potential for alteration of marine water chemistry. Such alterations in water chemistry can, in turn, provide the potential to affect the structure of marine biotic communities in the nearshore area.

In addition, the Natural Energy Laboratory of Hawaii (NELH) and Hawaii Ocean Science and Technology (HOST) Park (together administered as the Natural Energy Laboratory of Hawaii Authority [NELHA]) lies approximately 3.5 miles north of the project site. The primary activities at NELHA revolve around the use of cold nutrient-rich seawater pumped from below the vertically stratified surface layer to support various forms of mariculture. Other

uses at the NELHA facility involve usage of warm, low-salinity seawater pumped ashore from the surface layer of the nearshore ocean. Concerns have also been stated on the potential effects to NELHA from the proposed Kaloko-Honokohau Business Park and other neighboring projects on water quality at NELHA.

In the interest of addressing these concerns and assuring maintenance of environmental quality, it has been deemed appropriate to conduct an assessment of the pond and marine environments that are downslope from the proposed Kaloko-Honokohau Business Park. The rationale of this assessment is to determine the contribution of groundwater to the pond and marine environments, and the effects of such input on marine community structure and function at the present time before the commencement of any new construction activities. Of particular interest is assessing the metabolic activity of the Aimakapa Pond. As this pond is essentially sealed from direct contact with the ocean, the metabolic function of the pond could be potentially influenced by changes in groundwater composition.

The resulting data provides a characterization of the effects of the existing phases of Kaloko-Honokohau Business Park. Combining this information with estimates of changes in groundwater flow rates and chemical composition of groundwater that will enter the ponds that will likely result from construction of the project, it will be possible to evaluate the potential effects to the metabolic character of the marine and pond environments. Predicted changes in groundwater flow rates and groundwater chemistry have been supplied by Tom Nance Water Resource Engineering (TNWRE) in a report under separate cover entitled "Potential Impact on Water Resources of the Proposed Kaloko-Honokohau Business Park in North Kona Hawaii" dated January 2002. Results of the combined evaluation will indicate if, and to what degree, there is the potential for negative effects to the aquatic environments from the proposed project.

2.0. METHODS

2.1. WATER CHEMISTRY

2.11. Sampling Sites

The Kaloko-Honokohau National Historical Park is located seaward of the existing Kaloko-Honokohau Business Park, as well as the planned increment. Over half of this 1,160-acre park is comprised of ocean waters. Contained within its boundaries are also two large fishponds (Kaloko and Aimakapa), tidal areas and wetlands (Figure 1). Water samples were collected on transects that bisected each fishpond to obtain baseline information on the composition and

stratification of pond waters. Transects extended from the most landward shoreline of the ponds, through the approximate center of the ponds to the seaward shorelines, and then continued into the ocean for a distance deemed to reach open coastal ocean (Figure 1). In addition, groundwater and other water samples were collected from a variety of sources. These included: 1) high level potable quality wells that are part of the Department of Water Supply (DWS) North Kona system; 2) Basal wells of brackish water quality, primarily three monitoring wells located on Kaloko-Honokohau National Historical Park property (Figure 1); 3) basal wells of saline quality, primarily located on the property of NELHA; and 4) springs where groundwater discharge was evident along the periphery of Kaloko and Aimakapa Ponds.

Data was collected during several periods. The first set of water samples was collected in May-June 2000 in both Aimakapa and Kaloko Pond. Subsequently, a second set of samples was collected in December 2001 only in Aimakapa Pond. In addition to the water samples collected specifically for this report, data collected as part of the Comprehensive Environmental Monitoring Program (CEMP) at NELHA was also utilized. The locations of all well water samples and well designations, as well as the dates of well samplings are shown in TNWRE (2002).

2.12. Sampling Protocol

All field work was conducted on May 26, June 2, 5, and 10, 2000 and December 19, 2001 by divers working from shore. Environmental conditions during all sample collection were similar, and consisted of light wind, and moderate seas with a surf break of approximately 2-3 feet. Water samples were collected at seven equally spaced stations in Aimakapa Pond and eight stations in Kaloko Pond. Each of the transects continued from the ocean shoreline a distance of approximately 150 meters (m) seaward where water was collected at seven stations. Such a sampling scheme was designed to span the greatest range of salinity with respect to freshwater efflux at the shorelines of the ponds and the ocean. Sampling was more concentrated in the nearshore oceanic zone because this area is most likely to show the effects of alteration in groundwater composition (e.g., mixing of groundwater and ocean water). With the exception of the two ocean stations closest to the shoreline, samples were collected at two depths; a surface sample was collected within approximately 20 centimeters (cm) of the pond or sea surface, and a bottom sample was collected within approximately 20 cm of the pond or sea floor. Owing to the shallow depth (<1 foot) at the two ocean stations closest to shore, only one water sample was collected.

Pond water samples were collected by investigators wading through the center of the pond starting at the most landward point and moving seaward. Surface samples were collected by

carefully sampling the upper 20 cm of the water column in areas that were not subjected to resuspended sediment plumes. Bottom water sampling in the ponds presented a challenge owing to the extremely turbid conditions and soft, flocculent sediment bottom that was easily resuspended with the slightest water motion. In addition, the bottom topography was extremely variable with numerous deep holes and shallow platforms. It was found that the most effective manner to sample bottom waters was by carefully diving to the bottom, swimming ahead out of the turbid plume created by wading, visibly determining the location of the sediment-water interface and carefully opening a sample bottle just above the bottom. Such a method appears far more effective than attempting to sample bottom waters remotely from the surface (such as from a small boat). Owing to the shallow depth of much of the pond (less than one meter), the highly irregular surface, the extremely flocculent bottom sediments, and the lack of visibility of the bottom from above the water remote sampling would result in substantial contamination of samples from resuspended material.

Samples were collected in pre-rinsed 1-liter polyethylene bottles at the desired depth. Subsamples for nutrient analyses were immediately placed in 125-milliliter (ml) acid-washed, triple rinsed, polyethylene bottles and stored on ice until delivery on the same day as collection to the analytical laboratory in Honolulu. Water for other analyses was subsampled from 1-liter polyethylene bottles and kept chilled until analysis.

Specific constituents of State of Hawaii Water Quality Standards include Total Nitrogen (TN) and Total Phosphorus (TP). In order to evaluate these constituents, it is mandatory that water samples are unfiltered prior to analysis. Because there remains some controversy as to the effects of filtering samples with respect to analytical results, the samples collected in Aimakapa Pond on December 19, 2001 were immediately split, with half the volume filtered immediately following collection. Samples were filtered by hand pressure using 150 ml syringes and Whatman GF/C filter papers. As with the unfiltered samples, filtered samples were placed in acid-washed, triple-rinsed 125-ml polyethylene bottles and stored on ice until delivered to the analytical laboratory.

2.13. Monitoring Constituents

Water quality parameters evaluated included the 10 specific criteria designated for open coastal waters in Chapter 11-54, Section 06 (Open Coastal waters) of the Water Quality Standards, Department of Health, State of Hawaii. These criteria include: total nitrogen (TN) which is defined as inorganic nitrogen plus organic nitrogen, nitrate + nitrite nitrogen (NO_3^- + NO_2^-, hereafter referred to as NO_3^-), ammonium (NH_4^+), total phosphorus (TP) which is defined as inorganic phosphorus plus organic phosphorus, chlorophyll a (Chl *a*), turbidity,

dissolved oxygen, pH and salinity. In addition, orthophosphate phosphorus (PO_4^{-3}) and silica (Si) were reported because these constituents are sensitive indicators of biological activity and the degree of groundwater mixing, respectively. Total suspended solids (TSS) were also analyzed. Owing to the method of collection, field measurement of temperature in the discrete water samples would not have produced accurate results. Instead, vertical profiles of temperature (as well as salinity) were acquired throughout the ponds using an Ocean Sensors CTD. Complete temperature and salinity profiles in the ponds are shown in TNWRE (2002).

2.14. Analytical Methodology

Analyses for NH_4^+, PO_4^{3-}, and $NO_3^- + NO_2^-$ (hereafter termed NO_3^-) were performed using a Technicon autoanalyzer according to standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TN and TP were analyzed in a similar fashion following UV oxidative digestion. For unfiltered samples, total organic nitrogen (TON) and total organic phosphorus (TOP) were calculated as the difference between total nitrogen (TN) and inorganic nitrogen ($NO_3^- + NH_4^+$), and total phosphorus (TP) and inorganic phosphorus (PO_4^{3-}), respectively. For the filtered samples, dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) were calculated in the same manner as the difference between TN and dissolved inorganic nitrogen (DIN), and TP and dissolved inorganic phosphorus (DIP), respectively. The level of detection for the dissolved nutrients is 0.2 µM for TN and Si, 0.02 µM for TP, NO_3^- and NH_4^+, and 0.01 µM for PO_4^{3-}.

Turbidity was measured on a Monitek Model 21 90-degree nephelometer, and reported in nephelometric turbidity units (ntu, level of detection 0.01 ntu). Chl *a* was measured by filtering 300 ml of water through glass fiber filters; pigments on filters were extracted in 90% acetone in the dark at -5° C for 12-24 hours, and the fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer (level of detection 0.01 µg/L). Salinity was determined using an AGE Model 2100 laboratory salinometer with a precision of 0.0003‰. pH was determined using a lab meter with combination electrode and a precision of 0.01 pH units. Dissolved oxygen was measured using a YSI model 51 meter. TSS was determined gravimetrically using a Cahn electrobalance.

All lab analyses were conducted by Marine Analytical Specialists (Laboratory Certification NO. HI-0009).

2.2. POND PRODUCTION-RESPIRATION

2.21. Dissolved Oxygen Measurements

In order to evaluate metabolic function of Aimakapa Pond, oxygen was measured with an In-situ TROLL Model 4000 data logger manufactured by In-Situ Inc. fitted with a Clark polarographic electrode and a temperature sensor. The oxygen electrode was calibrated at 0% and 100% saturation as specified by the manufacturer, and deployed in the approximate center of Aimakapa Pond for a seven-day period from 1000 December 26, 2001 to 0700 January 2, 2002. Measurements of sensor output were made and recorded internally every five minutes. The instrument was moored to the bottom with a lead weight and supported in an approximate 45° upright orientation by a float in order to keep the sensors both out of the mud and below the pond surface. Using this configuration, the sensors remained between approximately 20 and 40 cm below the pond surface throughout the deployment. In addition, the angled mooring kept the sensors free of sediment deposition. Following deployment, data retrieval indicated that the instrument recorded uninterrupted through the 7-day period.

2.22. Estimates of Pond Metabolism (P, R, and NCP)

Oxygen and temperature data were used to calculate Community Production (P), Community Respiration (R), and Net Community Production (NCP) over a five-day period from December 27, 2001- January 1, 2002. These days were selected in order to have a complete record from sunrise through sunset for each of the days. The *in situ* temperature data was used to calculate the saturation concentration of dissolved oxygen at each point in time according to Weiss (1970). A gas exchange coefficient of 0.5 m d^{-1} was used to correspond to the light winds that typify the Kona area, and the lack of wave turbulence in the pond. The area of the pond was estimated at 60,000 m^2 for the area of the pond and an average depth of one meter.

P, R, and NCP were calculated according to Falter et al. (2001) as follows. Net Production (NP) is defined as the instantaneous rate of net dissolved O_2 and O_2 disequilibrium between the pond water and atmosphere according to:

$$NP(t) = \left(\frac{1}{A_b}\right)\left[V\frac{d[O_2]}{dt} + v_{ex}\,A_b\left([O_2](t) - [O_2]_{sat}\right)\right] \qquad \text{(Eq. 1)}$$

where the above variables are defined as follows:

$[O_2]$ = measured dissolved oxygen concentration;
$[O_2]_{sat}$ = concentration of dissolved oxygen in equilibrium with the atmosphere;
V = volume of the pond (60,000 m^3);
A_b = surface area of pond (60,000 m^2);
v_{ex} = gas exchange coefficient (0.5 m d^{-1}); and
t = time in decimal days.

Equation 1 can be integrated to estimate net production over a known time interval:

$$\int_{t1}^{t2} NP(t)\,dt = \left(\frac{1}{Ab}\right)\left[V([O_2]_{t2} - [O_2]_{t1}) + v_{ex}A_b\int_{t1}^{t2}\left([O_2] - [O_2]_{sat}\right)dt\right] \quad \text{(Eq. 2)}$$

Integrating *NP(t)* from sunrise to sunset yields the amount of net production that occurs over the daylight hours (NP_{light}), and integration of *NP(t)* from sunset to sunrise yields the amount of dark respiration R_{dark}). Sunrise and sunset data were taken from the U.S. Naval Observatory web site aa.usno.navy.mil/data/docs/RS_OneYear.html for nearby Kailua-Kona.

P and R were calculated as follows:

$$P = NP_{light} + R_{light} \quad \text{(Eq. 3)}$$
$$R = R_{light} + R_{dark} \quad \text{(Eq. 4)}$$

NCP was determined by direct integration of *NP(t)* from sunrise on one day to sunrise on the next.

2.2 ASSESSMENT OF MARINE BIOLOGICAL COMMUNITY STRUCTURE

Evaluation of the marine biological community was conducted by qualitative reconnaissance surveys along the length of the area fronting Kaloko and Aimakapa Ponds from the shoreline out to the 10 meters (30 feet) depth contour. Information gathered during the surveys included abundance estimates of the dominant flora and fauna, as well as observations on the factors that affect these biotic assemblages. Quantitative surveys of the offshore area were not possible as the entire region off the pond was subjected to breaking surf which makes deployment of sampling gear impossible.

3.0 RESULTS

3.1 WATER CHEMISTRY

3.1.1 Physical Characteristics of Aimakapa and Kaloko Ponds.

Tables 1-4 show results of all marine and pond water chemical analyses for samples collected in the vicinity of the proposed Kaloko-Honokohau Business Park development in May-June 2000. Tables one and two show results for sampling of Aimakapa Pond and the offshore ocean, while Tables 3 and four show results for sampling in Kaloko Pond and the offshore ocean. Tables one and three show nutrient concentrations in micromolar units (µM), while Tables 2 and four show nutrient concentrations in units of micrograms per liter (µg/L). Concentrations of twelve chemical constituents in surface and bottom water samples from Kaloko and Aimakapa Ponds from May-June 2000 are plotted as functions of distance from the shorelines in Figures 2-5.

Tables five and six show results of water sampling for filtered and unfiltered samples collected in Aimakapa Pond in December 2001 (Table 5 shows nutrient concentrations if µM; Table 6 shows nutrient concentrations in mg/L). Concentrations of chemical constituents in filtered and unfiltered surface and bottom water samples from Aimakapa Pond in December 2001 are plotted as functions of distance from the shorelines in Figures 6-9. Tables seven and eight show the results of analyses of water from wells and springs.

Examination of Tables 1-6 and Figures 2-5 show several major patterns of horizontal stratification of water chemistry constituents in the ponds and ocean during the summer 2000 samplings. Probably the most obvious characteristic of the data set is the major differences between water quality in Aimakapa and Kaloko Ponds. These differences in water chemistry are primarily the result of differences in physical structure of the barriers between the ponds and the ocean. Aimakapa pond is separated from the ocean by a fairly wide (~20 m) continuous sand berm which is not very permeable to exchange between the pond and the ocean. Such impermeability is apparent in the sharp, nearly vertical gradients at the shoreline of many of the water chemistry constituents (e.g., Salinity, Si, TN, TP, TON, TOP) in Aimakapa Pond (Figures 2-4). Kaloko Pond is separated from the ocean by a man-made rock wall that was undergoing reconstruction at the time of water sampling.

Compared to the sand berm, the rock wall that separates Kaloko Pond from the ocean is highly permeable, and exchange of water between the ocean and pond is enhanced by channels ("makahas") constructed into the wall. It should be noted that these direct connections

between the pond and ocean eliminate Kaloko Pond from the designation of "anchialine" which requires that no such connections exist. As a result of the increased water exchange between Kaloko Pond and the ocean, there are no sharp gradients of water chemistry constituents at the marine shoreline.

While both ponds contain thick sediment bottoms, there is a substantial difference in the quality of the sediment. Bottom composition of Aimakapa Pond consists of soft flocculent silty mud that is easily penetrable for at least one meter. Bottom composition of Kaloko Pond is a hard sand/mud mixture that is largely covered with marine algae, primarily the introduced species *Acanthophora specifera*. Sand/mud bottoms in both ponds were distinctly anaerobic beneath the surface layer as evidenced by the strong odor of H_2S when the bottom was even slightly disturbed.

3.1.2 Effects of Filtering on Nutrient Analyses

A general perception is that valid determination of dissolved nutrients requires that water is filtered through glass fiber filters prior to analysis to remove particulate material. In oligotrophic waters, it has been shown that there is no statistical difference in nutrient concentrations between filtered and unfiltered samples in open ocean water samples collected off Hawaii (Dore et al. 1996). As a result of the lack of a significant effect from filtering, and because the process introduces another potential cause for sample contamination, the methodological protocols for many marine sampling programs, such as the Global Ocean Flux Study, Hawaii Ocean Time Series Program (GOFS-HOTS) does not include filtering of water samples prior to nutrient analyses (See Appendix A for GOFS-HOTS Field and Laboratory Protocols).

In addition, the perception that filtering is necessary for determination of valid dissolved nutrient concentrations even in non-oligotrophic waters has been suspect. Researchers have postulated that the physical act of pressure filtration may cause the lysing of cells which releases intracellular materials to the water. In order to evaluate the effect of filtering on water samples collected for the present evaluation of nutrient metabolism in Kaloko-Honokohau National Park, samples obtained in December 2001 in Aimakapa Pond and the offshore ocean were immediately split following collection. Results of nutrient determinations on filtered and unfiltered samples are shown in Tables 5 and 6.

Table 9 also shows the results of nutrient analyses on filtered and unfiltered sample splits, as well as the difference between the splits. Positive values of the difference between unfiltered and filtered samples splits indicates a higher value in the unfiltered sample; conversely a

negative value indicates a higher value in the filtered sample. Should the particulate fraction of the nutrient pool contribute to the nutrient concentration in unfiltered samples, it would be expected that the difference between unfiltered and filtered samples would be consistently positive in value. Inspection of the data in Table 9 indicates that such a result is not found. For the inorganic nutrients PO_4^{3-}, NO_3^-, and Si there are approximately as many negative as positive differences between unfiltered and filtered splits, suggesting that there is no consistent effect of filtering. On the other hand, the inorganic nutrient NH_4^+ shows consistently negative values for the difference between unfiltered and filtered samples. This result suggests that the act of filtering results in consistently higher values, possibly as a result of lysing of cells that contribute NH_4^+ to the dissolved phase.

As would be expected, TN and TP show the greatest positive differences between unfiltered and filtered splits, as the process of UV oxidation that is performed to convert all forms of organic material to inorganic N and P. However, even for TN and TP, there is not consistent difference between filtered and unfiltered samples, with some samples having higher concentrations following filtration.

To evaluate the statistical significance of the differences between filtered and unfiltered samples, linear regression statistics of unfiltered vs. filtered samples were performed following the procedures described in Dore et al. (1996). Results of the linear regressions for each nutrient are shown in Table 9. Slopes of regression lines greater than one (plus or minus the 95% confidence interval) indicate that unfiltered samples are statistically greater than filtered samples. Slopes of regression lines less than one (plus or minus the 95% confidence interval) indicate that filtered samples are statistically greater than unfiltered samples. Y-intercepts statistically different from zero indicate some factor not related to filtering is contributing to the sample results.

Plots of unfiltered vs. filtered nutrients (Figure 10) are also useful for displaying the trends shown in the statistical relationships. The dashed lines in each plot in Figure 10 represents a perfect 1:1 relationship between unfiltered and filtered samples. Data points below the line indicate higher concentrations in the filtered split; data points above the line indicate higher concentrations in the unfiltered split.

All nutrients had Y-intercepts that were not significantly different than zero. The slope for Si was not different than one, while slopes for PO_4^{3-}, NO_3^- and NH_4^+ were less than one (Table 9). As described above, slopes less than one indicate that filtered samples had a higher concentration than unfiltered samples. Examination of Table 10 confirms the statistical results with the positions of data points below the 1:1 line. This is especially apparent in the plot of

NH_4+, which is the constituent that is most likely to be released during cell lysis. These data verify that unfiltered water likely provides a more accurate estimate of dissolved inorganic nutrients in the water column, even in samples with high particulate loads. In any event, it is clear from these data as well as in the scientific literature that elimination of filtering does not necessarily add a significant bias to analytical results of inorganic nutrients.

Examination of the filtered vs. unfiltered plots and regression statistics for TN and TP indicates a cluster of data points above the 1:1 slope line that represent the samples from collected in the central region of Aimakapa Pond that contain high levels of Chl *a*. Filtering removes this particulate material from the analysis of TN and TP. Digestion of unfiltered samples results in transformation of a portion of the particulate material to dissolved material which accounts for the higher values in unfiltered relative to filtered samples. Evaluation of organic nutrients are distinguished as dissolved organic nitrogen and phosphorus (DON, DOP) which is the difference between TN, TP and dissolved inorganic nitrogen and phosphorus (DIN, DIP) in filtered samples, and total organic nitrogen and phosphorus (TON, TOP) which is the difference between TN and TP and inorganic N and P in unfiltered samples.

3.1.3 Horizontal and Vertical Stratification

During all sampling events, salinity within both ponds showed surprisingly little horizontal gradations from the ocean to the shoreward sides of the ponds. In Aimakapa Pond, surface water increased in salinity from mauka to makai by 0.4‰ in summer 2000 and 0.3‰ in winter 2001. There was only the slightest hint of vertical stratification between surface and bottom water in Aimakapa Pond with the largest difference between salinity of surface and bottom water at any site 0.12‰ in 2000 and 0.3‰ in 2001. Vertical stratification of Kaloko Pond was slightly greater, with bottom water on the order of 0.1 to 0.9‰ higher than surface water.

The overall salinity between the two ponds, however, varied to a large extent. Salinity in Aimakapa Pond was approximately 13‰ (parts per thousand) during both summer and winter, while salinity in Kaloko Pond was 32-33‰. As seawater has a salinity of approximately 35‰, the composition of water in Aimakapa can be estimated as about 37% seawater and 63% freshwater (not factoring in evaporative loss). On the other hand, based on salinity, the composition of Kaloko Pond consists of about 93% seawater and 7% freshwater. Similar measurements made by Marine Research Consultants in 1996 of Kaloko pond revealed that salinity was approximately 6‰ lower (~29‰) in surface pond water than in ocean waters. Comparison of these data suggest that salinity of the pond has increased over the last several years. The open channels in the rock wall allowing free exchange of water between the ocean and pond is likely the source of the increased salinity.

Comparing values of salinity within the ponds to salinities of springs around the perimeter of the ponds shows spring water at Aimakapa Pond is near the same salinity as pond water (13-17‰), while springs around Kaloko Pond have substantially lower salinities than the pond (9-14‰)(Tables 7-8). These comparisons again point to the open circulation between Kaloko Pond and the ocean. Water from groundwater monitoring wells located landward of the ponds all had lower salinities than any of the pond waters (Tables 7-8).

Typically, in nearshore surface ocean waters of West Hawaii there is a pattern of decreasing salinity with distance from shore. This gradient is indicative of low salinity groundwater entering the ocean near the shoreline and mixing with high salinity ocean water. A somewhat unusual result in the present study is that the lowest salinities in the ocean samples were not found nearest to the shoreline off of either fishpond. Rather, the lowest salinities were measured in surface ocean samples approximately 25-50 m offshore during both the 2000 and 2001 surveys. Such a consistent result suggests that groundwater flow to the ocean is primarily around the pond boundaries, rather than through the shoreline barriers that separate the ponds from the ocean.

Horizontal and vertical stratification of salinity in the ocean samples was evident at all stations during all surveys. Beyond 25-50 m from shore, with increasing distance from shore, salinity increased at all stations in both surface and bottom water. The difference in salinity between surface and bottom water samples was greater in the ocean than in either pond.

As a result of the differences in permeability between the two ponds and the ocean, the patterns of dissolved nutrients vary considerably between ponds. The patterns prescribed by the concentrations of dissolved Silica (Si) on transects are essentially a mirror image of salinity during both the summer 2000 and winter 2001 sampling events (Figures 2, 6). Such a pattern reflects the two orders of magnitude difference in concentrations of Si between groundwater and ocean water. In addition, the mirror image of Si and salinity indicates that Si is a "conservative" tracer, in that it is not utilized to any measurable extent by biotic or chemical reactions within the ponds and ocean. As a result, there is the same large variation in concentration of Si between the ponds, and same degree of stratification of Si as was evident in salinity.

Throughout Kaloko Pond there was little variation in nutrient concentrations. Concentrations of NO_3^-, Si, PO_4^{3-} and NH_4^+ were also consistently lower than the peak concentrations in the offshore ocean 25-50 m from the shoreline (Figures 2-5, Tables 3,4).

In Aimakapa Pond, the situation is substantially different. In addition, gradients of nutrients were very different between winter and summer. With the exception of NO_3^- and NH_4^+, water in Aimakapa Pond in summer 2000 had distinctly higher concentrations of nutrients compared to ocean water samples collected directly offshore of the ponds. NO_3^- in Aimakapa Pond is similar to Kaloko Pond, with consistently lower values in the pond relative to the ocean in summer 2000 (Figures 2-5, Tables 3,4). As with salinity, there are distinct discontinuities between concentrations of nutrients between the seaward end of the ponds and the nearshore ocean indicates that the sand berm is an effective barrier impeding free exchange between the pond and ocean. As a result, while separated by only about 20 m, pond and ocean water display very different nutrient characteristics with little apparent connection. The gradients in Kaloko Pond were far less pronounced, as the rock wall and associated channels provide far more mixing capability between the pond and the ocean.

During the winter sampling (December 2001), the gradients of salinity and Si were essentially identical to the gradients in the summer, with little variation between surface and bottom samples, and no horizontal gradients across the pond (Figures 2 and 6). However, the patterns of other nutrients were very different between the seasons. While concentrations of NO_3^-, PO_4^{3-} and NH_4^+ displayed little vertical and horizontal stratification across the length of the pond in winter, there were substantial gradients in the winter sampling. Concentrations of NO_3^- were two orders of magnitude higher at the landward end of the pond relative to the central and seaward areas (Figure 6, Table 5). In addition, surface samples were approximately twice the value of bottom samples (Figure 6, Table 5). PO_4^{3-}, NH_4^+ and filtered samples for TN and TP showed similar trends.

Because salinity and Si did not display similar distinct gradients, the distribution of the N and P is not a result of input of high nutrient groundwater at the landward end of the pond. It can be seen, however, that Chl *a* displayed a mirror image of NO_3^- and PO_4^{3-} (Figure 9, Table 5) with low concentrations at the landward boundary of the pond relative to the central and seaward sections. Such a relationship makes it clear that the horizontal gradient of nutrients through the pond is a response to uptake by plankton in the water column.

Along the oceanic portion of the transect, there is an increase in NO_3^- compared to values at the seaward end of the pond. This discontinuity indicates that groundwater entering the ocean is primarily from flow around the ponds, rather than through them. The highest value of NO_3^- in Kaloko Pond adjacent to the rock wall is result of landward circulation of ocean water mixing with pond water.

The patterns prescribed by concentrations of TN, DON, TP and DOP are all nearly identical (Figures 3 and 4). All show elevated concentrations in Aimakapa Pond, with higher concentrations in bottom water relative to surface water, steep decreasing gradients at the shoreline, and low concentrations in the offshore ocean. In Kaloko Pond, concentrations are essentially constant across the entire sampling transect (pond and ocean). As the concentrations of the organic constituents of N and P (DON, DOP) are substantially greater than the inorganic constituents of N and P (NO_3^-, NH_4^+ and PO_4^{-3}), the patterns of distribution of TN and TP, are essentially the same as DON and DOP.

During the summer 2000 sampling, the patterns of distribution of Chl *a*, turbidity and TSS in the ponds and ocean are all generally similar, with bottom water from Aimakapa Pond exhibiting far higher values than all other areas (Figure 5). As described above, the floor of Aimakapa Pond is composed of very fine-grained silty mud that is easily resuspended, contributing to the high levels of turbidity and TSS. It is apparent from the similar high levels of Chl *a* that there is also a community of benthic plankton or resuspended plant material near the bottom of the pond.

All three constituents are also elevated in surface and bottom waters of Kaloko Pond relative to ocean water, but without the considerable vertical stratification of Aimakapa Pond. Chl *a* at all stations in Kaloko Pond is an order of magnitude greater than in ocean samples.

During the winter 2001 sampling, the patterns of Chl *a* and turbidity in Aimakapa Pond were substantially different than in the winter. As described above, at the landward area of the pond, between the shoreline and rock walls that separate fishponds, values of Chl *a* were substantially lower than in the remainder of the pond. Correspondingly, turbidity was substantially decreased in the landward section of the pond (Figure 9). While the Chl a value in the bottom water was substantially higher throughout the pond in summer (Figure 5), values were similar between the surface and bottom during the summer (Figure 9). Concentrations of Chl *a* in surface waters were slightly higher in summer relative to winter (Figures 5 and 9).

3.1.2 Conservative Mixing Analysis

A useful treatment of water chemistry data for interpreting the extent of material input from land is application of a hydrographic mixing model. In the simplest form, such a model consists of plotting the concentration of a dissolved chemical species as a function of salinity. Comparison of the curves produced by such plots with conservative mixing lines provides an indication of the origin and fate of the material in question (Officer 1979, Dollar and Atkinson 1992, Smith and Atkinson 1993). This method of data interpretation has recently been adopted

by the State of Hawaii Department of Health as a new protocol for evaluating compliance with water quality standards in West Hawaii.

Figures 11-13 show plots of concentrations of eight nutrient constituents as functions of salinity for a variety of water samples (pond, ocean, wells, springs) collected in the Kaloko-Honokohau region in May-June 2000. In addition, data from the last available quarterly sampling (September 1999) of twenty-one monitoring wells and two drainage trenches as part of the NELHA CEMP are also included. Figures 15-18 show similar plots with filtered and unfiltered samples for the sampling in Aimakapa Pond in December 2001. Each graph in Figures 11-16 also shows a conservative mixing line that was constructed by connecting the end member concentrations of open ocean water and averaged high-level groundwater concentrations from several potable wells located upland of Kaloko.

If the parameter in question displays purely conservative behavior (no input or removal from any process other than physical mixing), data points should fall on, or very near, the conservative mixing line. If, however, external material is added to the system through processes such as leaching of fertilizer nutrients to groundwater, data points will fall above the mixing line. If material is being removed from the system by processes such as uptake by biotic metabolic processes, data points will fall below the mixing line.

Dissolved Si represents a check on the model as this material is present in high concentration in groundwater, but is not a major component of fertilizer. In addition, Si is not utilized rapidly within the nearshore environment by biological processes. It can be seen in Figure 6 that most of the data points from Kaloko Pond and the ocean fall very close to the conservative mixing line for Si. All of the data points for NELHA samples fall in a linear array slightly above the conservative mixing line. This offset is a result of the high levels of Si (~80 µM) that occur in deep seawater (~600 m) which is used at NELHA, relative to surface seawater which has a concentration of Si of approximately 2-10 µM. Such agreement indicates that the end members used to construct the lines are representative of the system.

In Figure 11, data points for Si from Aimakapa Pond and some of brackish wells fall below the conservative mixing line suggesting either some form of biogeochemical alteration of Si in these areas, or another source of groundwater.

The plot of NO_3^- versus salinity reveal distinctly different results than plot of Si (Figure 11). Plots of concentrations of NO_3^- show that most of the data points from the ocean and ponds fall below the conservative mixing line, especially in Aimakapa Pond. Data points for the springs and brackish wells, however, are near, or above the mixing line. These relationships indicate

several important points. First, the elevation of data points from the springs and brackish wells above the mixing lines indicates a subsidy of NO_3^- from sources other than groundwater. In the cases of the wells and springs in the Kaloko-Honokohau area, it is possible that the subsidies are from land uses upland of the coastal area that are adding materials (e.g., fertilizers, septic system leachate) to groundwater. Such a scenario is typical of areas downslope from agricultural lands or landscaped areas where fertilizers leach to groundwater, and subsequently percolate to the coastal ocean (Dollar and Atkinson 1992).

The data points that extend farthest above the conservative mixing line, hence contain the greatest subsidies of NO_3^- are the monitoring wells at NELHA. As virtually all of the water used for aquaculture practices at the facility is discharged of through trenches that connect to the water table, the elevated concentrations in the NELHA wells are with little doubt a result of discharge of water used at the facility. It is important to note that the groundwater sampled from monitoring wells at NELHA discharges to the nearshore ocean directly off NELHA at Keahole Point. It is also important that when scaled to salinity, the subsidies of NO_3^- at NELHA are approximately twice that of the brackish monitoring wells at Kaloko-Honokohau. Thus, subsidies of NO_3^- to the nearshore ocean from present activities at NELHA are far greater than from present activities that might be contributing to groundwater in the Kaloko-Honokohau area.

All of the concentrations of NO_3^- in the ponds lie far below the mixing line, indicating that there is substantial uptake of NO_3^- within the ponds. Uptake is most evident in Aimakapa Pond, where the concentrations of NO_3^- are near the detection limit at the salinity in the Pond of about 13‰ (Figure 11). While the actual concentrations of NO_3^- are slightly lower in Kaloko Pond compared to Aimakapa Pond, the difference in distance between data points and the conservative mixing line indicate that there is substantially more uptake of NO_3^- in Aimakapa Pond than in Kaloko Pond (Figure 11).

The other form of dissolved inorganic nitrogen, NH_4^+, does not show a linear pattern of distribution with respect to salinity for any of the data points (Figure 12). As with NO_3^-, well and spring samples had the highest concentrations of NH_4^+, when compared to the ponds or ocean. These relationships indicate a subsidy of NH_4^+ to low-level groundwater that is not a result of input from high level groundwater or the ocean. Contrary to NO_3^-, the wells at NELHA contain far less subsidy of NH_4^+ than the wells at Kaloko-Honokohau.

PO_4^{3-} is also a major component of fertilizer and sewage effluent, but is usually not found to leach to groundwater to the extent of NO_3^-, owing to a high absorptive affinity of phosphorus in soils. Similar to the results for NO_3^-, the PO_4^{3-} data points for pond samples, particularly

Aimakapa Pond, fall below the mixing line indicating uptake by pond plants (Figure 12). As with NO_3^- many of the data points from the monitoring wells at NELHA lie farther above the mixing lines than the data from the monitoring wells at Kaloko-Honokohau. As with NO_3^-, the elevations in the concentrations of PO_4^{-3} scaled to salinity in the NELHA wells are likely a result of the high concentrations of these nutrients in deep seawater used for aquaculture, and discharged into trenches.

Because TOP and TON occur in very low concentrations in both open ocean water and high level groundwater, the mixing lines for these constituents are essentially flat (Figure 13). The occurrence of data points of TOP and TON far above the mixing lines likely reflects the metabolic cycling conversion of inorganic nutrients to organic nutrients by plant metabolism and decomposition in Aimakapa Pond.

The anomalously high concentrations of TOP and TON in wells and springs in the Kaloko-Honokohau area are curious, as these compounds are associated with biotic activity that is not usually possible within the water table. TON and TOP are also not components of fertilizers, so the occurrence in wells in not a result of leaching of these materials to groundwater. As the highest concentrations of TON and TOP, and lowest concentrations of NO_3^-, are found in KAHO Monitoring Well 1 (4060-01) located directly behind Aimakapa Pond, it is possible that water from the pond is being carried landward by tidal action to the region of the monitoring wells.

Such a theory is supported by the results shown in TNWRE (2002) who has demonstrated that the difference in a tidal phase in Aimakapa Pond and groundwater in the volcanic formation around the pond is so pronounced that it causes a gradient reversal between the pond and surrounding groundwater on virtually all changes of the tide. When groundwater level is higher than the level in the pond, groundwater flows into the pond; when pond level is higher than groundwater, water flows out of the pond back into the surrounding volcanic formation. This flow reversal appears to reach as far inland as KAHO Monitoring Well 1, which is approximately 900 feet inland. Hence, the anomalously low concentrations of NO_3^- and high concentrations of TON and TOP in Well 1 are likely a result of landward transport of Pond water. Mixing plots of TP and TN reflect the combined effects of inorganic and organic N and P, with data points above the mixing lines from most of the sources of groundwater (Figure 14).

Mixing plots from the December 2001 sampling (Figures 15-18) reveal the general patterns as for Summer 2000. In these plots, Monitoring Well 1 is differentiated from Wells 2 and 3 in

order to illustrate the landward flow of pond water behind Aimakapa Pond. It can be seen in Figures 15-18 that the clustered distribution of all nutrients is substantially different between Well 1 and Wells 2-3. Another consistent point that is clearly illustrated in Figures 15-18 is the complete lack of any mixing between the pond waters (salinity ≈ 13‰) and marine water (salinity ≈ 34‰). The lack of any data points between these two salinities indicates that there is very restricted water movement between the pond and the ocean.

Several points can be made to summarize the results of mixing analyses. First, and most importantly, there are no indications of a buildup of inorganic nutrients within the ponds or nearshore ocean resulting from groundwater subsidies that may be a result of activities of man. The two constituents that show substantial elevations in the ponds (TON, DON) and (TOP, DOP) are not the direct result of nutrient loading, but rather byproducts of metabolic cycling coupled with long residence time (slow water exchange) within the ponds. Subsidies to groundwater of NO_3^- and PO_4^{-3} are far greater at NELHA than in the Kaloko-Honokohau area as a result of high concentrations in deep seawater that is discharged into disposal trenches along the shoreline.

3.1.3 Pond Metabolism

The major concern regarding impacts to the pond resources at the KAHO from development of the Kaloko-Honokohau Business Park is the effect that increased nutrient loading will have on pond metabolic function. The perception is that increases in nutrient concentrations to groundwater flowing mauka from the development site to the National Park will alter the ponds in an undesirable manner. In order to estimate the magnitude of such changes, pond metabolism was estimated using measured changes in dissolved oxygen concentration in Aimakapa Pond over a one-week period in December 2001. Deployment of an instrument capable of continuously logging dissolved oxygen and temperature at five minute intervals produced a record of approximately 2,000 data points for each variable.

Figure 19 shows the resulting plots of dissolved oxygen and temperature over the 7-day deployment. Oxygen concentrations and temperature track exceptionally well. The highest daylight temperatures corresponding to the peak oxygen concentrations in mid-afternoon. The temperature and oxygen lows occur just prior to dawn. Peak oxygen concentrations of 11 mg/L at 27.5° correspond to saturation of about 140% while lows of oxygen concentration of 2.5 mg/L at 23° correspond to a saturation of about 33%. Of interest is that the daily amplitude of the peaks and lows for each day is similar with the exception of December 30, 2001, when peak temperature and oxygen were lower than the remainder of the data set.

Weather conditions on this day consisted of heavy rainfall, with little direct sun. All other days were sunny.

This pattern indicates that pond metabolism is dominated by daylight photosynthesis and dark respiration according to molar relationships defined in the Redfield equation:

$$106CO_2 + 16H^+ + 16NO_3^- + H_3PO_4 + 122H_2O$$

$$\Leftrightarrow (CH_2O)_{106}(NH_3)_{16}H_3PO_4 + 138O_2 \qquad \text{(Eq. 5)}$$

where photosynthesis proceeds to the right catalyzed by light, and respiration proceeds to the left.

Integrating equation 2 over the five-day period of oxygen measurements resulted in a rate of gross carbon production (P) equal to 29,800 moles d^{-1}, and gross respiration (R) equal to 29,900 moles d^{-1}, and net community metabolism (NCP) equal to -900 moles d^{-1}. These values did not vary considerably when the gas exchange coefficient (v_{ex}) varied from zero to one. Scaling N and P to C using Redfield ratios (Eq. 5) results in production of 4,380 moles N d^{-1} and 274 moles P d^{-1}, and respiration of 4,520 moles N d^{-1} and 282 moles P d^{-1}.

In order to determine the potential contribution of groundwater nutrients to these rates of production, it is necessary to estimate the flux of groundwater into the pond. As discussed above, it is clear from the lack of salinity and temperature gradients within the pond that groundwater flow is impeded to a large degree relative to free flow. However, in order to evaluate the most conservative estimate of nutrient uptake, it can be assumed that groundwater flow to the pond is equal to the average rate of discharge along the shoreline. TNWRE (2002) estimates this rate as 3 million gallons (11,000 m^3) per shoreline mile (1,600 m) per day. The shoreline width of the pond is estimated at 250 m, and the average concentration of DIN and DIP in basal groundwater are 95 and 6 µM, respectively (TNWRE 2002). With the assumption of no impedance of groundwater flow, the estimated daily loading to the pond is 160 moles N d^{-1} and 10 moles P d^{-1}. It is important to note that these estimates are derived with no measurements of nutrients in the ponds or ocean.

Comparing groundwater nutrient loading to the pond with gross production/respiration within the pond indicates that only approximately 4% of the pond metabolism can be supported by "new" nutrients delivered to the pond by groundwater flux. The remaining 96% of nutrient

uptake must therefore be supported by recycling of nutrients within the pond. It is likely that the actual percentage of nutrient recycling is even higher (~99%) than the estimate as it is clear from all available data that groundwater flow into the pond is substantially restricted.

3.2. BIOLOGICAL COMMUNITY ASSESSMENT

Marine community structure as represented in this report can be defined as the abundance, diversity, and distribution of a benthos (bottom dwelling organisms), including stony and soft corals, marine plants (algae), a motile benthos such as echinoderms, pelagic species such as reef fish, and federally protected species. When considering environmental changes caused by changes in land use or changes in non-point input of water of altered composition, benthic communities are probably the most useful biological assemblages for direct evaluation of environmental impacts to the offshore marine environment. Because benthos are generally long-lived, immobile, and can be significantly affected by exogenous input of sediments and other potential pollutants, these organisms must either tolerate the surrounding conditions within the limits of adaptability or die.

3.2.1 Zonation of the Marine Habitat

As described above, Kaloko Pond and the open ocean are separated by a rampart of basaltic boulders, while Aimakapa Pond is separated from the ocean by a solid berm of beach sand. The main structural feature of the offshore area seaward of both ponds is a basaltic ledge of pahoehoe lava. Adjacent to the Kaloko Pond frontage the shoreline is composed of a rocky shoreline composed primarily of outcrops of lava that extend seaward.

Because of the structure of the boulder rampart and beach berm that separate the ponds from the ocean, there is virtually no intertidal area. Beyond the boulder shoreline, the structure of the offshore environment off of Kaloko generally conforms to the pattern that has been documented as characterizing much of the west coast of the Island of Hawaii (Dollar 1975, 1982, Dollar and Tribble 1993).

The zonation scheme consists of three predominant regions. Beginning at the shoreline and moving seaward, the shallowest zone beyond the shoreline is comprised of a seaward extension of the basaltic shoreline bench. *Pocillopora meandrina*, a sturdy hemispherical coral is the dominant colonizer of the nearshore area. This species is able to flourish in areas that are physically too harsh for most other species, particularly due to wave stress. The shallow flat

pavement area directly in front of the Kaloko Pond seawall appears to be an ideal habitat for *Pocillopora meandrina.*

Moving seaward, the flat nearshore bench area terminates in a ledge that has a roughly vertical face that extends to a depth of approximately 25 feet. Beyond the ledge, bottom topography consists of a reef platform that is typical of West Hawaii. The transition area between the shallow flat pavement zone and the reef platform zone is characterized by high relief in the form of undercut ledges and basaltic boulder pinnacles. As wave stress in this region is less than in the shallower areas, and suitable hard substrata abound, the area provides an ideal locale for colonization by attached benthos, particularly reef corals, and generally the widest assortment of species and growth forms are encountered in this region. The predominant coral in the area in *Porites lobata,* which occurs in a variety of growth forms.

The seaward edge of the reef platform (at a depth of about 50 feet) is marked by an increase in slope to an angle of approximately 20-30 degrees. In the deep slope zone, substratum changes from the solid continuation of the island mass to an aggregate of generally unconsolidated sand and rubble. The predominant coral cover in the slope zone is typically interconnected mats of "finger coral" (*Porites compressa*), which grow laterally over unconsolidated substrata.

The physical structure of the offshore region at Aimakapa is somewhat different than off Kaloko. The nearshore area consists of an extended flat basalt shelf that extends approximately 100 m from shore. Figure 20 is an aerial photograph of the Kaloko-Honokohau area that clearly shows the extent of the basaltic shelf that extends off of Aimakapa Pond (as denoted by green, rather than blue water). The surface of the platform contains holes and fissures, and small sand-filled channels, but relatively low cover of living corals. At the seaward termination of the shelf, a reef crest consisting of a shallower ridge of limestone separates the inner bench from the outer reef, which is similar to that described above off of Kaloko Pond.

3.2.2 Coral Communities

The predominant taxon of macrobenthos (bottom-dwellers) throughout the reef zones off of Kaloko Pond are Scleractinian (reef- building) corals. In total, twelve species of "stony" corals, and two "soft corals" were observed throughout the region of study. The dominant species in all of the zones off Kaloko-Aimakapa was *Porites lobata.* The second and third most abundant species were *Porites compressa* and *Pocillopora meandrina.* Other species that were common in the shallow nearshore areas were *Montipora verrucosa, M. patula* and *Pavona varians.* It was

estimated that coral cover on the shallow bench comprised approximately 15% of bottom cover at Kaloko and 5% at Aimakapa. It was not apparent that community structure in the shallow nearshore areas adjacent to the boulder rampart, or sand berm separating the ocean from the pond was affected by freshwater flow from the pond.

The mid-depth reef platform zone had the highest number of coral species at both survey sites. In the mid-depth zone, dominant species were *Porites lobata* and *Porites compressa*. *Porites lobata* occurs in various growth forms including flat encrustations and large dome-shaped colonies, which are responsible for much of the true "reef" accumulation in the mid-depth zones. The abundance of suitable solid surfaces for coral settlement and growth, as well as the reduced wave stress compared to the shallower boulder zones provides a suitable setting for a variety of smaller encrusting coral species. Coral cover on the outer reef platform comprised approximately 40-60% of bottom cover.

3.2.3 Other Benthic Macroinvertebrates

The other dominant group of macroinvertebrates are the sea urchins (Class Echinoidea). The most common urchin was *Echinometra matheai*, which occurred in all reef zones. *E. matheai* are small urchins that are generally found within interstitial spaces bored into basaltic and limestone substrata. *Tripneustes gratilla*, and *Heterocentrotus mammillatus* were other species of urchins that occurred commonly throughout the reef. Both of these urchins occur as larger individuals (compared with *E. matheai*) that are generally found on the reef surface, rather than within interstitial spaces.

Sea cucumbers (Holothurians) observed during the survey consisted of three species, *Holothuria atra*, *H. nobilis*, and *Actinopyga obesa*. Individuals of these species were distributed sporadically across the mid-reef and deep reef zones. Numerous sponges were also observed on the reef surface, often under ledges and in interstitial spaces.

Frondose benthic algal zonation was not apparent at the study area off of Kaloko. However, encrusting red calcareous algae (*Porolithon spp.*, *Peysonellia rubra*, *Hydrolithon spp.*) were common on the boulders and exposed rocks throughout the study area. These algae were also abundant on bared limestone surfaces, and on the nonliving parts of coral colonies.

The design of the reef survey was such that no cryptic organisms or species living within interstitial spaces of the reef surface were enumerated. Since this is the habitat of the majority of mollusks and crustacea, detailed species counts were not included in the

assessment. No dominant communities of these classes of biota were observed during the reef surveys at any of the study stations.

3.2.4 Reef Fish Community Structure

Reef fish community structure was largely determined by the topography and composition of the benthos. The reef fish community off Kaloko-Aimakapa is typical of that found along most of the Kona Coast, as described by Hobson (1974), and Walsh (1984). Fish community structure can be divided into six general categories: juveniles, planktivorous damselfishes, herbivores, rubble-dwelling fish, swarming tetrodonts, and surge-zone fish.

Surgeonfish (*Acanthuridae*) were the most abundant family of fish. The most common species were the yellow tang (lau'i-pala, *Zebrasoma flavescens*) and the goldring surgeonfish (kole, *Ctenochaetus strigosus*). On the shallower reef terrace, adult whitebar surgeonfish (maikoiko, *Acanthurus leucopareius*), orangeband surgeonfish (na'ena'e, *A. olivaceus*), and parrotfish (uhu, *Scarus spp.*) were also common. Planktivorous damselfish, principally of the genus *Chromis* were abundant in all areas surveyed. In areas where coral rubble was abundant, common fish included potters angelfish (*Centropyge potteri*), and several species of wrasses, notably fourline wrasse (*Psuedochilinus tetrataenia*), eightline wrasse (*P. octotaenia*), and yellowtail wrasse (aki-lolo, *Coris gaimard*).

Surge zone fish consisted principally of herbivores such as rudderfish (nenue, *Kyphosus bigibbus*), surgeonfish (*Acanthurus spp.*), and unicornfish (mostly umaumalei, *Naso lituratus*). Saddle wrasse (hinalea lau-wili, *Thallassoma trilobatum*) and surge wrasse (hou, *T. purpureum*) were also abundant in the surge zone. Black durgeon (humuhumu-ele'ele, *Melanichthys niger*) and pinktail durgeon (humuhumu-hi'u-kole, *M. vidula*) were also observed congregating in the water column over the reef platform.

Several species of "food fish" (taken by subsistence and/or recreational fishermen) were observed during the survey. Rocky ledges and large coral heads sheltered fair numbers of squirrelfish (u'u, *Myripristes berndti*). Other food fishes included parrotfish (uhu, *Scarus spp.*), goatfish (moana kea and malu, *Parupaneus cyclostomus* and *P. bifasciatus*), jacks (papio, *Caranx melamphygus*), and grouper (roi, *Cephalopholus argus*). None of these species were particularly abundant. Orange-eyed surgeonfish (kole, *Ctenochaetus strigosus*), while abundant, was generally not large enough to be considered suitable as "food fish." Overall, fish community structure at Kaloko appeared fairly typical of the assemblages found in West Hawaii reef environments.

3.2.5 Endangered and Protected Species

Several species of marine animals that occur in Hawaiian waters have been declared threatened or endangered by Federal jurisdiction. The threatened green sea turtle (*Chelonia mydas*) occurs commonly along the Kona Coast, and is known to feed on selected species of macroalgae. The endangered hawksbill turtle (*Eretmochelys imbricata*) is known infrequently from waters off the Kona Coast. The area off of Aimakapa Pond is clearly a preferred habitat for green turtles, as at least eight individuals were observed in the nearshore zone during the survey. In addition, at least ten turtles were observed hauled out on the basalt shelf to the south of the pond during a low tidal stand when much of the basaltic bench in this area was exposed.

Populations of the endangered humpback whale (*Megaptera novaeangliae*) are known to winter in the Hawaiian Islands from December to April. The present survey was conducted in March, when whales were present in Hawaiian waters. No whales were observed during the course of the survey. Similarly, no Hawaiian monk seals (*Monachus schlauslandi*) were observed in the area.

4.0 DISCUSSION and CONCLUSIONS

The purpose of this baseline survey is to provide the information to make valid estimates of the potential for impact to the marine and pond environments at Kaloko Honokohau National Historical Park, and possibly NELHA, from development of the Kaloko-Honokohau Business Park. The information collected for this study provides the basis to understand the processes that are operating in the pond-ocean system, and to specifically address the concerns raised in the planning process.

To summarize, it is generally accepted that the two large fishponds within the Kaloko-Honokohau National Historical Park function in a similar manner to smaller anchialine ponds that occur on the west coast of Hawaii. By definition anchialine ponds are surface exposures of the water table with no direct connection to the ocean that contain brackish water which is a mixture of seaward flowing groundwater and landward flowing seawater. Anchialine ponds in early successional stages usually have sediment-free bottoms which allow for relatively rapid exchange of water. It is important to note that healthy anchialine ponds are NOT nutrient limited systems, and contain high concentrations of plant nutrients. The excess nutrients do not lead to algal dominated water columns, however, as a result of a balance between short residence time of water within the ponds, and production and consumption by pond biota.

Specifically, rapid flux of water through the ponds, and grazing by resident populations prevent plankton buildup within the water column.

In the later stages of the anchialine pond cycle, infilling by sediment reduces the rate of water exchange and the balance between production and consumption is lost. Ultimately, in the last stages of pond senescence infilling is complete and pond become wetlands.

The results of this survey, as well as others (Brock and Kam 1997), indicate that Kaloko Pond is not technically an anchialine pond because it contains direct connections to the ocean. Water in the pond is near oceanic in salinity, indicating that groundwater comprises a very small component of the pond makeup. Groundwater flux into the pond is overwhelmed by exchange of ocean water that is driven by wave action carrying water landward through the rock wall. If construction of new rock walls separating the pond from the ocean includes more open channels, it is likely that salinity in the pond will increase even further, lowering the contribution from groundwater.

Aimakapa Pond, on the other hand, can be considered an anchialine pond because it is sealed from direct exchange with the ocean by a sand berm of low permeability. The nearly vertical gradients in salinity between the pond and nearshore ocean provide evidence that the sand berm is essentially impermeable to water exchange (a good analogy is the use of sand bags for flood control levees).

Substantial data also indicates that groundwater flow is predominantly around, rather than through the ponds, and that water is actually flowing landward out of the ponds as a result of offset tidal gradients. These factors combine to result in greatly restricted flow of groundwater into Aimakapa Pond. The restricted flow of freshwater through the ponds is borne out by the near complete lack of both vertical and horizontal gradients within the ponds, as well as substantial damping and lag of tidal oscillations (TNWRE 2002). Thus while the pond consists of water that has salinity less than one half marine waters, the brackish condition is not a result of high input of freshwater, but rather of more restricted exchange with the ocean water than groundwater.

All of factors result in a long residence time within the enclosed basin of Aimakapa Pond. Based solely on the volume of Aimakapa Pond and the generalized rate of groundwater flow in the area, the residence time of water in the pond is about 30 days. In reality, owing to the restriction of groundwater flow into the pond, the residence time of water in Aimakapa is more likely on the order of 90-120 days.

The metabolic activity within Aimakapa Pond can be considered as a simple box model of sources and sinks. Figure 21 is a conceptual diagram showing a simple system such as an anchialine pond located adjacent to the coastal ocean, and receiving inputs from land developed by the Land-Ocean Interactions in the Coastal Zone (LOICZ) Project of the International Geosphere-Biosphere Programme: A Study of Global Change (IGBP) of the International Council of Scientific Unions (ICSU). The box model clearly indicates that internal cycling between sediments and water within the system is as important in determining metabolic function as fluxes into and out of the system through land, the atmosphere and the ocean.

Measurements of metabolic activity within Aimakapa Pond indicate that nutrient uptake is orders of magnitude higher than nutrient supply through groundwater flux. Nutrient cycling between the sediment and water column is by far the predominant process occurring in the pond. Low levels of available inorganic N and P throughout the pond indicate that the nutrient uptake is not presently limited by other factors such as light. These results are consistent with the physical composition of the system, which consists of a high biomass of phytoplankton in the water column and a sediment floor composed of a flocculent, easily resuspended layer of organic material. As mentioned several times in the sections above, the almost complete lack of physical gradients (temperature, salinity) within the pond indicate very slow turnover of the pond water column by either incoming ocean water or seaward flowing groundwater.

All of these factors indicate that the pond is essentially a closed system which is accumulating sediment which cannot be naturally flushed from the enclosed pond basin. With the warm, sunny year-round climate of the area, high phytoplankton biomass, and lack of pond flushing, the pond is an effective positive feedback system. Continued metabolic activity will produce increasing sediment deposition which will elevate rates of nutrient release from sediment decomposition, which will in turn allow for increased phytoplankton growth. Eventually organic sediment deposition will completely dominate the pond to the point where the water column disappears, and is replaced by a marsh or wetland. Such a progression has been described as the natural "life history" of anchialine ponds.

Kaloko-Honokohau Business Park does not include any plans for any direct alteration of the shoreline or offshore areas. Therefore, potential impacts to the marine environment can only be considered from activities on land that may result in delivery of materials (nutrients, potentially toxic chemicals) to the ponds and ocean through infiltration to groundwater, changes in surface runoff, and wind transport. The project may have an impact on groundwater as a result of: 1) disposal of wastewater generated on-site; 2) disposal of stormwater runoff; and 3) percolating water from landscape irrigation. Presented below are

considerations of potential impacts from sedimentation and nutrient enrichment (toxic materials that may be considerations for the planned project are addressed in another consultants report).

4.0.1 SEDIMENTATION AND RUNOFF

A potential mechanism for negative impact to nearshore marine and pond systems is increased sedimentation from wind and surface runoff as a consequence of grading and changes in land use. There appears to be little potential for alteration to the pond and marine communities offshore of Kaloko-Honokohau Business Park from increased sedimentation associated with the project for several reasons. The climate of the Kaloko area is one of the driest in the Hawaiian Islands. On an annual basis rainfall is likely to be far exceeded by evaporation at the *proposed* project site. Surface water runoff from storm events is infrequent. The basaltic composition of the land surface is highly porous and is capable of absorbing rainfall with little or no surface runoff. Even in the event of heavy rainfall, the porous nature of the soil ground cover is such that sheet flow carrying suspended sediment toward the ocean would be expected to be relatively small. Rather, most rainwater that would enter the ocean as runoff would do so following percolation through the surface rock layers to the water table, followed by groundwater extrusion at the shoreline.

The project site is presently comprised of extensive areas of exposed soil and rock, with relatively little vegetative groundcover. During the construction phases, it is likely that permit regulations will limit the area of excavation at any particular time, and require dust control measures. In addition, the predominant direction of wind (land breezes) generated by thermal convection from solar heating of the land mass is inland, resulting in transport of dust inland, and not toward the ocean. As a result, it appears that there is little potential for significant input of sediment to the marine and pond environment resulting from the proposed project.

The entire floors of Kaloko and Aimakapa Ponds are covered with a thick layer of fine-grained flocculent sediment. As described above, the sediment layer plays an important role in the metabolic functioning of the ponds. Pond biota are adapted to this high sediment composition. Should a small amount of sediment reach the pond as a result of construction activity, it is not likely that there will be any qualitative change to sediment composition.

Within the marine environment, the nearshore area contains locally high regions of cover of calcareous sands of marine origin. Corals and other reef organisms are capable of removing sediment suspended by natural phenomena, up to threshold levels of deposition where cleaning mechanisms are overwhelmed and organisms become buried. Because of the

existence of natural sands, and the normally turbulent conditions which continually resuspend natural sediment, biotic community structure is presently adapted to extremes in sediment stress from natural conditions. Organisms that do occur in the region are therefore capable of withstanding the stress associated with large natural sediment loads. In comparison to the frequent natural sediment resuspension within the study area, any additional input from land resulting from construction activity would probably not have the potential to accumulate to the point where organisms could be buried.

4.0.2 ALTERATION OF GROUNDWATER FLOW

TNWRE (2002) provides a detailed description of the hydrology of the Kaloko area and the potential for changes that may occur to groundwater discharge to the ocean as a result of the Kaloko-Honokohau Business Park project. Four aspects of the project development have the potential to change the groundwater flowrate and/or chemistry:

1) supplying potable water to the project from wells located in the high level aquifer directly inland will decrease the recharge to the basal lens.

2) disposal of wastewater in individual onsite systems such as septic tanks and leach fields will create a nutrient-rich source of local recharge to the basal lens. Such input will only occur during an interim period before sewer service is available.

3) Collection of surface runoff from impervious surfaces and its disposal in dry wells and seepage pits will create a source of local recharge with potential water quality consequences.

4) percolation of excess landscape irrigation and other miscellaneous outdoor uses of water are another source of local recharge with the potential to impact groundwater chemistry.

Considering the changes to these process that could occur as a result of development of the Kaloko-Honokohau Business Park, TNWRE (2002) found that within the southern half of Kaloko-Honokohau National Historical Park (down gradient from the subject property), the groundwater flowrate would be decreased by about 3%. As shown in TNWRE (2002) this change would not be significant, as the natural variations of groundwater level caused by long-term ocean level variations (which carry basal groundwater up and down) are far greater than the change resulting from a 3% reduction in flow rate. Within the range of seasonal and year-to-year variability of the natural system, such a change would therefore not likely cause any observable changes to the ponds or ocean.

When County sewer service becomes available in several years, all of the project's wastewater will be delivered to the Kealakehe WWTP for treatment and disposal. Until that time, any tenants would handle wastewater with individual enhanced septic tank-leach field systems. TNWRE (2002) has assessed the effect on groundwater from such disposal assuming 15% of the project would be built-out before County service is available. Using typical nutrient concentrations in wastewater and basal groundwater, and removal rates from the combination of enhanced septic systems and lateral travel with groundwater to the shoreline, onsite disposal of wastewater during the interim period is estimated to increase nitrogen and phosphorus loading by 0.5% and 0.4%, respectively, in the southern half of KAHO. Once sewer service is implemented, onsite disposal would be terminated, and the addition nutrient loading to groundwater from this source would terminate.

TNWRE (2002) also shows estimates of changes to nutrient concentrations in groundwater resulting from stormwater runoff and from landscape irrigation and other miscellaneous external water uses. Changes to the stormwater contribution were evaluated based on measurements of nutrient concentrations in water samples collected at the existing Kaloko Industrial Park during two episodes of heavy rainfall. Compared to the present amounts of nitrogen and phosphorus in groundwater moving through the southern half of KAHO, changes to groundwater following development would result in increases to nitrogen of 0.2% and phosphorus of 0.1%. Landscape irrigation would potentially result in increases of nitrogen of 0.14% and phosphorus of 0.035. Hence, in total from all sources, the changes to nutrient concentrations in groundwater from development of the Kaloko Honokohau Business Park would total less than 1% of the existing concentrations.

Such increases of less than 1% of nutrient loading will not result in changes to the ponds or nearshore ocean. As described above, healthy anchialine ponds are not nutrient limited, and already contain an excess of nutrients that are not utilized within the biogeochemical cycles within the ponds. A 1% increase in nutrients in basal groundwater would result in a change of 95 to 96 µM for N and 6 to 6.1 µM for P. Such changes are well within the natural variability of the system, and essentially represent no change to present conditions. As long as there are no changes to the physical structure of healthy anchialine ponds (e.g., infilling) or changes to the balance of native biotic assemblages (e.g., introduction of alien species) the small increase in nutrient concentrations in groundwater entering the ponds would have no effect.

With respect to the fishponds, Kaloko Pond presently consists primarily of seawater (~93%). At a maximum increase of 1% in the nutrients in the groundwater that comprises pond water, concentrations would increase by 0.07% within the pond. Such a small increase is well within the natural variability of the system and should not result in any effect.

In Aimakapa pond, measurements of pond metabolism indicate that a maximum of 4% of the pond production can be driven by incoming nutrients from groundwater, with the remaining 96% driven by recycled nutrients. Increasing the concentrations of nutrients in groundwater by 1% does not change these estimates, as the change is far smaller than the natural variability of all of the parameters of community metabolism. In addition, it is important to remember that these changes assume completely unimpeded flow of groundwater through the ponds. With physical retarding of groundwater flow, the estimates of change are even lower. The data indicate that Aimakapa Pond has already reached a level of metabolic function that can be termed "nutrient saturated" and is functioning essentially as a closed system. As a result, input of more inorganic nutrients to the low-exchange pond would result in no further changes.

TNWRE (2002) also calculates the cumulative changes that could occur in the 2.1 mile wide zone that encompasses the Kaloko-Honokohau National Historical Park. With regard to changes to groundwater from treatment and disposal of groundwater, it is expected that future projects of significant size or density will be required to connect to the County sewer system. Most of the wastewater conveyed to the County WWTP will ultimately be treated to R-1 quality for irrigation reuse. Based on the County's present and long-term plans, irrigation reuse will occur around and directly mauka of the Kealakehe WWTP. Percolation of a portion of this reuse water to the basal lens, because of the location of application would not likely impact groundwater that flows to KAHO. Therefore, over both the short and long-term, there does not appear to be any potential for impacts to the ponds at KAHO from increased nutrient loading to groundwater from sewage disposal.

4.0.3 EFFECTS TO NELH AND HOST PARK

A concern that has been raised regarding development in the Kaloko-Honokohau region is the effect to water chemistry at NELH and HOST Park mariculture facilities located at Keahole Point, approximately 3.5 miles from the project site. These concerns are apparently based on suppositions regarding upwelling and current-driven transport of materials emanating from the project site to Keahole Point. The concern is without merit for several reasons. First, the premise on which the NELH concept is primarily based is to utilize the high nutrient content in cold deep seawater from below the mixed layer to stimulate production in mariculture ventures. The close proximity of land to deep water afforded by the steeply sloping nearshore topography off Keahole Point makes this area uniquely suited as a site for the facility.

Most of the water used at NELH is pumped from a depth of 1,995 feet (608 m), far below the thermocline which restricts exchange between deep and surface waters. Deep water that

might be upwelled to the surface that could be influenced by the project could not be returned to the depth of intake. Hence, there is virtually no chance for contact between any water that might be influenced by activities on land and intake of cold water at NELH.

Secondly, the major point of the report is to address the potential for increased nutrient percolation to groundwater and the coastal ocean as a result of the proposed project. While it is extremely unlikely that any increases in nutrients in coastal seawater would be detectable 3.5 miles away from the project site, it must be recognized that the purpose of the NELH facility is to utilize high nutrient water for productive purposes. Hence, any increased nutrient concentrations at NELH cannot be considered a negative effect. This point is most effectively demonstrated in that the NELH and HOST Park tenants discharge all of their used water into on-site trenches which percolates to the water table and eventually to the nearshore ocean. The increased levels of nutrients in groundwater on the NELH property is clearly evident in data from monitoring wells on the site. A secondary source of water used at NELH is warm, surface water with an intake of approximately 60 feet (20 m). Contamination of this water is far more likely to occur from discharge water from NELH activities at Keahole Point than from groundwater discharge 3.5 miles downcoast. Hence, while extremely remote, any effects from nutrient subsidies at Keahole Point that may result from the proposed project are overshadowed by the standard operation of the NELH facilities.

4.0.4 EFFECTS TO THE NEARSHORE MARINE ENVIRONMENT

It is also unlikely that there would be any effects to the nearshore marine environment as a result of increases in nutrient concentrations in groundwater. Dollar and Atkinson (1992) modeled the input of nutrients to the ocean downslope from two golf courses in West Hawaii over a four-year period. Results of the studies showed that at a location where fertilizer nutrients entered an embayment (Keauhou Bay) with restricted circulation relative to open coastal shorelines, nitrates increased by about 100% and phosphate increased by about 20% over natural input. However, because the nutrients were retained within a surface layer, there was no exposure to the benthos. Circulation within the embayment was also rapid enough to prevent phytoplankton blooms. These results indicated that even with long-term input of extremely high nutrient subsidies, there are situations where there are no negative effects to the receiving environment. Similar lack of impact would be expected at the Kaloko-Honokohau region where nutrient subsidies would be less than have occurred at Keauhou,

Several other important points are also worth mentioning with respect to impacts to coral reef ecosystems. Figure 20 shows the extent that wave turbulence impinges on the nearshore environment off of Aimakapa Pond. Such wave turbulence is the reason coral communities are

poorly developed in this area. Hence, owing both to the lack of coral presently in the area, and the high and consistent rates of mixing, it is not likely that nutrient concentrations in the waters downslope from the project site will have any effect on coral communities.

In addition, some clarification on the actual extent of potential damage to coral reefs from nutrients is also important to note. While the perception is that elevated nutrient concentrations are universally detrimental to corals and other reef organisms, the scientific literature does not bear this out as fact. Atkinson et al. (1995) showed that 57 species of corals have grown at in seawater with consistent nutrient concentrations about 10-fold higher than is normally found on Hawaiian reefs. Growth rates of these corals were near the upper rates reported from the field, demonstrating that corals can and do flourish in relatively high nutrient water. Atkinson et al. (1995) conclude that "Statements implying that corals can only grow in low nutrient oligotrophic waters are oversimplifications of the processes that govern growth of these organisms."

Another clear example of the lack of impact to corals from sewage effluent is illustrated in Figure 22. In the photographs in this figure, corals can be seen covering sewage diffuser that are actively discharging primary treated effluent off of the island of Guam. Similar situations have been noted in Hawaii, where the elevated nutrient concentrations in waters adjacent to ocean sewage outfalls has not impacted corals or coral communities (Dollar 1999, Grigg 1994).

4.0.5 POTENTIAL EFFECTS TO ENDANGERED AND PROTECTED MARINE SPECIES

As mentioned in the results there are several protected marine species that may inhabit the offshore environment. Because there is no plan for any work in the nearshore region, there is no potential for blasting or excavation that might affect behavior of whales, monk seals and other marine mammals. Similarly, as described above, there is little potential for changes in water quality resulting from construction. As part of the Kaloko area mauka of Queen Kaahumanu Highway is a National Park, the Kaloko-Honokohau Business Park project will not alter access to the shoreline. Thus, there is little potential for any negative factors associated with the project that may affect turtles or other protected species.

4.0.6 COMPARISON OF SIMILAR LAND-INFLUENCES ON PONDS

Perhaps the best illustration of the effects of the proposed development will have on shoreline ponds is to examine other such systems in neighboring areas of West Hawaii where shoreline development has been in existence for some time. Figures 23 and 24 show three ponds similar

to Aimakapa Pond located along the South Kohala coastline, all of which are brackish in nature and separated from the ocean by a sand berm. Figure 23 show fishponds directly landward of Kukio Bay and Anaehoomalu Bay, while Figure 24 shows two views of Wai'kauhi fishpond at Hualalai. All of these ponds are surrounded by resort development, and hence are likely to receive groundwater with nutrient subsidies. Because development has extended to the ponds boundaries in all of these cases, the effects are likely to be more pronounced than at Kaloko-Honokohau where the development is substantially inland from the ponds. In all cases shown in Figures 22 and 23, the apparent condition of the ponds, in terms of visible water quality (e.g. turbidity, plankton biomass), fish stocks, and habitation by birds does not appear to be affected by the adjacent development.

5.0 SUMMARY

A major concern in the planning process for the Kaloko-Honokohau Business Park is impacts to pond and marine environments within the Kaloko-Honokohau National Historical Park, which lies directly downgradient from the project site. As there will be no alterations of any of the pond or marine habitats by the project, potential impacts could only result from alteration of groundwater that flows under the project site to the ocean.

The potential for impact to marine and pond communities as a result of development of the Kaloko-Honokohau Business Park project appears to be minimal. The two large fishponds within the Park are similar in that thick layers of sediment lining the floors of the ponds. Kaloko Pond is separated from the ocean by a man-made rock wall that contains openings to promote exchange of pond water and ocean water. Aimakapa Pond is sealed from the ocean by a unbroken sand berm. The distinct discontinuities between concentrations of water chemistry constituents between the seaward end of the Aimakapa Pond and the nearshore portion of the ocean indicate that the sand berm is an effective barrier preventing free exchange between the pond and ocean. Both ponds exhibit little vertical and horizontal stratification. The lack of stratification, along with substantially damped tidal oscillations both in magnitude and time, indicate a substantially reduced input of groundwater relative to what would if there was free exchange between the ponds and groundwater flow. The tidal damping also results in landward flow of water out of the ponds during periods when pond levels are higher than groundwater in surrounding lava formations, and flow into the pond when pond levels are lower than in surrounding rock.

Concentrations of inorganic nutrients, particularly NO_3^- and PO_4^{3-}, which are high in basal groundwater are substantially lower in the ponds. Measurements of metabolism within

Concentrations of inorganic nutrients, particularly NO_3^- and PO_4^{3-}, which are high in basal groundwater are substantially lower in the ponds. Measurements of metabolism within Aimakapa Pond indicates high rates of both gross production and respiration. Even with no consideration of the limited input of groundwater to the ponds, the maximum amount of metabolism that can be attributed to groundwater nutrients is about 5%. Therefore, a minimum of 95% of pond metabolism is driven by nutrients recycled within the pond. Such a scenario is consistent with the lack of stratification within the ponds, high phytoplankton biomass, and thick flocculent organic sediment that lines the floor of the pond.

In addition, it has been repeatedly documented that healthy anchialine ponds are not nutrient limited, so increases in nutrient concentrations will no effect as long as the physical and biological components of the ponds are kept intact. Estimates of changes in groundwater flow volume that would occur from the Kaloko-Honokohau Business Park project are within the range of natural variability. Increases in nutrient concentrations to groundwater from septic systems, stormwater and irrigation total an increase in less than 1% of the existing nutrient loads. Such changes are within the natural variability of groundwater composition. In addition, because Aimakapa Pond potentially utilizes groundwater nutrients for only a small percentage of metabolic requirements, the small changes to groundwater composition will not result in detectable differences in pond function.

Estimates of cumulative changes to groundwater from the total assemblage of existing and proposed projects also do not appear to have the potential for alterations to pond or marine habitats. Future developments will be required to utilize the County wastewater treatment plants, hence eliminating the major source of nutrient subsidies.

There is no indication that the project will have any effect on the NELH-HOST Park facility at Keahole Point. Cold water used by the mariculture facilities is pumped from below the mixed layer, and does not come into contact with surface ocean water. In addition, high nutrient water used at the facility is discharged into trenches that allows percolation to the coastal ocean. As a result, nutrient concentrations in groundwater that flows to the ocean is presently higher at NELH-HOST Park than it could be with construction and operation of the planned project.

Examination of other similar fishponds that receive groundwater input and are separated from the ocean by sand berms indicates no apparent effects from surrounding development. The studies conducted for this assessment show rather unequivocally that Aimakapa Pond is functioning essentially as a closed system in a positive feedback mode. Physical attributes of the pond restrict groundwater input, while high organic deposition and decomposition supply an

ample source of nutrients to support high production within the water column. With no flushing, organic buildup will continue and the cycling process will accelerate until the pond is transformed into a wetland. The most likely action to interrupt this feedback system may be to conduct a sediment removal process (e.g. dredging) that curtail the nutrient cycling-organic deposition that is currently taking place.

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TABLE 1. Results of water chemistry measurements in Aimakapa Pond and the coastal ocean directly off of the pond. "S" indicates surface sample; "B" indicates bottom sample. "DFS" indicates "distance from shore";negative values indicate distance inland from the beach berm; positive values indicate distance seaward from the beach berm. Nutrient concentrations are shown in micromolar units."Bdl" stands for "below detection limit."For station sampling locations, see Figure 1.

	SAMPLING STATION	DFS (m)	PO4 (µM)	NO3 (µM)	NH4 (µM)	Si (µM)	TOP (µM)	TON (µM)	TP (µM)	TN (µM)	Turb (ntu)	TSS (mg/l)	Salt (o/oo)	pH (rel)	Chl-a (µg/l)	O2 (%sat)
AIMAKAPA POND	1-S	-230-S	0.51	0.16	bdl	439.57	3.28	79.37	3.79	79.53	4.10	6.00	12.855	8.195	2.815	88.1
	1-B	-230-B	0.55	0.19	0.01	439.23	5.71	129.89	6.26	130.09	13.20	85.60	12.864	8.225	15.57	81.9
	2-S	-190-S	0.64	0.25	0.04	403.45	3.58	102.90	4.22	103.19	6.00	13.20	13.158	8.509	5.064	91.3
	2-B	-190-B	0.63	0.29	0.04	403.48	3.61	102.31	4.24	102.64	6.10	22.71	13.164	8.585	9.021	93.0
	3-S	-150-S	0.63	0.28	0.03	402.61	3.57	102.21	4.20	102.52	6.20	16.00	13.169	8.548	5.203	93.7
	3-B	-150-B	0.63	0.28	0.08	382.35	4.19	117.16	4.82	117.52	36.00	290.2	13.184	8.445	59.33	72.7
	4-S	-110-S	0.65	0.30	0.06	397.99	3.72	107.52	4.37	107.88	6.60	19.80	13.248	8.538	16.28	91.3
	4-B	-110-B	0.66	0.28	0.08	393.74	3.83	108.90	4.49	109.26	20.40	203.0	13.253	8.569	49.26	87.5
	5-S	-80-S	0.67	0.32	0.07	397.31	3.77	106.84	4.44	107.23	6.20	9.87	13.175	8.599	23.45	90.6
	5-B	-80-B	0.77	0.32	0.16	405.77	4.86	135.26	5.63	135.74	24.60	283.0	13.179	8.517	51.82	80.7
	6-S	-40-S	0.66	0.31	0.11	395.68	3.83	108.31	4.49	108.73	6.80	15.40	13.223	8.609	16.87	91.7
	6-B	-40-B	0.67	0.32	0.13	395.74	3.83	107.03	4.50	107.48	7.80	180.4	13.239	8.606	26.52	93.8
	7-S	-1-S	0.64	0.28	0.12	397.33	3.58	102.56	4.22	102.96	6.30	8.93	13.253	8.652	4.699	97.7
	7-B	-1-B	0.64	0.35	0.16	394.13	7.31	175.63	7.95	176.14	28.00	278.3	13.369	8.517	106.4	76.9
OCEAN	8-S	1-S	0.26	1.81	0.09	68.18	0.32	9.49	0.58	11.39	0.40	4.40	32.413	8.112	0.751	96.2
	9-S	3-S	0.24	1.81	0.23	68.66	0.30	9.28	0.54	11.32	0.33	3.27	32.287	8.098	0.323	97.6
	10-S	10-S	0.33	2.80	0.08	80.40	0.27	8.98	0.60	11.86	0.21	2.93	31.733	8.152	0.206	102.6
	10-B	10-B	0.30	2.07	0.12	68.01	0.27	8.69	0.57	10.88	0.30	2.29	32.283	8.107	0.260	98.9
	11-S	25-S	0.24	4.09	0.29	138.35	0.31	9.16	0.55	13.54	0.42	9.40	29.343	8.270	0.239	123.6
	11-B	25-B	0.32	2.19	0.36	93.10	0.42	11.68	0.74	14.23	0.35	11.20	31.032	8.226	0.772	117.2
	12-S	50-S	0.28	2.35	0.23	91.72	0.29	9.09	0.57	11.67	0.25	5.20	31.090	8.207	0.696	114.2
	12-B	50-B	0.22	1.35	0.22	61.10	0.32	9.76	0.54	11.33	0.40	2.47	32.305	8.279	0.273	131.3
	13-S	100-S	0.27	0.99	0.13	48.52	0.29	10.48	0.56	11.60	0.19	2.93	32.755	8.229	0.206	112.4
	13-B	100-B	0.14	0.23	0.22	26.78	0.30	9.10	0.44	9.55	0.27	5.67	33.549	8.234	0.210	110.9
	14-S	150-S	0.19	0.70	0.15	11.80	0.24	6.98	0.43	7.83	0.08	2.87	33.956	8.164	0.089	119.7
	14-B	150-B	0.14	0.30	0.03	3.99	0.31	5.99	0.45	6.32	0.11	3.74	34.178	8.163	0.054	99.8

TABLE 2. Results of water chemistry measurements in Aimakapa Pond and the coastal ocean directly off of the pond. "S" indicates surface sample; "B" indicates bottom sample. "DFS" indicates "distance from shore";negative values indicate distance inland from the beach berm; positive values indicate distance seaward from the beach berm. Nutrient concentrations are shown in micrograms per liter. "Bdl" stands for "below detection limit." For station sampling locations, see Figure 1.

SAMPLING STATION		DFS (m)	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	Turb (ntu)	TSS (mg/l)	Salt (o/oo)	pH (rel)	Chl-a (µg/l)	O2 (%sat)
1-S	AIMAKAPA POND	-230-S	15.81	2.24	bdl	12308	101.7	1111.2	117.49	1113.4	4.10	6.00	12.855	8.195	2.815	88.1
1-B		-230-B	17.05	2.66	0.14	12298	177.0	1818.5	194.06	1821.3	13.20	85.60	12.864	8.225	15.57	81.9
2-S		-190-S	19.84	3.50	0.56	11297	111.0	1440.6	130.82	1444.7	6.00	13.20	13.158	8.509	5.064	91.3
2-B		-190-B	19.53	4.06	0.56	11297	111.9	1432.3	131.44	1437	6.10	22.71	13.164	8.585	9.021	93.0
3-S		-150-S	19.53	3.92	0.42	11273	110.7	1430.9	130.2	1435.3	6.20	16.00	13.169	8.548	5.203	93.7
3-B		-150-B	19.53	3.92	1.12	10706	129.9	1640.2	149.42	1645.3	36.00	290.2	13.184	8.445	59.33	72.7
4-S		-110-S	20.15	4.20	0.84	11144	115.3	1505.3	135.47	1510.3	6.60	19.80	13.248	8.538	16.28	91.3
4-B		-110-B	20.46	3.92	1.12	11025	118.7	1524.6	139.19	1529.6	20.40	203.0	13.253	8.569	49.26	87.5
5-S		-80-S	20.77	4.48	0.98	11125	116.9	1495.8	137.64	1501.2	6.20	9.87	13.175	8.599	23.45	90.6
5-B		-80-B	23.87	4.48	2.24	11362	150.7	1893.6	174.53	1900.4	24.60	283.0	13.179	8.517	51.82	80.7
6-S		-40-S	20.46	4.34	1.54	11079	118.7	1516.3	139.19	1522.2	6.80	15.40	13.223	8.609	16.87	91.7
6-B		-40-B	20.77	4.48	1.82	11081	118.7	1498.4	139.5	1504.7	7.80	180.4	13.239	8.606	26.52	93.8
7-S		-1-S	19.84	3.92	1.68	11125	111.0	1435.8	130.82	1441.4	6.30	8.93	13.253	8.652	4.699	97.7
7-B		-1-B	19.84	4.90	2.24	11036	226.6	2458.8	246.45	2466	28.00	278.3	13.369	8.517	106.4	76.9
8-S	OCEAN	1-S	8.06	25.34	1.26	1909	9.92	132.86	17.98	159.46	0.40	4.40	32.413	8.112	0.751	96.2
9-S		3-S	7.44	25.34	3.22	1922	9.30	129.92	16.74	158.48	0.33	3.27	32.287	8.098	0.323	97.6
10-S		10-S	10.23	39.20	1.12	2251	8.37	125.72	18.60	166.0	0.21	2.93	31.733	8.152	0.206	102.6
10-B		10-B	9.30	28.98	1.68	1904	8.37	121.66	17.67	152.32	0.30	2.29	32.283	8.107	0.260	98.9
11-S		25-S	7.44	57.26	4.06	3874	9.61	128.24	17.05	189.56	0.42	9.40	29.343	8.270	0.239	123.6
11-B		25-B	9.92	30.66	5.04	2607	13.02	163.52	22.94	199.22	0.35	11.20	31.032	8.226	0.772	117.2
12-S		50-S	8.68	32.90	3.22	2568	8.99	127.26	17.67	163.38	0.25	5.20	31.090	8.207	0.696	114.2
12-B		50-B	6.82	18.90	3.08	1711	9.92	136.64	16.74	158.62	0.40	2.47	32.305	8.279	0.273	131.3
13-S		100-S	8.37	13.86	1.82	1359	8.99	146.72	17.36	162.4	0.19	2.93	32.755	8.229	0.206	112.4
13-B		100-B	4.34	3.22	3.08	749.84	9.30	127.4	13.64	133.7	0.27	5.67	33.549	8.234	0.210	110.9
14-S		150-S	5.89	9.80	2.10	330.4	7.44	97.72	13.33	109.62	0.08	2.87	33.956	8.164	0.089	119.7
14-B		150-B	4.34	4.20	0.42	111.72	9.61	83.86	13.95	88.48	0.11	3.74	34.178	8.163	0.054	99.8

TABLE 3. Results of water chemistry measurements in Kaloko Pond and the coastal ocean directly off of the pond. "S" indicates surface sample; "B" indicates bottom sample. "DFS" indicates "distance from shore";negative values indicate distance inland from the beach berm; positive values indicate distance seaward from the beach berm. Nutrient concentrations are shown in micromolar units. For station sampling locations, see Figure 1.

SAMPLING STATION		DFS (m)	PO4 (µM)	NO3 (µM)	NH4 (µM)	Si (µM)	TOP (µM)	TON (µM)	TP (µM)	TN (µM)	Turb (ntu)	TSS (mg/l)	Salt (o/oo)	pH (rel)	Chl-a (µg/l)	O2 (%sat)
1-S	KALOKO POND	-200-S	0.35	0.08	0.04	77.57	0.72	23.17	1.07	23.29	0.70	8.87	32.184	8.327	4.800	94.9
1-B		-200-B	0.30	0.06	0.13	76.27	0.48	18.03	0.78	18.22	0.80	14.80	32.240	8.349	8.979	96.5
2-S		-170-S	0.23	0.05	0.18	76.71	0.49	17.18	0.72	17.41	0.69	11.20	32.195	8.351	3.633	97.0
2-B		-170-B	0.39	0.05	0.25	44.03	0.43	16.70	0.82	17.00	0.72	10.80	33.513	8.351	7.951	97.7
3-S		-140-S	0.24	0.04	0.17	66.69	0.45	17.33	0.69	17.54	0.62	8.20	32.618	8.360	3.143	96.4
3-B		-140-B	0.35	0.06	0.21	45.37	0.47	16.70	0.82	16.97	0.66	10.80	33.409	8.361	2.903	98.5
4-S		-110-S	0.24	0.06	0.15	60.35	0.49	17.16	0.73	17.37	0.58	8.93	32.841	8.365	2.941	98.7
4-B		-110-B	0.31	0.05	0.54	40.77	0.42	15.56	0.73	16.15	0.63	11.86	33.595	8.342	2.530	94.5
5-S		-80-S	0.21	0.03	0.13	59.51	0.52	17.62	0.73	17.78	0.61	7.60	32.889	8.360	2.618	99.3
5-B		-80-B	0.36	0.04	0.18	37.85	0.53	18.25	0.89	18.47	0.59	7.27	33.736	8.297	2.736	82.6
6-S		-50-S	0.28	0.04	0.15	59.68	0.46	17.71	0.74	17.90	0.56	9.40	32.926	8.355	2.564	97.9
6-B		-50-B	0.26	0.06	0.18	44.48	0.51	16.76	0.77	17.00	0.62	12.40	33.477	8.341	4.116	93.4
7-S		-20-S	0.24	0.07	0.31	56.38	0.55	17.06	0.79	17.44	0.53	5.80	33.034	8.361	2.316	95.0
7-B		-20-B	0.30	0.03	0.18	51.81	0.45	15.53	0.75	15.74	0.56	8.93	33.233	8.356	2.622	96.4
8-S		-1-S	0.23	0.09	0.19	52.00	0.51	18.46	0.74	18.74	0.58	8.40	33.213	8.351	3.415	93.8
8-B		-1-B	0.23	0.26	0.38	50.39	0.48	16.57	0.71	17.21	0.54	6.47	33.277	8.335	3.176	91.8
9-S	OCEAN	1-S	0.37	3.04	0.40	62.65	0.37	14.27	0.74	17.71	0.31	14.20	32.418	8.408	7.636	94.3
10-S		3-S	0.33	3.39	0.57	66.43	0.24	9.25	0.57	13.21	0.28	4.80	32.401	8.377	0.885	98.3
11-S		10-S	0.34	3.67	0.62	66.57	0.25	9.12	0.59	13.41	0.38	2.93	32.418	8.355	0.730	95.9
12-S		25-S	0.31	5.88	0.25	115.18	0.29	8.66	0.60	14.79	0.19	4.27	30.685	8.333	0.331	115.6
12-B		25-B	0.73	5.64	0.53	108.98	0.34	19.95	1.07	26.12	0.17	2.80	30.918	8.336	0.470	124.4
13-S		50-S	0.30	4.13	0.25	83.02	0.29	9.26	0.59	13.64	0.20	3.20	31.791	8.298	0.466	119.1
13-B		50-B	0.25	3.15	0.20	25.43	0.30	8.15	0.50	11.46	0.14	2.90	32.538	8.289	0.387	117.3
14-S		100-S	0.17	2.10	0.18	47.33	0.30	7.95	0.47	10.23	0.12	1.80	33.107	8.260	0.277	111.3
14-B		100-B	0.15	0.48	0.15	12.20	0.30	8.07	0.45	8.70	0.13	1.67	34.298	8.238	0.239	108.8
15-S		150-S	0.15	0.77	0.13	14.51	0.27	6.36	0.42	7.26	0.13	1.98	33.798	8.180	0.096	112.0
15-B		150-B	0.11	0.19	0.08	3.87	0.26	6.34	0.37	6.61	0.05	1.78	34.183	8.160	0.075	109.4

TABLE 4. Results of water chemistry measurements in Kaloko Pond and the coastal ocean directly off of the pond. "S" indicates surface sample; "B" indicates bottom sample. "DFS" indicates "distance from shore";negative values indicate distance inland from the beach berm; positive values indicate distance seaward from the beach berm. Nutrient concentrations are shown in micrograms per liter. For station sampling locations, see Figure 1.

SAMPLING STATION		DFS (m)	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	DOP (µg/L)	DON (µg/L)	TP (µg/L)	TN (µg/L)	Turb (ntu)	TSS (mg/l)	Salt (o/oo)	pH (rel)	Chl-a (µg/l)	O2 (%sat)
1-S	KALOKO POND	-200-S	10.85	1.12	0.56	2172.0	22.32	324.38	33.17	326.06	0.70	8.87	32.184	8.327	4.800	94.9
1-B		-200-B	9.30	0.84	1.82	2135.6	14.88	252.42	24.18	255.08	0.80	14.80	32.240	8.349	8.979	96.5
2-S		-170-S	7.13	0.70	2.52	2147.9	15.19	240.52	22.32	243.74	0.69	11.20	32.195	8.351	3.633	97.0
2-B		-170-B	12.09	0.70	3.50	1232.8	13.33	233.80	25.42	238.00	0.72	10.80	33.513	8.351	7.951	97.7
3-S		-140-S	7.44	0.56	2.38	1867.3	13.95	242.62	21.39	245.56	0.62	8.20	32.618	8.360	3.143	96.4
3-B		-140-B	10.85	0.84	2.94	1270.4	14.57	233.80	25.42	237.58	0.66	10.80	33.409	8.361	2.903	98.5
4-S		-110-S	7.44	0.84	2.10	1689.8	15.19	240.24	22.63	243.18	0.58	8.93	32.841	8.365	2.941	98.7
4-B		-110-B	9.61	0.70	7.56	1141.6	13.02	217.84	22.63	226.10	0.63	11.86	33.595	8.342	2.530	94.5
5-S		-80-S	6.51	0.42	1.82	1666.3	16.12	246.68	22.63	248.92	0.61	7.60	32.889	8.360	2.618	99.3
5-B		-80-B	11.16	0.56	2.52	1059.8	16.43	255.50	27.59	258.58	0.59	7.27	33.736	8.297	2.736	82.6
6-S		-50-S	8.68	0.56	2.10	1671.0	14.26	247.94	22.94	250.60	0.56	9.40	32.926	8.355	2.564	97.9
6-B		-50-B	8.06	0.84	2.52	1245.4	15.81	234.64	23.87	238.00	0.62	12.40	33.477	8.341	4.116	93.4
7-S		-20-S	7.44	0.98	4.34	1578.6	17.05	238.84	24.49	244.16	0.53	5.80	33.034	8.361	2.316	95.0
7-B		-20-B	9.30	0.42	2.52	1450.7	13.95	217.42	23.25	220.36	0.56	8.93	33.233	8.356	2.622	96.4
8-S		-1-S	7.13	1.26	2.66	1456.0	15.81	258.44	22.94	262.36	0.58	8.40	33.213	8.351	3.415	93.8
8-B		-1-B	7.13	3.64	5.32	1410.9	14.88	231.98	22.01	240.94	0.54	6.47	33.277	8.335	3.176	91.8
9-S	OCEAN	1-S	11.47	42.56	5.60	1754	11.47	199.78	22.94	247.94	0.31	14.20	32.418	8.408	7.636	94.3
10-S		3-S	10.23	47.46	7.98	1860	7.44	129.50	17.67	184.94	0.28	4.80	32.401	8.377	0.885	98.3
11-S		10-S	10.54	51.38	8.68	1864	7.75	127.68	18.29	187.74	0.38	2.93	32.418	8.355	0.730	95.9
12-S		25-S	9.61	82.32	3.50	3225	8.99	121.24	18.60	207.06	0.19	4.27	30.685	8.333	0.331	115.6
12-B		25-B	22.63	78.96	7.42	3051	10.54	279.30	33.17	365.68	0.17	2.80	30.918	8.336	0.470	124.4
13-S		50-S	9.30	57.82	3.50	2325	8.99	129.64	18.29	190.96	0.20	3.20	31.791	8.298	0.466	119.1
13-B		50-B	7.75	44.10	2.80	712.0	9.30	114.10	15.50	160.44	0.14	2.90	32.538	8.289	0.387	117.3
14-S		100-S	5.27	29.40	2.52	1325	9.30	111.30	14.57	143.22	0.12	1.80	33.107	8.260	0.277	111.3
14-B		100-B	4.65	6.72	2.10	341.6	9.30	112.98	13.95	121.80	0.13	1.67	34.298	8.238	0.239	108.8
15-S		150-S	4.65	10.78	1.82	406.3	8.37	89.04	13.02	101.64	0.13	1.98	33.798	8.180	0.096	112.0
15-B		150-B	3.41	2.66	1.12	108.4	8.06	88.76	11.47	92.54	0.05	1.78	34.183	8.160	0.075	109.4

TABLE 5. Results of water chemistry measurements in Almakapa Pond and the coastal ocean directly offshore of the pond on December 19, 2001. "S" indicates surface sample; "B" indicates bottom sample. "DFS" indicates "distance from shore"; negative values indicate distance inland from the beach berm; positive values indicate distance seaward from the beach berm. "UF" indicates water sample was unfiltered; "F" indicates water sample was filtered through GFC filter immediately following collection. TON and TOP (total organic nitrogen, total organic phosphorus) represent difference between TN, TP and inorganic N, P in unfiltered samples; DON and DOP (dissolved organic nitrogen and phosphorus) represent difference between TN, TP and inorganic N, P in filtered samples. Nutrient concentrations are shown in micromolar units (µM). For station locations, see Figure 1.

SAMPLING STATION	DFS (m)	UF/F	PO4 (µM)	NO3 (µM)	NH4 (µM)	Si (µM)	T/DOP (µM)	T/DON (µM)	TP (µM)	TN (µM)	TURB (ntu)	SALT (o/oo)	pH (rel)	Chl-a (µg/l)	Diss. O2 (% sat)
1-S	-230	UF	2.79	26.17	1.00	451.37	0.22	10.57	3.01	37.74	0.47	12.400	7.814	0.971	59
		F	2.86	27.53	1.15	452.80	0.10	9.89	2.96	38.57					
1-B	-230	UF	2.19	14.38	0.40	452.08	0.70	16.03	2.89	30.81	0.96	12.774	7.961	4.395	75
		F	2.20	12.84	0.11	451.41	0.22	11.62	2.42	24.57					
2-S	-190	UF	2.93	27.23	1.59	455.27	0.20	9.99	3.13	38.81	0.50	12.369	7.789	1.880	51
		F	2.95	28.40	1.52	457.11	0.19	10.21	3.14	40.13					
2-B	-190	UF	1.19	12.14	0.25	445.71	0.78	19.56	1.97	31.85	1.53	12.749	7.878	5.914	66
		F	1.67	12.63	0.16	450.32	0.36	13.48	2.03	26.27					
3-S	-160	UF	1.10	7.32	0.27	436.37	1.27	24.09	2.37	31.68	2.10	12.563	8.039	7.872	76
		F	1.14	7.77	0.20	434.42	1.33	26.17	2.47	34.14					
3-B	-160	UF	0.49	0.18	0.39	429.63	1.61	28.87	2.10	29.44	2.70	12.644	8.188	8.951	86
		F	0.69	1.72	1.17	410.57	0.54	17.15	1.23	20.04					
4-S	-110	UF	0.36	0.07	0.01	411.22	2.02	34.46	2.38	34.54	3.80	12.753	8.395	9.370	80
		F	0.25	0.03	0.05	409.21	0.78	18.70	1.03	18.78					
4-B	-110	UF	0.35	0.07	0.03	392.19	1.89	33.57	2.24	33.67	4.10	12.750	8.469	10.070	97
		F	0.13	0.05	0.31	411.34	0.73	18.75	0.86	19.11					
6-S	-80	UF	0.41	0.06	0.03	406.68	1.71	31.91	2.12	32.00	3.80	12.776	8.533	9.450	95
		F	0.15	0.01	0.08	408.88	0.85	18.39	1.00	18.48					
6-B	-80	UF	0.38	0.11	0.03	411.92	1.73	31.16	2.11	31.30	4.50	12.785	8.565	8.511	98
		F	0.10	0.15	0.39	407.08	0.77	17.11	0.87	17.65					
6-S	-40	UF	0.36	0.10	0.04	405.06	2.14	38.58	2.50	38.72	4.40	12.773	8.607	8.252	93
		F	0.04	0.13	0.12	399.79	0.85	19.63	0.89	19.88					
6-B	-40	UF	0.35	0.13	0.05	400.15	2.25	39.30	2.60	39.48	5.60	12.795	8.566	9.111	99
		F	0.22	0.08	0.10	409.75	0.99	20.60	1.21	20.78					
7-S	-1	UF	0.39	0.12	0.06	397.77	2.73	46.19	3.12	46.37	5.00	12.741	8.621	8.391	112
		F	0.09	0.10	0.01	397.42	1.00	22.25	1.09	22.36					
7-B	-1	UF	0.43	0.15	0.09	400.19	2.68	43.52	3.11	43.76	6.10	12.782	8.570	9.490	90
		F	0.27	0.12	0.04	405.72	1.17	22.47	1.44	22.63					
8-S	1	UF	0.43	3.29	0.47	51.89	0.15	6.00	0.58	9.76	1.12	33.261	8.195	0.288	85
		F	0.47	3.32	0.80	52.85	0.17	6.47	0.64	10.59					
9-S	3	UF	0.34	2.99	0.32	49.43	0.24	6.24	0.58	9.55	0.85	33.288	8.158	0.204	86
		F	1.09	2.96	2.30	50.22	0.01	8.75	1.10	14.01					
10-S	10	UF	0.38	2.77	0.29	49.32	0.17	5.98	0.55	9.04	0.81	33.243	8.158	0.136	86
		F	0.37	2.95	0.39	49.90	0.18	5.09	0.55	8.43					
10-B	10	UF	0.36	2.81	0.29	48.25	0.17	5.82	0.53	8.92	0.75	33.309	8.159	0.154	85
		F	0.38	2.79	0.50	48.43	0.17	5.18	0.55	8.47					
11-S	25	UF	0.37	2.98	0.31	59.14	0.19	7.38	0.56	10.67	0.34	32.601	8.198	0.116	95
		F	0.34	3.04	0.57	60.42	0.21	5.38	0.55	8.99					
11-B	25	UF	0.31	1.87	0.59	32.81	0.23	6.39	0.54	8.85	0.35	33.881	8.260	0.118	106
		F	0.29	1.94	0.52	33.30	0.17	5.96	0.46	8.42					
12-S	50	UF	0.36	2.70	0.15	54.00	0.64	5.40	1.00	8.25	0.39	32.829	8.227	0.086	97
		F	0.34	2.69	0.58	54.29	0.70	6.18	1.04	9.45					
12-B	50	UF	0.21	2.08	0.06	33.70	0.21	5.55	0.42	7.69	0.34	33.771	8.265	0.118	106
		F	0.22	2.02	0.11	33.59	0.71	6.53	0.93	8.66					
13-S	100	UF	0.16	1.83	0.06	43.98	0.47	5.26	0.63	7.15	0.30	33.225	8.234	0.094	95
		F	0.23	2.20	0.23	44.00	0.24	4.95	0.47	7.38					
13-B	100	UF	0.28	1.97	0.09	15.90	0.13	5.17	0.41	7.23	0.31	34.245	8.244	0.088	96
		F	0.22	2.00	0.25	15.90	0.18	5.21	0.40	7.46					
14-S	150	UF	0.12	1.61	0.07	30.76	0.27	7.27	0.39	8.95	0.33	33.880	8.230	0.088	94
		F	0.19	1.82	0.18	30.72	0.81	4.95	1.00	6.95					
14-B	150	UF	0.31	1.08	0.10	15.86	0.11	5.81	0.42	6.99	0.32	34.460	8.244	0.086	97
		F	0.24	1.24	0.30	15.84	0.16	4.73	0.40	6.27					

TABLE 6. Results of water chemistry measurements in Almakapa Pond and the coastal ocean directly offshore of the pond on December 19, 2001. "S" indicates surface sample; "B" indicates bottom sample. "DFS" indicates "distance from shore"; negative values indicate distance inland from the beach berm; positive values indicate distance seaward from the beach berm. "UF" indicates water sample was unfiltered; "F" indicates water sample was filtered through GFC filter immediately following collection. TON and TOP (total organic nitrogen, total organic phosphorus) represent difference between TN, TP and inorganic N, P in unfiltered samples; DON and DOP (dissolved organic nitrogen and phosphorus) represent difference between TN, TP and inorganic N, P in filtered samples. Nutrient concentrations are shown in micrograms per liter (µg/L). For station locations, see Figure 1.

SAMPLING STATION	DFS (m)	UF/F	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	T/DOP (µg/L)	T/DON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (ntu)	SALT (o/oo)	pH (rel)	Chl-a (µg/l)	Diss. O2 (% sat)
1-S	-230	UF	86.49	366.38	14.00	12683	6.82	148.0	93.31	528.4	0.47	12.400	7.814	0.971	59
		F	88.66	385.42	16.10	12724	3.10	138.5	91.76	540.0					
1-B	-230	UF	67.89	201.32	5.60	12703	21.70	224.4	89.59	431.3	0.96	12.774	7.961	4.395	75
		F	68.20	179.76	1.54	12685	6.82	162.7	75.02	344.0					
2-S	-190	UF	90.83	381.22	22.26	12793	6.20	139.9	97.03	543.3	0.50	12.369	7.789	1.880	51
		F	91.45	397.60	21.28	12845	5.89	142.9	97.34	561.8					
2-B	-190	UF	36.89	169.96	3.50	12524	24.18	273.8	61.07	447.3	1.53	12.749	7.878	5.914	66
		F	51.77	176.82	2.24	12654	11.16	188.7	62.93	367.8					
3-S	-160	UF	34.10	102.48	3.78	12262	39.37	337.3	73.47	443.5	2.10	12.563	8.039	7.872	78
		F	35.34	108.78	2.80	12207	41.23	366.4	76.57	478.0					
3-B	-160	UF	15.19	2.52	5.46	12073	49.91	404.2	65.10	412.2	2.70	12.644	8.188	8.951	86
		F	21.39	24.08	16.38	11537	16.74	240.1	38.13	280.6					
4-S	-110	UF	11.16	0.98	0.14	11555	62.62	482.4	73.78	483.6	3.80	12.753	8.395	9.370	80
		F	7.75	0.42	0.70	11499	24.18	261.8	31.93	262.9					
4-B	-110	UF	10.85	0.98	0.42	11021	58.59	470.0	69.44	471.4	4.10	12.750	8.469	10.070	97
		F	4.03	0.70	4.34	11559	22.63	262.5	26.66	267.5					
5-S	-80	UF	12.71	0.84	0.42	11428	53.01	446.7	65.72	448.0	3.80	12.776	8.533	9.450	95
		F	4.65	0.14	1.12	11490	26.35	257.5	31.00	258.7					
5-B	-80	UF	11.78	1.54	0.42	11575	53.63	436.2	65.41	438.2	4.50	12.785	8.565	8.511	98
		F	3.10	2.10	5.46	11439	23.87	239.5	26.87	247.1					
6-S	-40	UF	11.16	1.40	0.56	11382	66.34	540.1	77.50	542.1	4.40	12.773	8.607	8.252	93
		F	1.24	1.82	1.68	11234	26.35	274.8	27.59	278.3					
6-B	-40	UF	10.85	1.82	0.70	11244	69.75	550.2	80.60	552.7	5.60	12.795	8.568	9.111	99
		F	6.82	1.12	1.40	11514	30.69	288.4	37.51	290.9					
7-S	-1	UF	12.09	1.68	0.84	11177	84.63	646.7	96.72	649.2	5.00	12.741	8.621	8.391	112
		F	2.79	1.40	0.14	11168	31.00	311.5	33.79	313.0					
7-B	-1	UF	13.33	2.10	1.26	11245	83.08	609.3	96.41	612.6	6.10	12.782	8.570	9.490	90
		F	8.37	1.68	0.56	11401	36.27	314.6	44.64	316.8					
8-S	1	UF	13.33	46.06	6.58	1458	4.65	84.0	17.98	136.6	1.12	33.261	8.195	0.288	85
		F	14.57	46.48	11.20	1485	5.27	90.6	19.84	148.3					
9-S	3	UF	10.54	41.86	4.48	1389	7.44	87.4	17.98	133.7	0.85	33.288	8.158	0.204	88
		F	33.79	41.44	32.20	1411	0.31	122.5	34.10	196.1					
10-S	10	UF	11.78	38.78	4.06	1386	5.27	83.7	17.05	126.6	0.81	33.243	8.158	0.136	86
		F	11.47	41.30	5.46	1402	5.58	71.3	17.05	118.0					
10-B	10	UF	11.16	39.34	4.06	1356	5.27	81.5	16.43	124.9	0.75	33.309	8.159	0.154	85
		F	11.78	39.06	7.00	1361	5.27	72.5	17.05	118.6					
11-S	25	UF	11.47	41.72	4.34	1662	5.89	103.3	17.36	149.4	0.34	32.601	8.198	0.116	95
		F	10.54	42.56	7.98	1698	6.51	75.3	17.05	125.9					
11-B	25	UF	9.61	26.18	8.26	922	7.13	89.5	16.74	123.9	0.35	33.881	8.260	0.118	106
		F	8.99	27.16	7.28	936	5.27	83.4	14.26	117.9					
12-S	50	UF	11.16	37.80	2.10	1517	19.84	75.6	31.00	115.5	0.39	32.829	8.227	0.086	97
		F	10.54	37.66	8.12	1526	21.70	86.5	32.24	132.3					
12-B	50	UF	6.51	29.12	0.84	947	6.51	77.7	13.02	107.7	0.34	33.771	8.265	0.118	106
		F	6.82	28.28	1.54	944	22.01	91.4	28.83	121.2					
13-S	100	UF	4.96	25.62	0.84	1236	14.57	73.6	19.53	100.1	0.30	33.225	8.234	0.094	95
		F	7.13	30.80	3.22	1236	7.44	69.3	14.57	103.3					
13-B	100	UF	8.68	27.58	1.26	447	4.03	72.4	12.71	101.2	0.31	34.245	8.244	0.088	96
		F	6.82	28.00	3.50	447	5.58	72.9	12.40	104.4					
14-S	150	UF	3.72	22.54	0.98	864	8.37	101.8	12.09	125.3	0.33	33.880	8.230	0.088	94
		F	5.89	25.48	2.52	863	25.11	69.3	31.00	97.3					
14-B	150	UF	9.61	15.12	1.40	446	3.41	81.3	13.02	97.9	0.32	34.460	8.244	0.086	97
		F	7.44	17.36	4.20	445	4.96	66.2	12.40	87.8					

TABLE 7. Concentrations of dissolved nutrients and salinity from wells and other shoreline locations in the vicinity of Kaloko-Honokohau, North Kona, Hawaii. Concentrations of nutrients are in micromolar units.Wells designated "K-H" are monitoring wells in Kaloko-Honokohau National Park. Springs around Kaloko and Aimakapa ponds are designated as "mauka" for springs along the landward margins of the ponds, and "makai" for springs along the ocean margins of the ponds. Nutrient concentrations are in micromoles (µM).

WATER SOURCE	WELL NO.	PO4 (µM)	NO3 (µM)	NH4 (µM)	Si (µM)	TOP (µM)	TON (µM)	TP (µM)	TN (µM)	SALT (o/oo)
HIGH LEVEL POTABLE WELLS	4057-01	3.8	86.0	bdl	801	0.1	14.7	3.8	100.7	0.109
	4158-02	3.6	80.1	bdl	844	0.2	14.5	3.8	94.6	0.144
	4258-03	3.9	70.2	1.2	833	0.5	19.4	4.4	90.8	0.165
	4358-01	3.4	71.8	0.0	908	1.0	11.9	4.4	83.8	0.182
BRACKISH WELLS										
K-H WELL 1	4061-01 -T	1.8	55.0	0.3	334	0.2	24.8	2.0	80.2	9.464
	4061-01 -T	1.4	56.2	3.5	304	3.0	32.1	4.4	91.8	9.463
	4061-01 -T	0.2	38.5	5.7	40	0.5	20.4	0.7	64.6	8.657
	4061-01 -B	1.9	21.3	1.3	490	4.4	65.9	6.4	88.5	11.298
	4061-01 -B	2.6	54.4	1.4	477	3.4	38.2	6.0	94.0	10.655
	4061-01 -B	0.7	51.9	3.3	169	1.6	37.2	2.3	92.3	9.156
K-H WELL 2	4161-02 -T	4.1	87.2	0.5	653	0.6	22.8	4.6	110.4	5.399
	4161-02 -T	9.0	104.3	5.1	691	2.9	42.2	11.9	151.6	5.361
	4161-02 -T	4.3	86.6	1.9	616	0.0	2.0	4.4	90.5	5.401
	4161-02 -B	4.3	89.0	0.2	671	0.2	17.7	4.6	106.9	5.522
	4161-02 -B	5.2	89.7	0.6	696	2.3	32.5	7.5	122.8	5.883
	4161-02 -B	4.4	85.6	1.8	632	0.4	5.6	4.7	92.9	5.289
K-H WELL 3	4161-01 -T	4.4	75.0	0.2	672	0.0	14.8	4.4	90.0	6.259
	4161-01 -T	4.6	76.9	1.6	701	2.6	43.2	7.3	121.7	6.325
	4161-01 -T	4.4	79.5	4.2	651	0.1	0.1	4.4	83.7	6.305
	4161-01 -B	4.5	77.3	0.3	694	0.1	16.0	4.6	93.6	6.548
	4161-01 -B	5.3	76.4	1.5	709	2.2	31.4	7.5	109.3	6.601
	4161-01 -B	4.1	76.3	1.9	629	0.2	5.4	4.3	83.6	6.413
	4262-01M-T	3.6	91.4	1.0	741	0.7	35.8	4.3	128.2	7.850
	4360-01	0.3	3.2	2.5	182	0.3	24.9	0.6	30.6	1.509
SALINE WELLS	4363-04	4.1	72.3	1.4	287	0.6	32.8	4.6	106.6	26.836
	4363-04	3.8	65.6	0.9	291	0.5	21.6	4.3	88.1	26.695
	3960-01	1.4	30.5	1.6	356	0.7	22.5	2.1	54.6	25.698
KALOKO SPRINGS	MAUKA	2.4	39.6	0.8	539	1.9	52.0	4.4	92.4	10.460
	MAUKA	3.8	63.3	3.0	650	3.7	51.8	7.5	118.1	9.899
	MAUKA	3.8	64.0	1.3	665	3.4	38.4	7.2	103.7	8.566
	MAKAI	3.2	57.0	1.8	601	2.6	25.8	5.8	84.6	14.254
AIMAKAPA SPRING	MAKAI	2.5	49.6	2.7	472	3.0	32.6	5.4	85.0	17.373
	MAKAI	15.1	64.2	12.4	388	1.8	77.0	16.9	153.6	13.309

TABLE 8. Concentrations of dissolved nutrients and salinity from wells and other shoreline locations in the vicinity of Kaloko-Honokohau, North Kona, Hawaii. Concentrations of nutrients are in micromolar units.Wells designated "K-H" are monitoring wells in Kaloko-Honokohau National Park. Springs around Kaloko and Aimakapa ponds are designated as "mauka" for springs along the landward margins of the ponds, and "makai" for springs along the ocean margins of the ponds. Nutrient concentrations are in micrograms per liter (µg/L).

WATER SOURCE	WELL NO.	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	Si (µg/L)	TOP (µg/L)	TON (µg/L)	TP (µg/L)	TN (µg/L)	SALT (o/oo)
HIGH LEVEL	4057-01	116.6	1204.0	bdl	22434	2.5	206.1	119.0	1410.1	0.109
POTABLE WELLS	4158-02	112.8	1121.7	bdl	23632	6.2	203.3	119.0	1325.0	0.144
	4258-03	119.4	982.8	16.8	23324	15.5	271.6	134.9	1271.2	0.165
	4358-01	105.4	1005.8	0.6	25411	29.5	166.9	134.9	1173.2	0.182
BRACKISH WELLS										
K-H WELL 1	4061-01 -T	57.0	770.6	4.5	9349	6.2	347.8	63.2	1122.8	9.464
	4061-01 -T	44.6	787.4	49.3	8512	91.8	449.1	136.4	1285.8	9.463
	4061-01 -T	6.2	538.3	79.8	1121	14.0	285.6	20.2	903.7	8.657
	4061-01 -B	59.5	297.9	17.9	13732	137.6	922.9	197.2	1238.7	11.298
	4061-01 -B	81.8	761.6	19.0	13344	104.2	535.4	186.0	1316.0	10.655
	4061-01 -B	21.7	725.9	46.2	4742	48.1	520.1	69.8	1292.2	9.156
K-H WELL 2	4161-02 -T	126.5	1220.2	6.7	18282	17.4	319.2	143.8	1546.2	5.399
	4161-02 -T	280.2	1460.5	71.7	19354	89.3	590.2	369.5	2122.4	5.361
	4161-02 -T	133.3	1211.7	26.6	17249	1.5	28.0	134.9	1266.3	5.401
	4161-02 -B	133.9	1246.0	2.8	18796	7.4	248.1	141.4	1496.9	5.522
	4161-02 -B	161.2	1255.5	9.0	19477	71.9	454.7	233.1	1719.2	5.883
	4161-02 -B	134.9	1197.7	24.5	17702	10.9	77.7	145.7	1299.9	5.289
K-H WELL 3	4161-01 -T	135.2	1050.6	2.2	18824	1.2	206.6	136.4	1259.4	6.259
	4161-01 -T	143.8	1076.3	22.4	19631	81.8	604.8	225.7	1703.5	6.325
	4161-01 -T	134.9	1112.3	58.1	18232	2.2	1.4	137.0	1171.8	6.305
	4161-01 -B	140.1	1082.5	4.5	19423	2.5	223.4	142.6	1310.4	6.548
	4161-01 -B	163.7	1069.6	21.3	19855	69.4	439.0	233.1	1529.9	6.601
	4161-01 -B	125.6	1068.2	25.9	17612	6.2	75.6	131.8	1169.7	6.413
	4262-01M-T	111.6	1279.0	14.6	20749	22.3	501.8	133.9	1795.4	7.850
	4360-01	9.3	44.8	35.0	5096	9.3	348.6	18.6	428.4	1.509
SALINE WELLS	4363-04	126.5	1012.5	20.2	8042	17.4	459.2	143.8	1491.8	26.836
	4363-04	117.8	918.4	12.6	8148	15.5	302.4	133.3	1233.4	26.695
	3960-01	43.4	427.0	22.4	9968	21.7	315.0	65.1	764.4	25.698
KALOKO SPRINGS	MAUKA	75.6	555.0	11.2	15092	59.5	727.4	135.2	1293.6	10.460
	MAUKA	119.0	885.9	42.6	18198	114.1	724.6	233.1	1653.1	9.899
	MAUKA	116.6	896.0	17.9	18608	106.6	537.6	223.2	1451.5	8.566
	MAKAI	99.2	797.4	25.8	16818	81.8	360.6	181.0	1183.8	14.254
AIMAKAPA SPRING	MAKAI	76.9	694.4	38.1	13207	91.8	457.0	168.6	1189.4	17.373
	MAKAI	468.7	899.4	173.6	10875	54.6	1077.4	523.3	2150.4	13.309

TABLE 9. Results of nutrient analysis for unfiltered (UF) and filtered (F) splits from samples collected in Aimakapa Pond on December 19, 2001. Also shown are differences between unfiltered and filtered samples (U-F). Negative values of U-F indicate a higher concentration in filtered sample; Positive values of U-F indicate higher concentration in unfiltered sample. "dfs" represents distance from shore, with negative values indicating distance landward from the beach berm and positive values indicating distance seaward from the berm. Also shown are linear regression statistics for unfiltered vs. filtered samples.

Distance from Shore	Depth	PO4 (µM)			NO3 (µM)			NH4 (µM)			Si (µM)			TP (µM)			TN (µM)		
		UF	F	UF-F	UF	F	UF-F	UF	F	UF-F	UF	F	UF-F	UF	F	UF-F	UF	F	UF-F
-230	s	2.79	2.86	-0.07	26.17	27.53	-1.36	1.00	1.15	-0.15	451.37	452.80	-1.43	3.01	2.96	0.05	37.74	38.57	-0.83
-230	b	2.19	2.20	-0.01	14.38	12.84	1.54	0.40	0.11	0.29	452.08	451.41	0.67	2.89	2.42	0.47	30.81	24.57	6.24
-190	s	2.93	2.95	-0.02	27.23	28.40	-1.17	1.59	1.52	0.07	455.27	457.11	-1.84	3.13	3.14	-0.01	38.81	40.13	-1.32
-190	b	1.19	1.67	-0.48	12.14	12.63	-0.49	0.25	0.16	0.09	445.71	450.32	-4.61	1.97	2.03	-0.06	31.95	26.27	5.68
-150	s	1.10	1.14	-0.04	7.32	7.77	-0.45	0.27	0.20	0.07	436.37	434.42	1.95	2.37	2.47	-0.10	31.68	34.14	-2.46
-150	b	0.49	0.69	-0.20	0.18	1.72	-1.54	0.39	1.17	-0.78	429.63	410.57	19.06	2.10	1.23	0.87	29.44	20.04	9.40
-110	s	0.36	0.25	0.11	0.07	0.03	0.04	0.01	0.05	-0.04	411.22	409.21	2.01	2.38	1.03	1.35	34.54	18.78	15.76
-110	b	0.35	0.13	0.22	0.07	0.05	0.02	0.03	0.31	-0.28	392.19	411.34	-19.15	2.24	0.86	1.38	33.67	19.11	14.56
-80	s	0.41	0.15	0.26	0.06	0.01	0.05	0.03	0.08	-0.05	406.68	408.88	-2.20	2.12	1.00	1.12	32.00	18.48	13.52
-80	b	0.38	0.10	0.28	0.11	0.15	-0.04	0.03	0.39	-0.36	411.92	407.08	4.84	2.11	0.87	1.24	31.30	17.65	13.65
-40	s	0.36	0.04	0.32	0.10	0.13	-0.03	0.04	0.12	-0.08	405.06	399.79	5.27	2.50	0.89	1.61	38.72	19.88	18.84
-40	b	0.35	0.22	0.13	0.13	0.08	0.05	0.05	0.10	-0.05	400.15	409.75	-9.60	2.60	1.21	1.39	39.48	20.78	18.70
-1	s	0.39	0.09	0.30	0.12	0.10	0.02	0.06	0.01	0.05	397.77	397.42	0.35	3.12	1.09	2.03	46.37	22.36	24.01
-1	b	0.43	0.27	0.16	0.15	0.12	0.03	0.09	0.04	0.05	400.19	405.72	-5.53	3.11	1.44	1.67	43.76	22.63	21.13
1	s	0.43	0.47	-0.04	3.29	3.32	-0.03	0.47	0.80	-0.33	51.89	52.85	-0.96	0.58	0.64	-0.06	9.76	10.59	-0.83
3	s	0.34	1.09	-0.75	2.99	2.96	0.03	0.32	2.30	-1.98	49.43	50.22	-0.79	0.58	1.10	-0.52	9.55	14.01	-4.46
10	s	0.38	0.37	0.01	2.77	2.95	-0.18	0.29	0.39	-0.10	49.32	49.90	-0.58	0.55	0.55	0.00	9.04	8.43	0.61
10	b	0.36	0.38	-0.02	2.81	2.79	0.02	0.29	0.50	-0.21	48.25	48.43	-0.18	0.53	0.55	-0.02	8.92	8.47	0.45
25	s	0.37	0.34	0.03	2.98	3.04	-0.06	0.31	0.57	-0.26	59.14	60.42	-1.28	0.56	0.55	0.01	10.67	8.99	1.68
25	b	0.31	0.29	0.02	1.87	1.94	-0.07	0.59	0.52	0.07	32.81	33.30	-0.49	0.54	0.46	0.08	8.85	8.42	0.43
50	s	0.36	0.34	0.02	2.70	2.69	0.01	0.15	0.58	-0.43	54.00	54.29	-0.29	1.00	1.04	-0.04	8.25	9.45	-1.20
50	b	0.21	0.22	-0.01	2.08	2.02	0.06	0.06	0.11	-0.05	33.70	33.59	0.11	0.42	0.93	-0.51	7.69	8.66	-0.97
100	s	0.16	0.23	-0.07	1.83	2.20	-0.37	0.06	0.23	-0.17	43.98	44.00	-0.02	0.63	0.47	0.16	7.15	7.38	-0.23
100	b	0.28	0.22	0.06	1.97	2.00	-0.03	0.09	0.25	-0.16	15.90	15.90	0.00	0.41	0.40	0.01	7.23	7.46	-0.23
150	s	0.12	0.19	-0.07	1.61	1.82	-0.21	0.07	0.18	-0.11	30.76	30.72	0.04	0.39	1.00	-0.61	8.95	6.95	2.00
150	b	0.31	0.24	0.07	1.08	1.24	-0.16	0.10	0.30	-0.20	15.86	15.84	0.02	0.42	0.40	0.02	6.99	6.27	0.72
Slope of Regression		0.89			0.97			0.41			1.00			0.95			1.18		
95% confidence interval		0.78-0.99			0.94-0.99			0.19-0.62			0.98-1.01			0.53-1.36			0.83-1.55		
y-intercept of Regression		0.08			-0.02			0.08			-0.27			0.50			2.75		
95% confidence interval		-0.02-0.193			-0.271-.225			-0.071-0.23			-4.39-3.86			-0.08-1.09			-4.357-9.857		
Correlation coefficient		0.963			0.997			0.623			0.999			0.694			0.811		
Signicance of F		3.16E-15			2.03E-29			6.59E-04			1.47E-37			8.49E-05			4.95E-07		

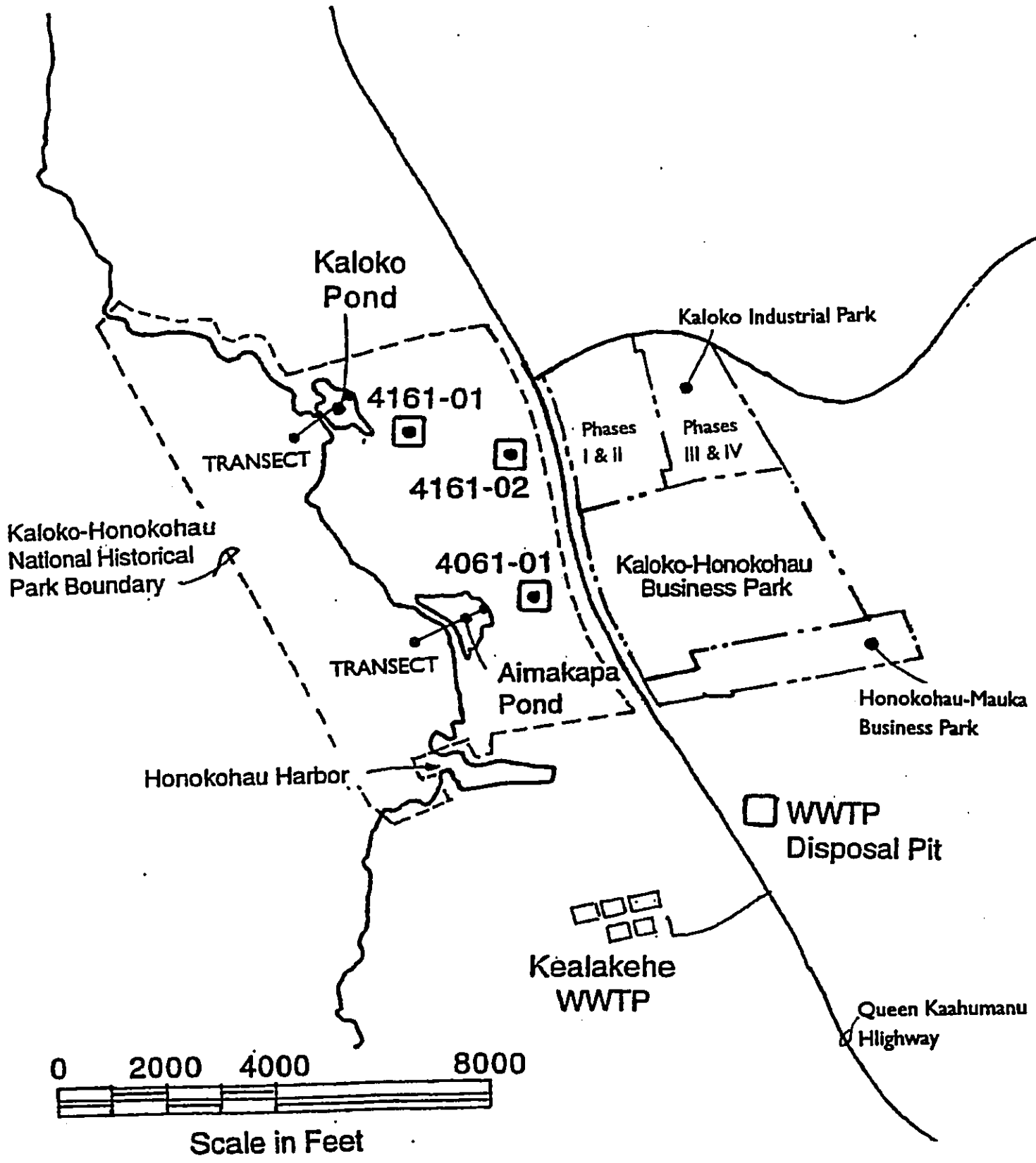


FIGURE 1. Map showing of location of proposed Kaloko-Honokohau Business Park in North Kona, Hawaii. Also shown are locations of the Kaloko-Honokohau National Historical Park boundary, and Kaloko and Aimakapa Ponds within the Historical Park. Water sampling transects bisecting the ponds and extending into the ocean are also indicated, as are the locations of Honokohau Harbor and the three monitoring wells within the National Park (4161-01,02 and 4061-01).

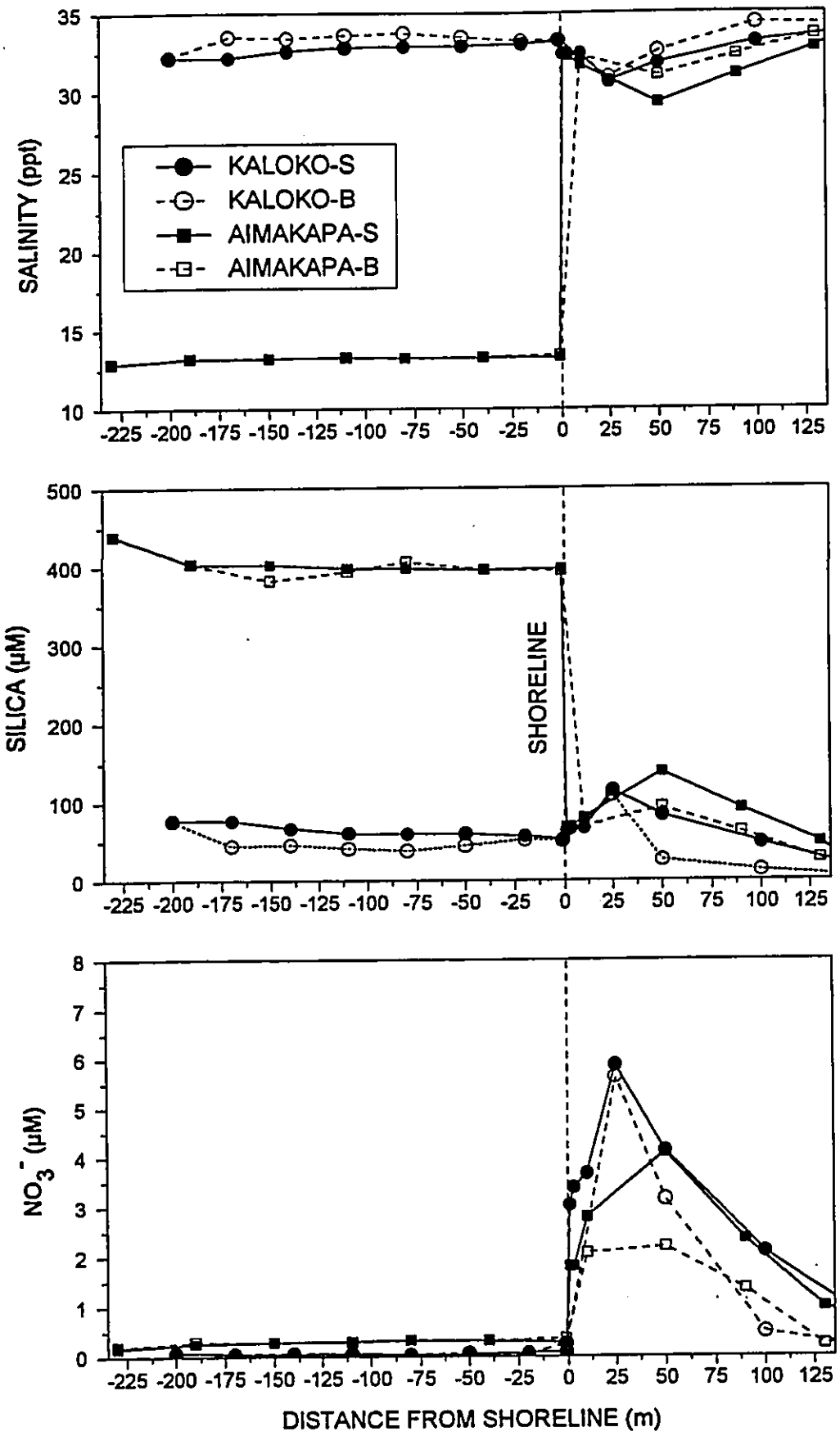


FIGURE 2. Plots of water chemistry constituents in surface (S) and bottom (B) samples collected in Kaloko and Aimakapa Ponds and offshore ocean in May-June 2000 as a function of distance from the ocean shoreline. Positive distances are distances from the shoreline into the ocean, negative distances are distances from the shoreline into the ponds. For transect locations, see Figure 1.

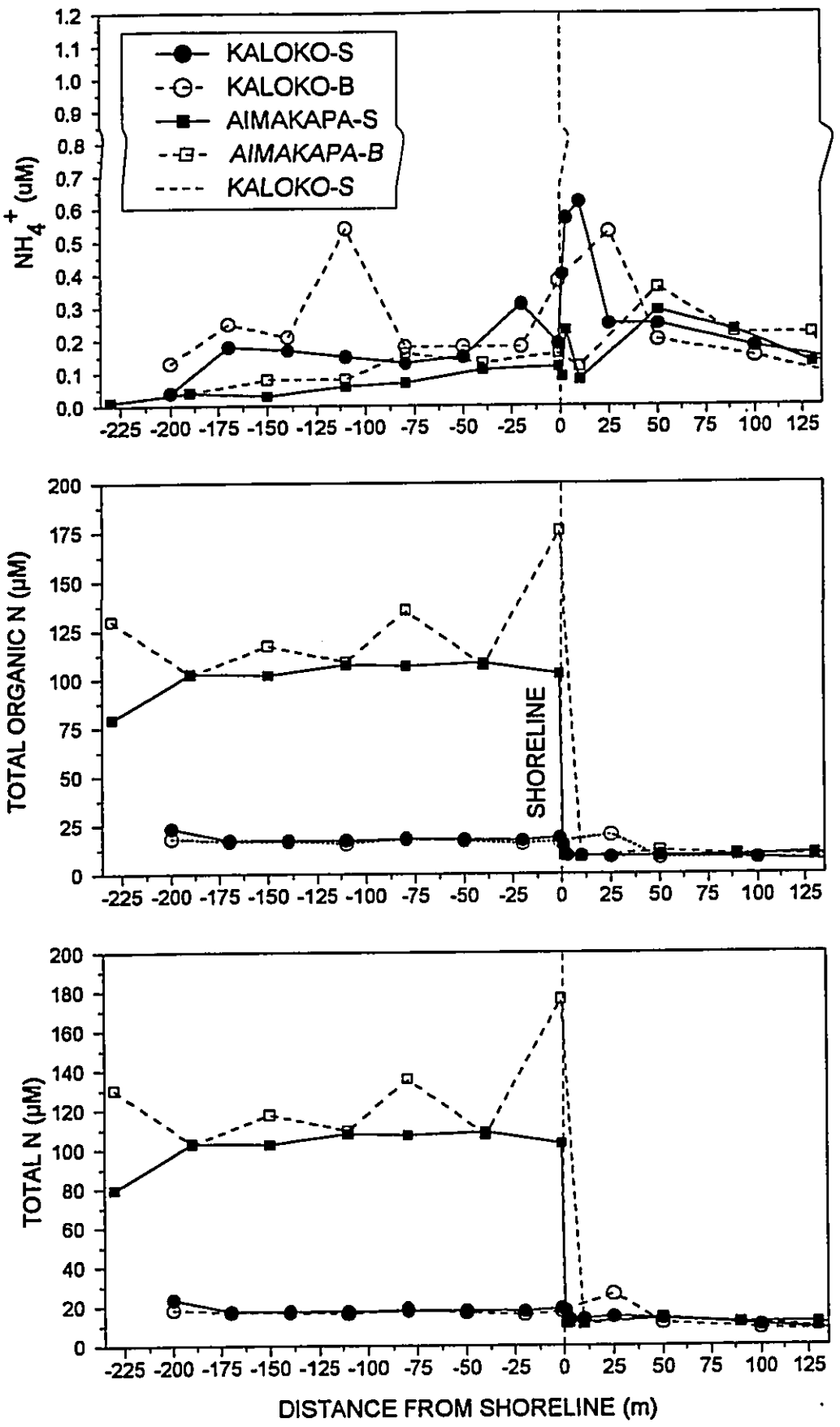


FIGURE 3. Plots of water chemistry constituents in surface (S) and bottom (B) samples collected in Kaloko and Aimakapa Ponds and offshore ocean in May-June 2000 as a function of distance from the ocean shoreline. Positive distances are distances from the shoreline into the ocean, negative distances are distances from the shoreline into the ponds. For transect locations, see Figure 1.

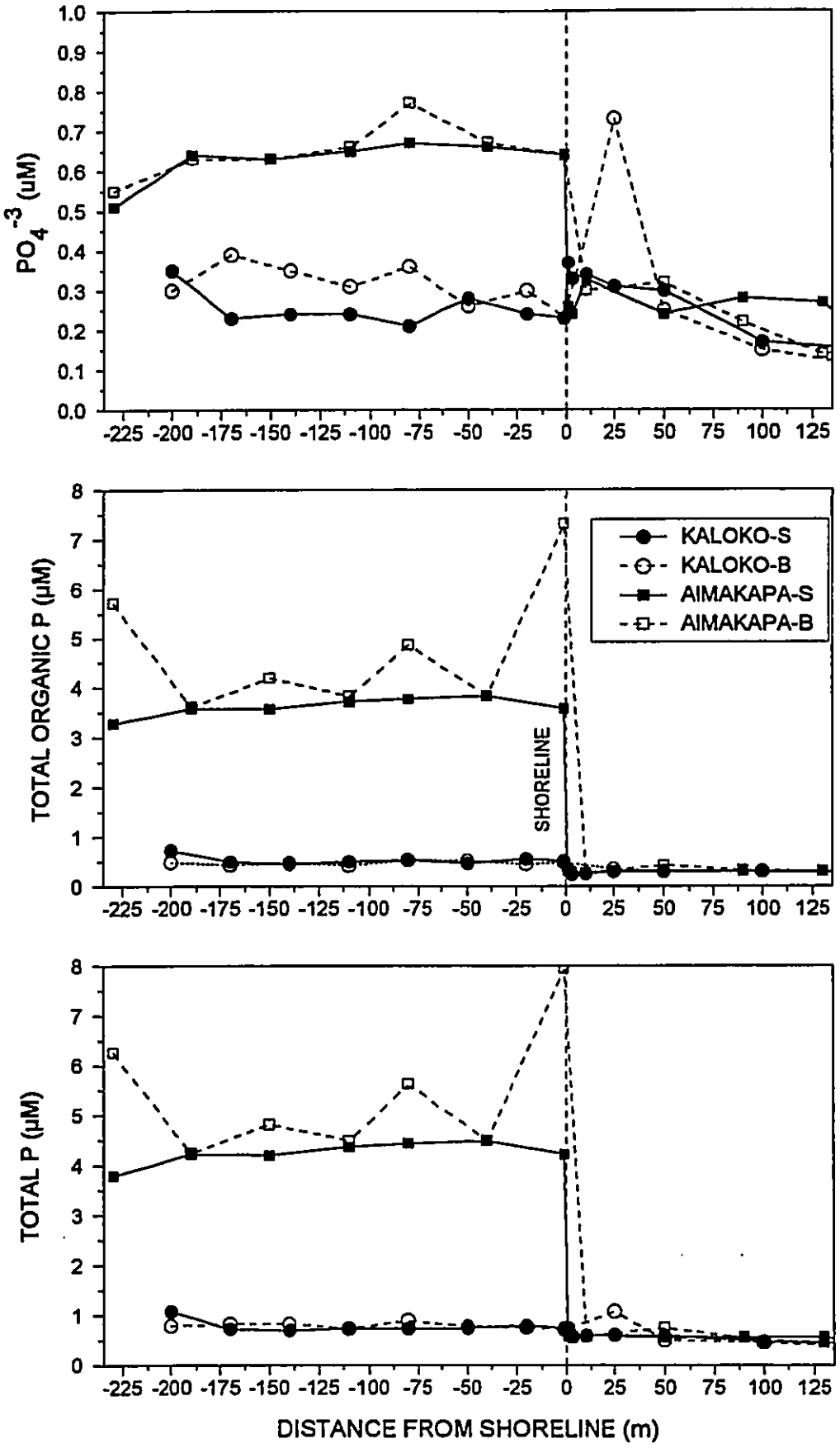


FIGURE 4. Plots of water chemistry constituents in surface (S) and bottom (B) samples collected in Kaloko and Aimakapa Ponds and offshore ocean in May-June 2000 as a function of distance from the ocean shoreline. Positive distances are distances from the shoreline into the ocean, negative distances are distances from the shoreline into the ponds. For transect locations, see Figure 1.

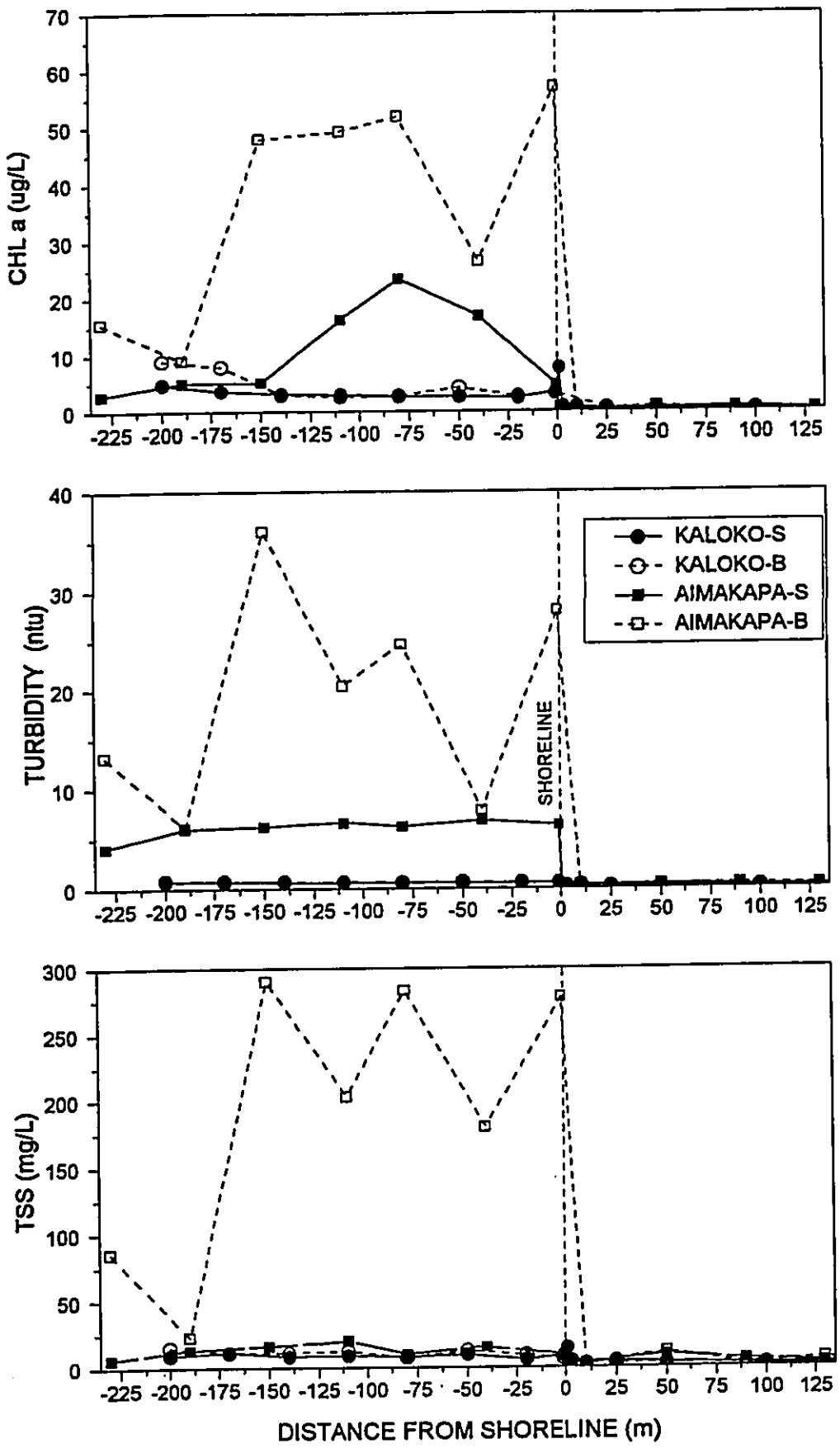


FIGURE 5. Plots of water chemistry constituents in surface (S) and bottom (B) samples collected in Kaloko and Aimakapa Ponds and offshore ocean in May-June 2000 as a function of distance from the ocean shoreline. Positive distances are distances from the shoreline into the ocean, negative distances are distances from the shoreline into the ponds. For transect locations, see Figure 1.

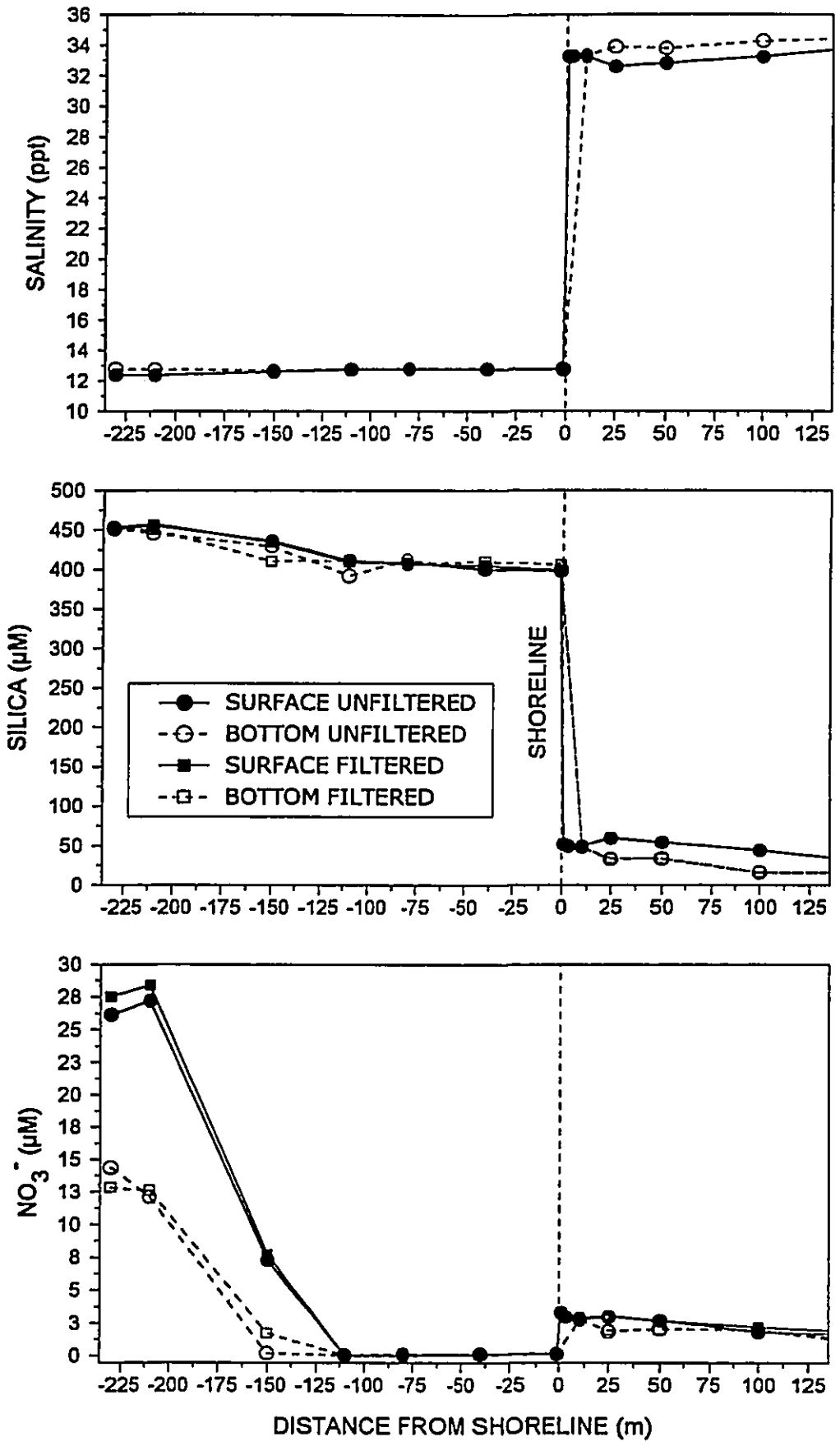


FIGURE 6. Plots of water chemistry constituents in surface (S) and bottom (B) samples collected in Aimakapa Pond and offshore ocean on December 19, 2001 (1000-1100) as a function of distance from the ocean shoreline. Positive distances are distances from the shoreline into the ocean, negative distances are distances from the shoreline into the ponds. Sample splits were filtered immediately after collection. For transect locations, see Figure 1.

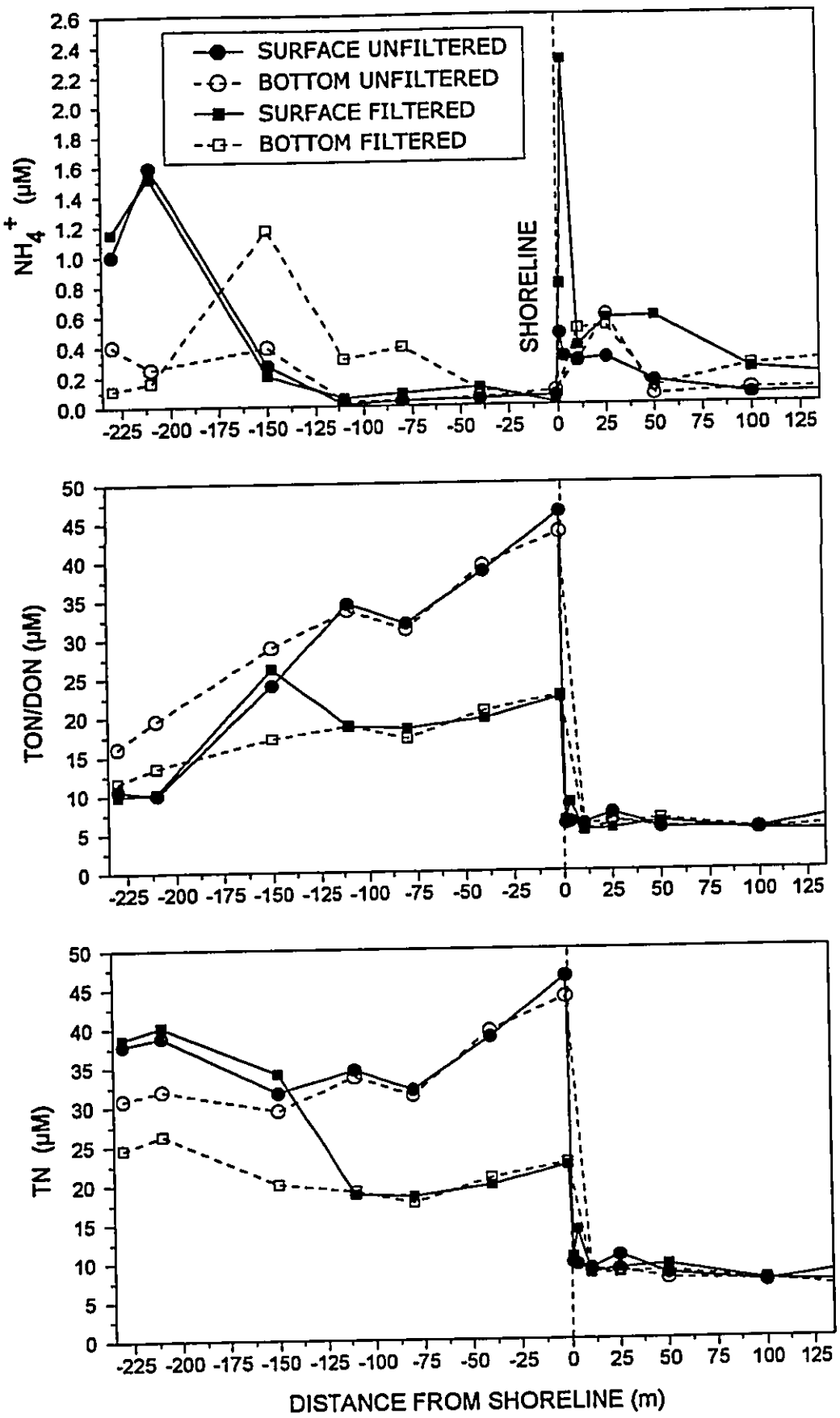


FIGURE 7. Plots of water chemistry constituents in surface (S) and bottom (B) samples collected in Aimakapa Pond and offshore ocean on December 19, 2001 (1000-1100) as a function of distance from the ocean shoreline. Positive distances are distances from the shoreline into the ocean, negative distances are distances from the shoreline into the ponds. Sample splits were filtered immediately after collection. For transect locations, see Figure 1.

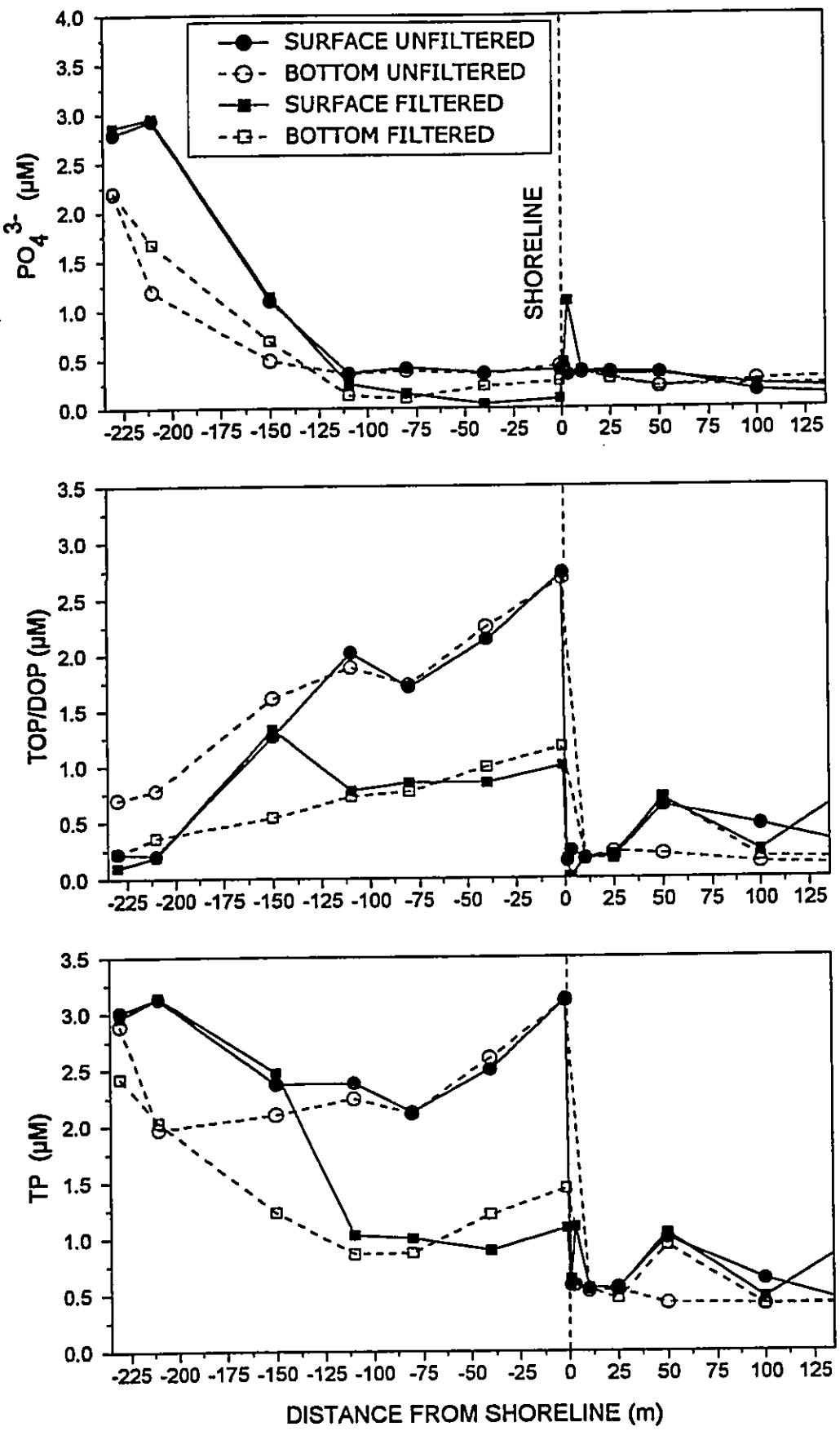


FIGURE 8. Plots of water chemistry constituents in surface (S) and bottom (B) samples collected in Aimakapa Pond and offshore ocean on December 19, 2001 (1000-1100) as a function of distance from the ocean shoreline. Positive distances are distances from the shoreline into the ocean, negative distances are distances from the shoreline into the ponds. Sample splits were filtered immediately after collection. For transect locations, see Figure 1.

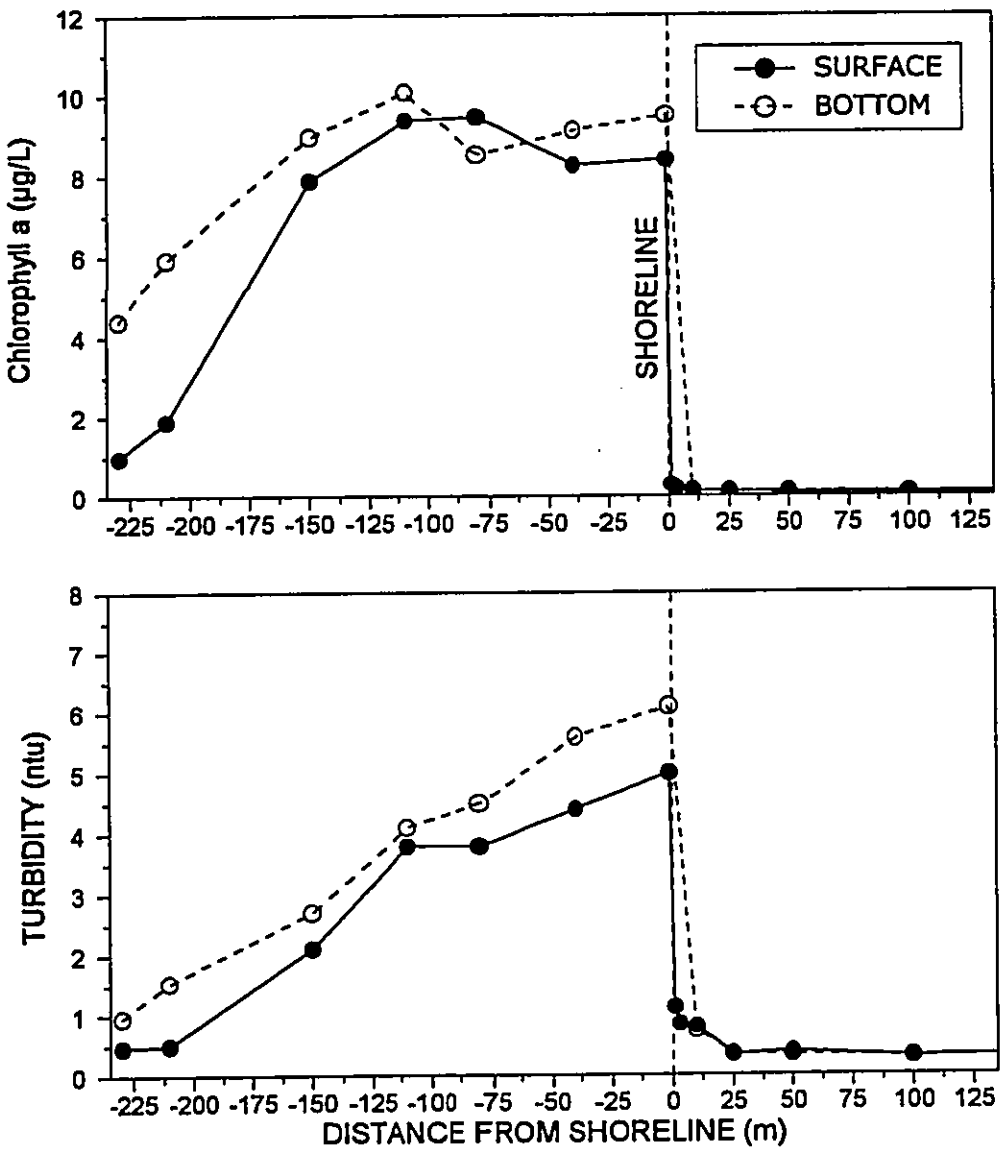
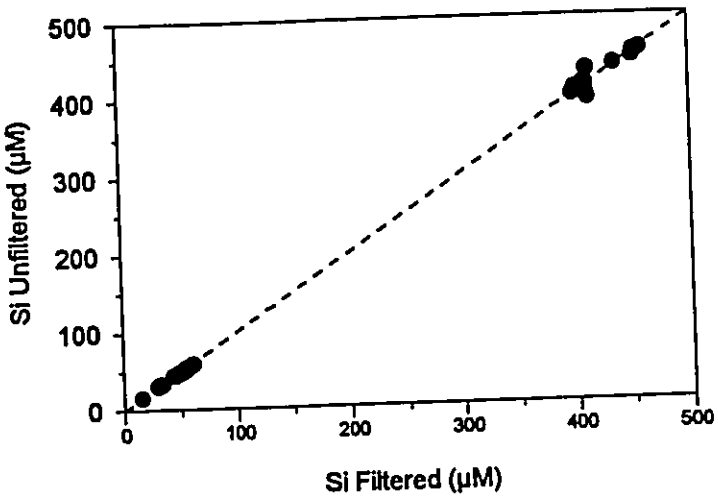
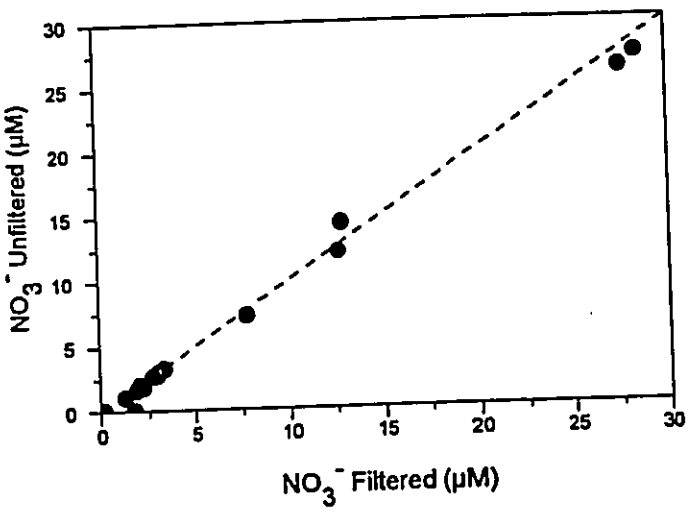
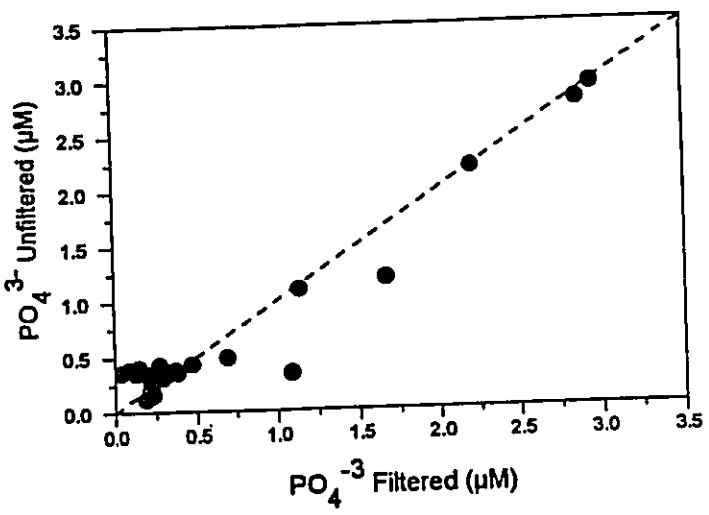
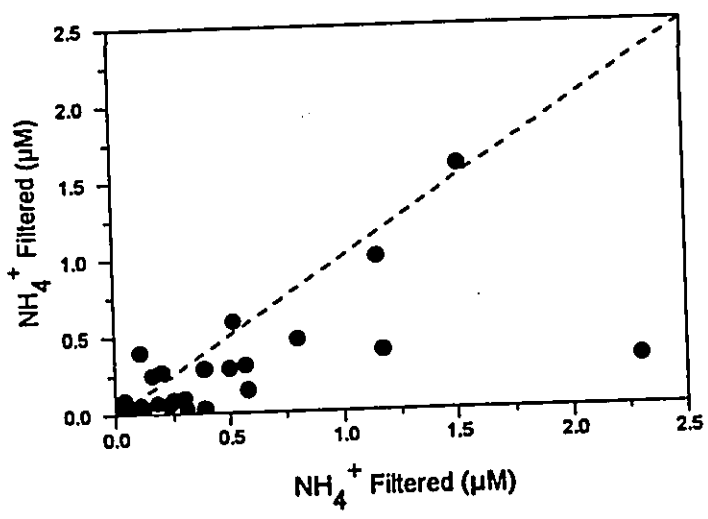


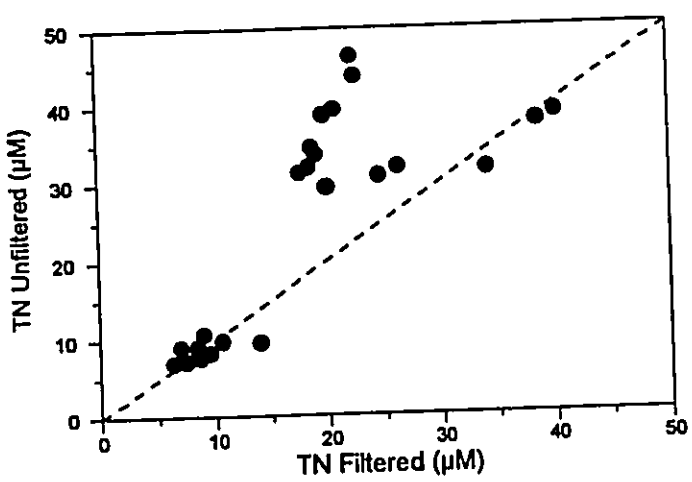
FIGURE 9. Plots of water chemistry constituents in surface (S) and bottom (B) samples collected in Aimakapa Pond and offshore ocean on December 19, 2001 (1000-1100) as a function of distance from the ocean shoreline. Positive distances are distances from the shoreline into the ocean, negative distances are distances from the shoreline into the ponds. Sample splits were filtered immediately after collection. For transect locations, see Figure 1.











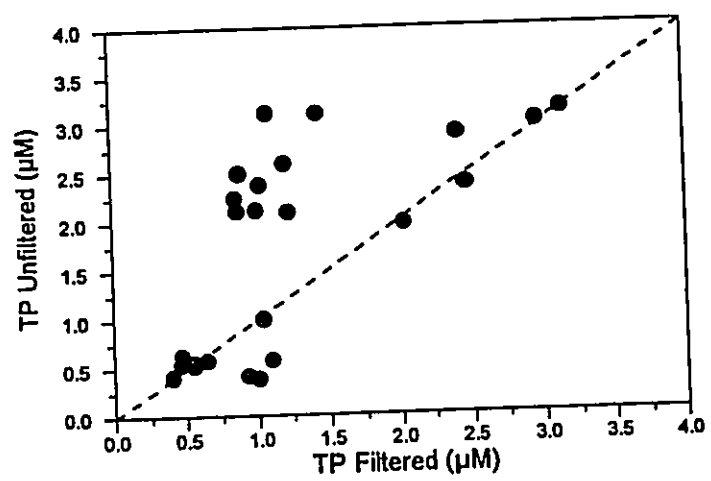


FIGURE 10. Plots of filtered vs. unfiltered nutrients from sample splits collected in Aimakapa Pond and the offshore marine environment collected on December 19, 2001. Dashed line in each plot represents a perfect 1:1 relationship. Data points falling below the dashed line indicate higher concentration in filtered sample split; data points above the dashed line indicate higher concentration in unfiltered sample split.

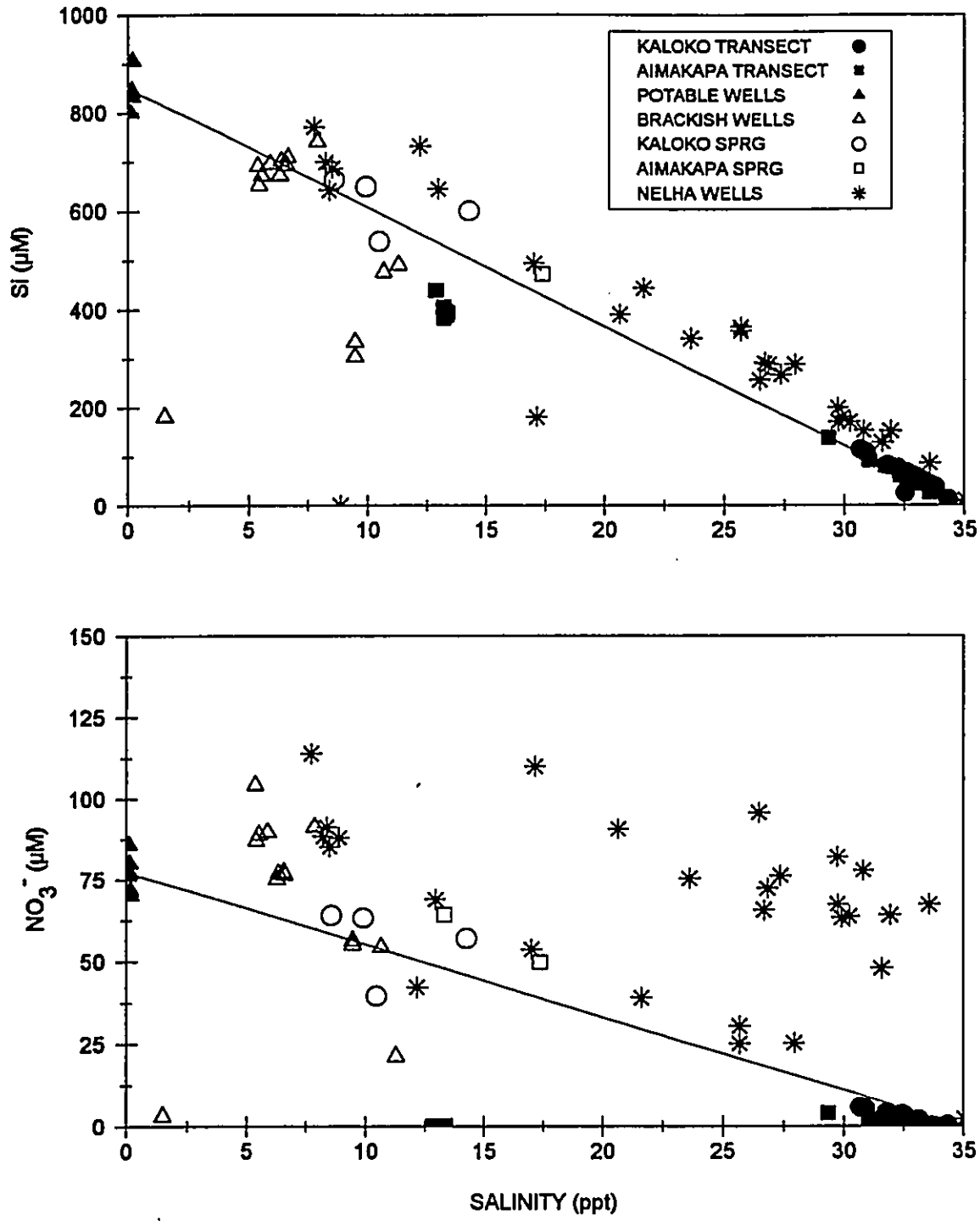
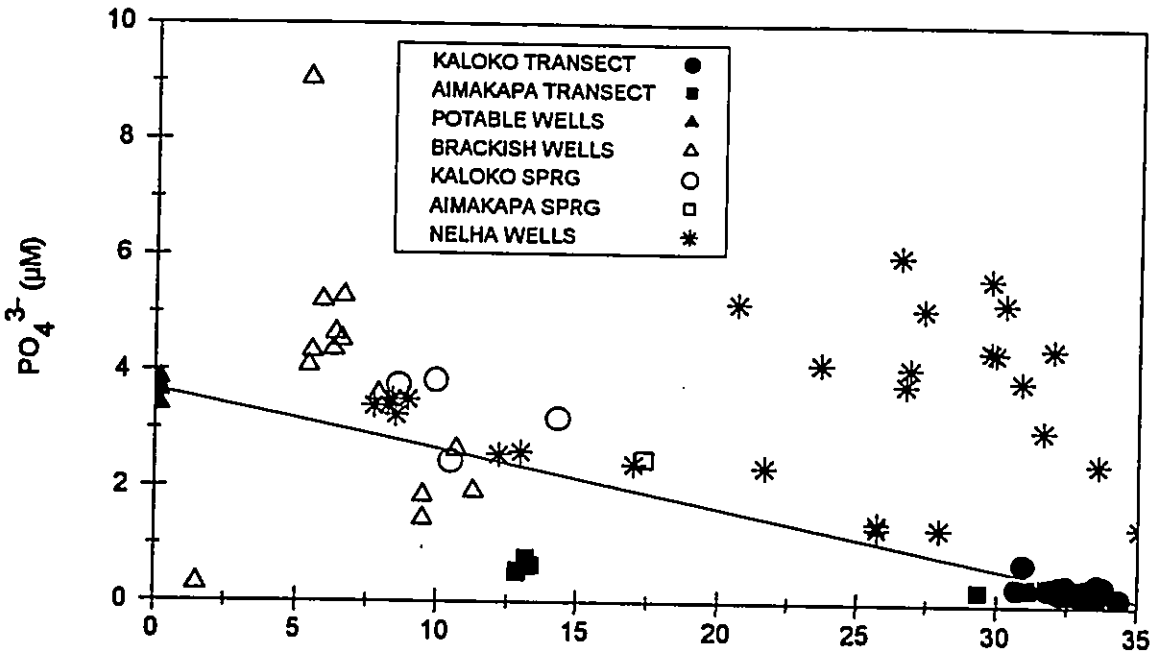


FIGURE 11. Plots of silica and nitrate as functions of salinity measured in water samples collected on transects through Kaloko and Aimakapa ponds, and springs near the ponds during May-June 2000. Also shown are data from potable wells upslope of the Kaloko-Honokohau region, brackish monitoring wells near Kaloko and Aimakapa ponds, and monitoring wells at NELHA. The solid line is the conservative mixing line connecting endpoint concentrations in open ocean water and high level (potable) groundwater.



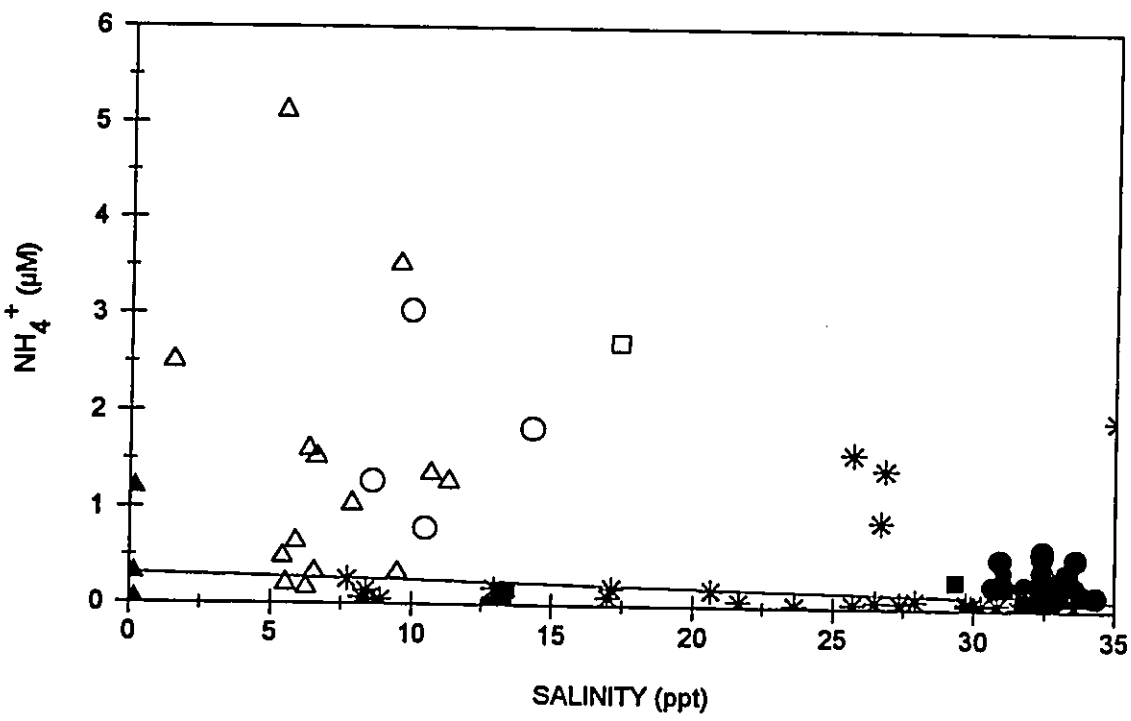


FIGURE 12. Plots of phosphate and ammonium as functions of salinity measured in water samples collected on transects through Kaloko and Aimakapa ponds and the offshore ocean, and springs near the ponds during May-June 2000. Also shown are data from potable wells upslope of the Kaloko-Honokohau region, brackish monitoring wells near Kaloko and Aimakapa ponds, and monitoring wells at NELHA. The solid line is the conservative mixing line connecting endpoint concentrations in open ocean water and high level (potable) groundwater.

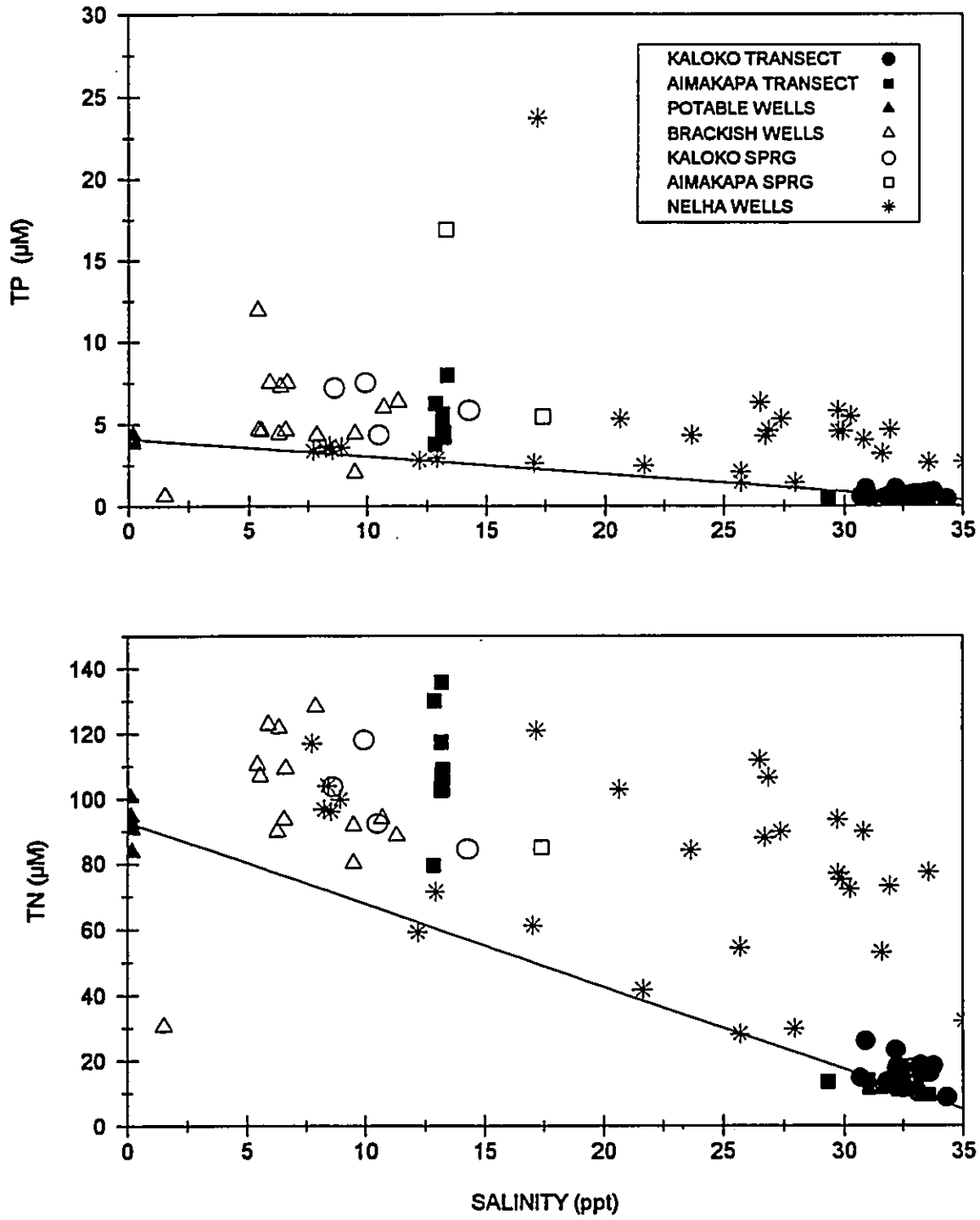


FIGURE 13. Plots of total phosphorus (TP) and total nitrogen (TN) as functions of salinity measured in water samples collected on transects through Kaloko and Aimakapa ponds and the offshore and springs near the ponds during May-June 2000. Also shown are data from potable wells of the Kaloko-Honokohau region, brackish monitoring wells near Kaloko and Aimakapa pond and monitoring wells at NELHA. The solid line is the conservative mixing line connecting end concentrations in open ocean water and high level (potable) groundwater.

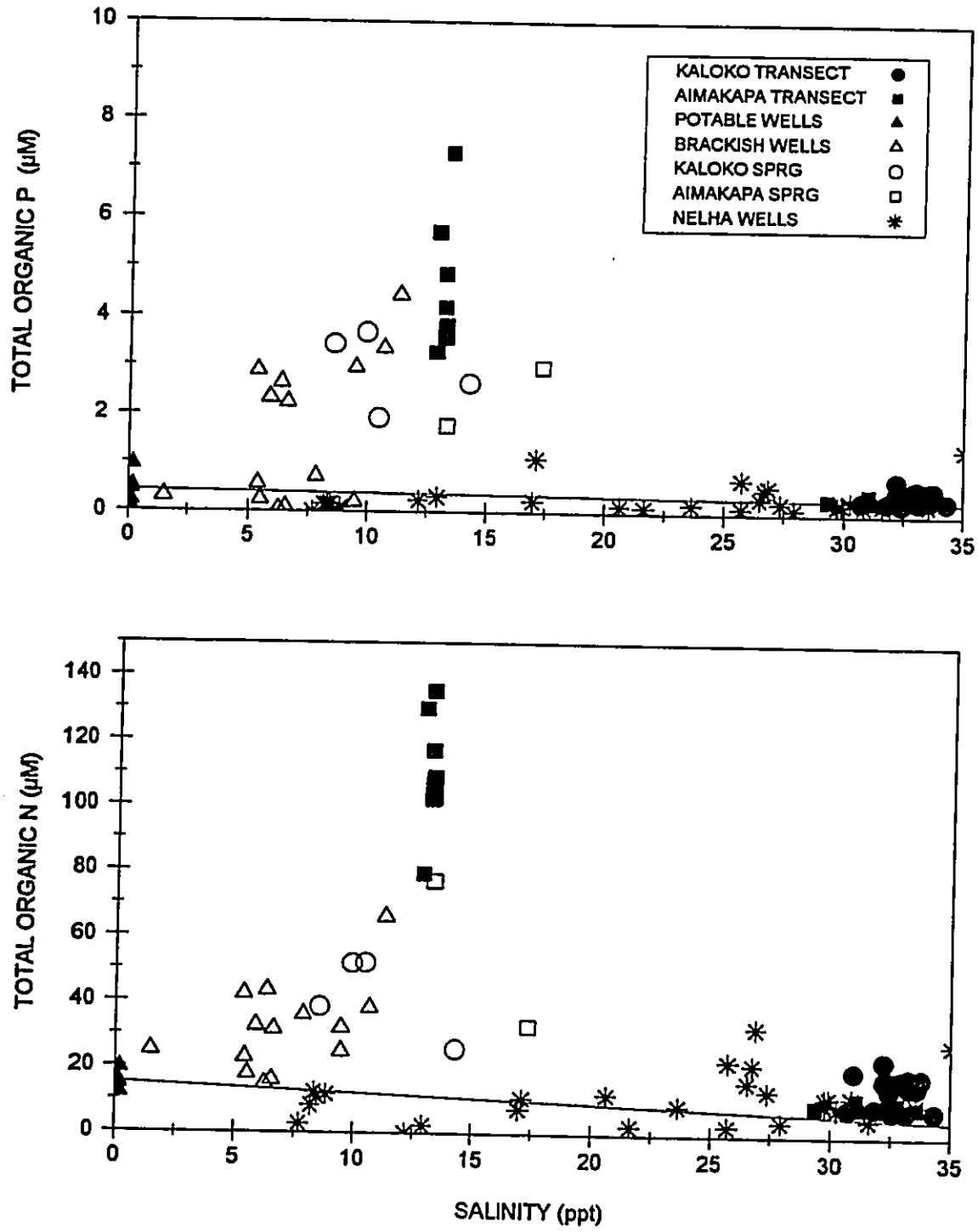
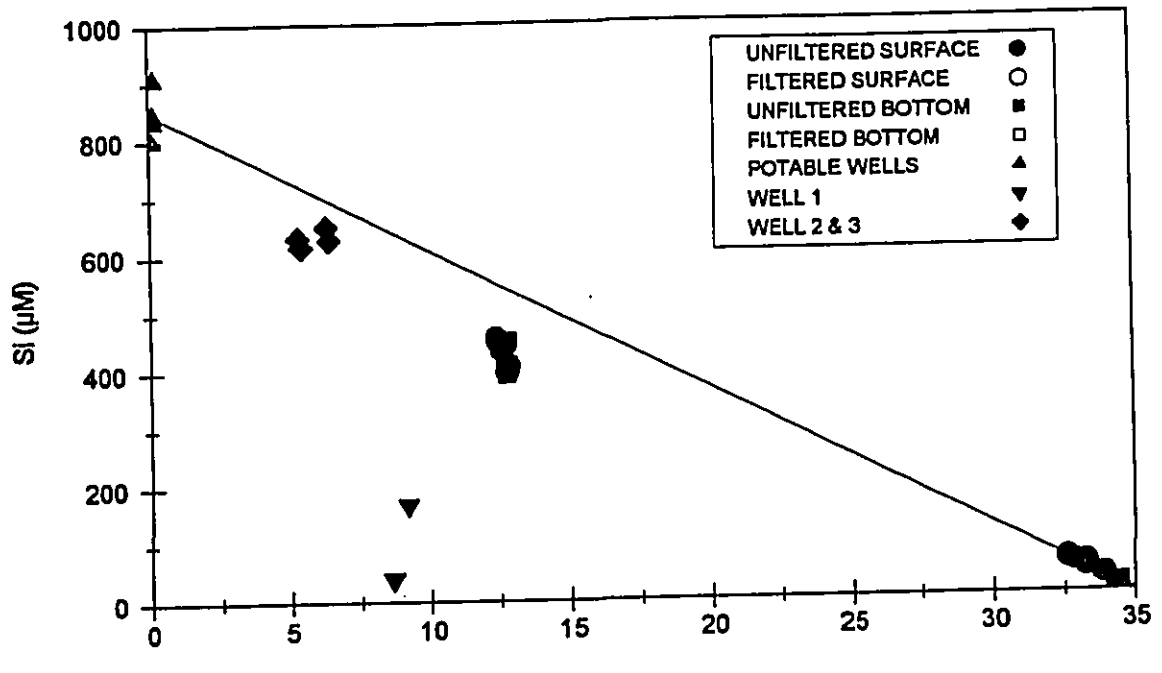


FIGURE 14. Plots of phosphate and ammonium as functions of salinity measured in water samples collected on transects through Kaloko and Aimakapa ponds and the offshore ocean, and springs near the ponds during May-June 2000. Also shown are data from potable wells upslope of the Kaloko-Honokohau region, brackish monitoring wells near Kaloko and Aimakapa ponds, and monitoring wells at NELHA. The solid line is the conservative mixing line connecting endpoint concentrations in open ocean water and high level (potable) groundwater.



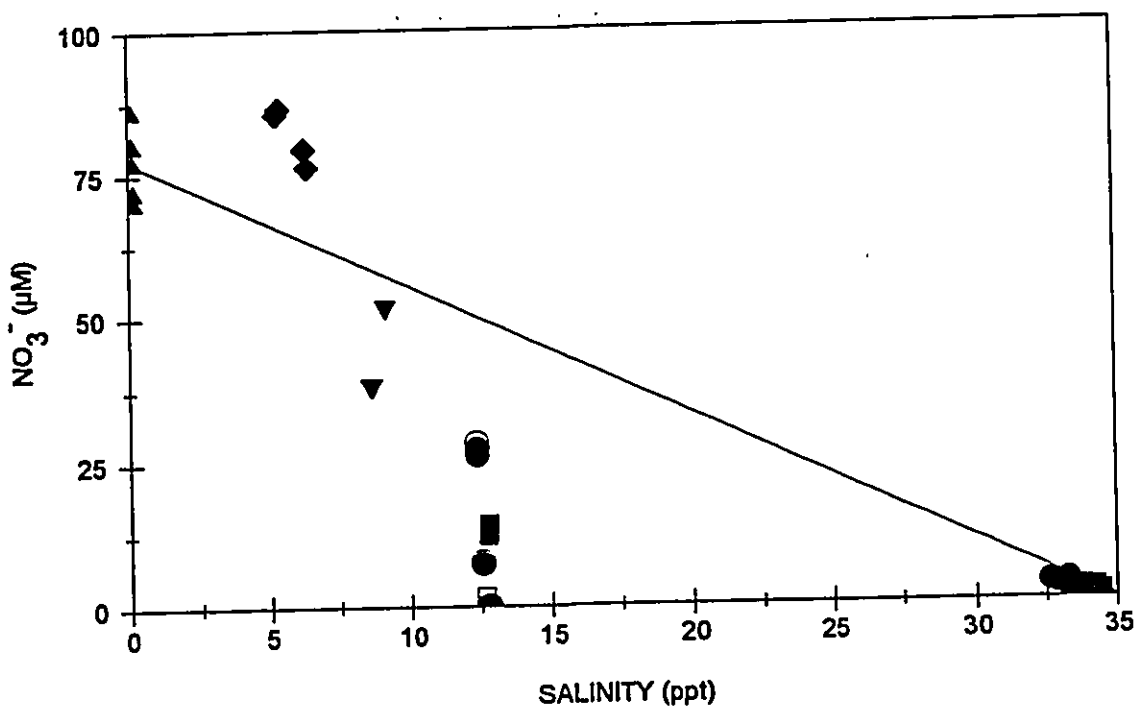


FIGURE 15. Plots of silica and nitrate as functions of salinity measured in water samples collected on a transect through Aimakapa pond in December 2001. Also shown are data from potable wells upslope of the Kaloko-Honokohau region, and three brackish monitoring wells near Kaloko and Aimakapa ponds (Well 1 is directly mauka of Aimakapa Pond). The solid line is the conservative mixing line connecting endpoint concentrations in open ocean water and high level (potable) groundwater.

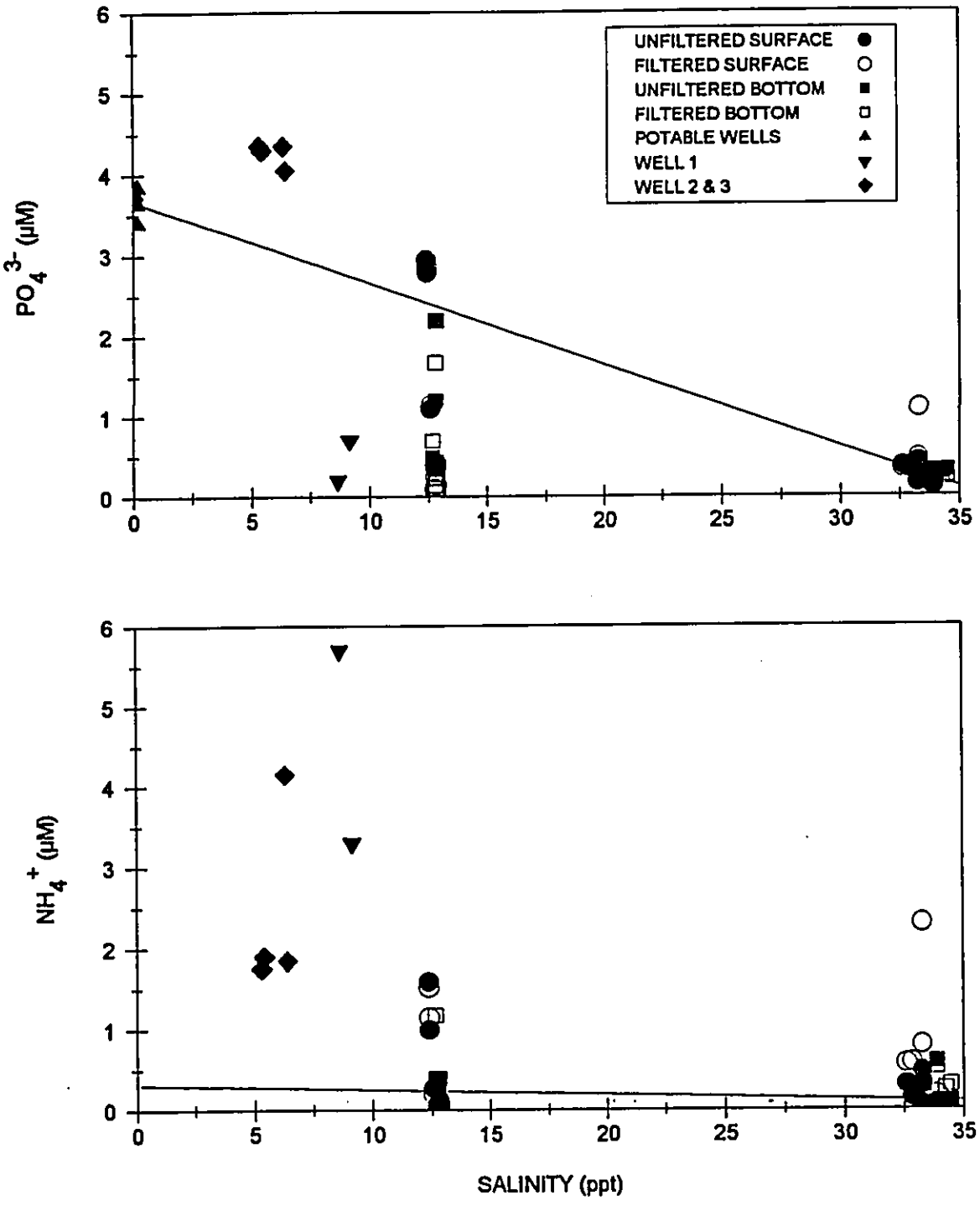
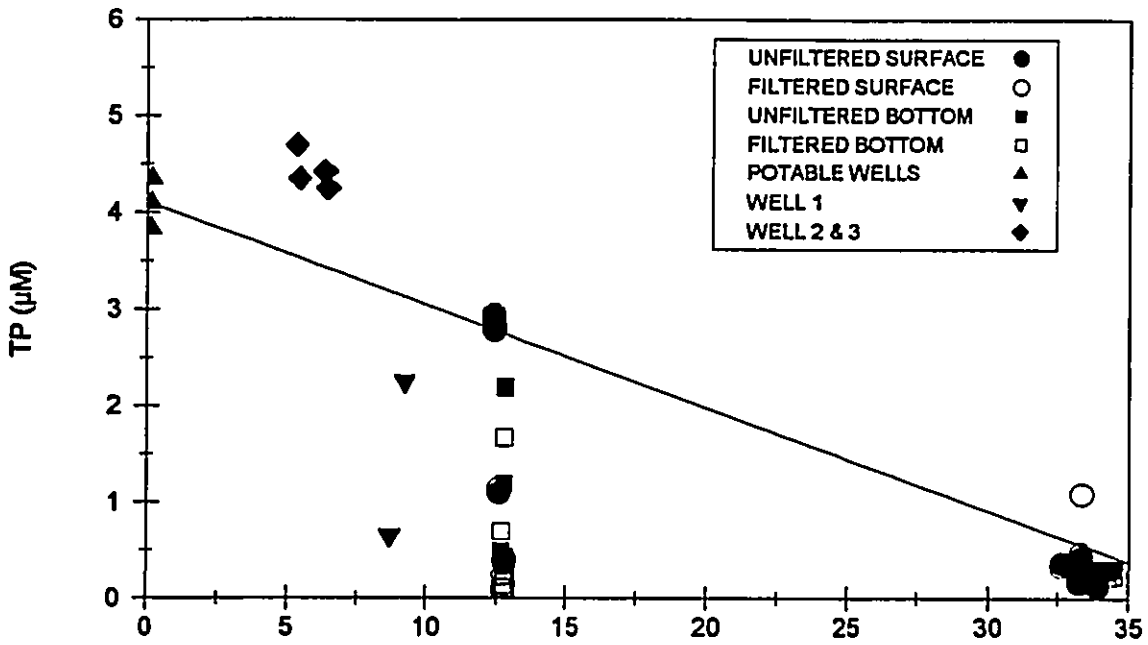


FIGURE 16. Plots of phosphate and ammonium as functions of salinity measured in water samples collected on a transect through Aimakapa pond in December 2001. Also shown are data from potable wells upslope of the Kaloko-Honokohau region, and three brackish monitoring wells near Kaloko and Aimakapa ponds (Well 1 is directly mauka of Aimakapa Pond). The solid line is the conservative mixing line connecting endpoint concentrations in open ocean water and high level (potable) groundwater.



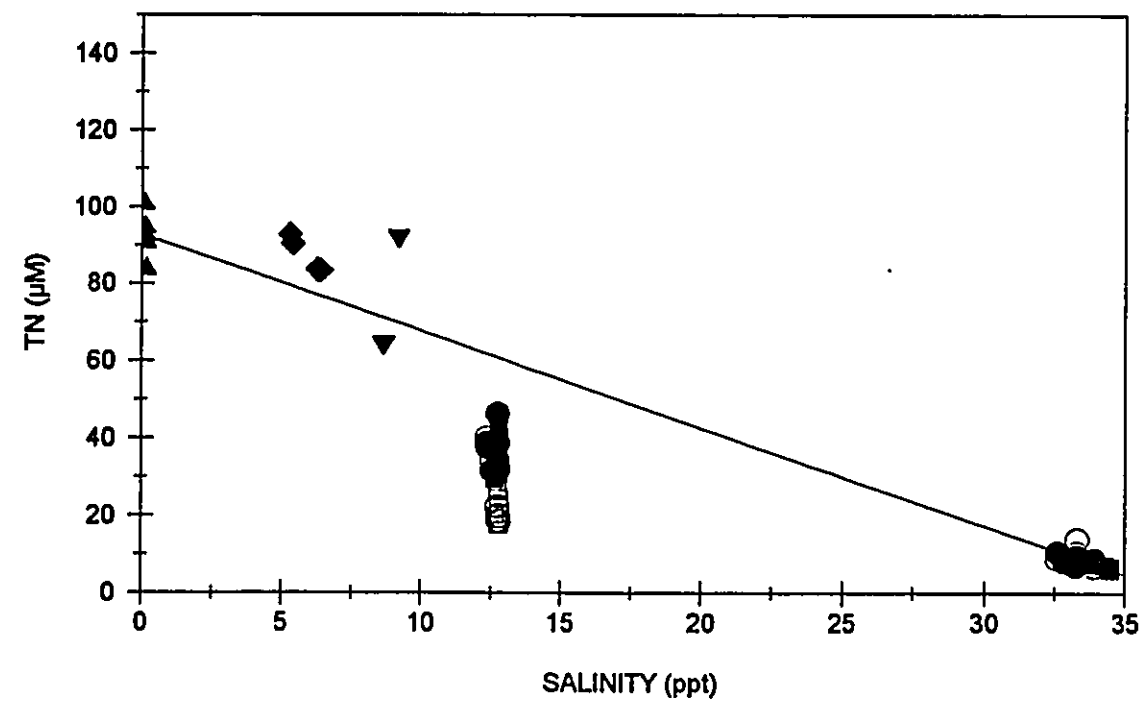


FIGURE 17. Plots of total phosphorus and total nitrogen as functions of salinity measured in water samples coll on a transect through Aimakapa pond in December 2001. Also shown are data from potable wells upslope of the Kaloko-Honokohau region, and three brackish monitoring wells near Kaloko and Aimakapa ponds (Well 1 is directly mauka of Aimakapa Pond). The solid line is the conservative mixing line connecting endpoint concentrations in open ocean water and high level (potable) groundwater.

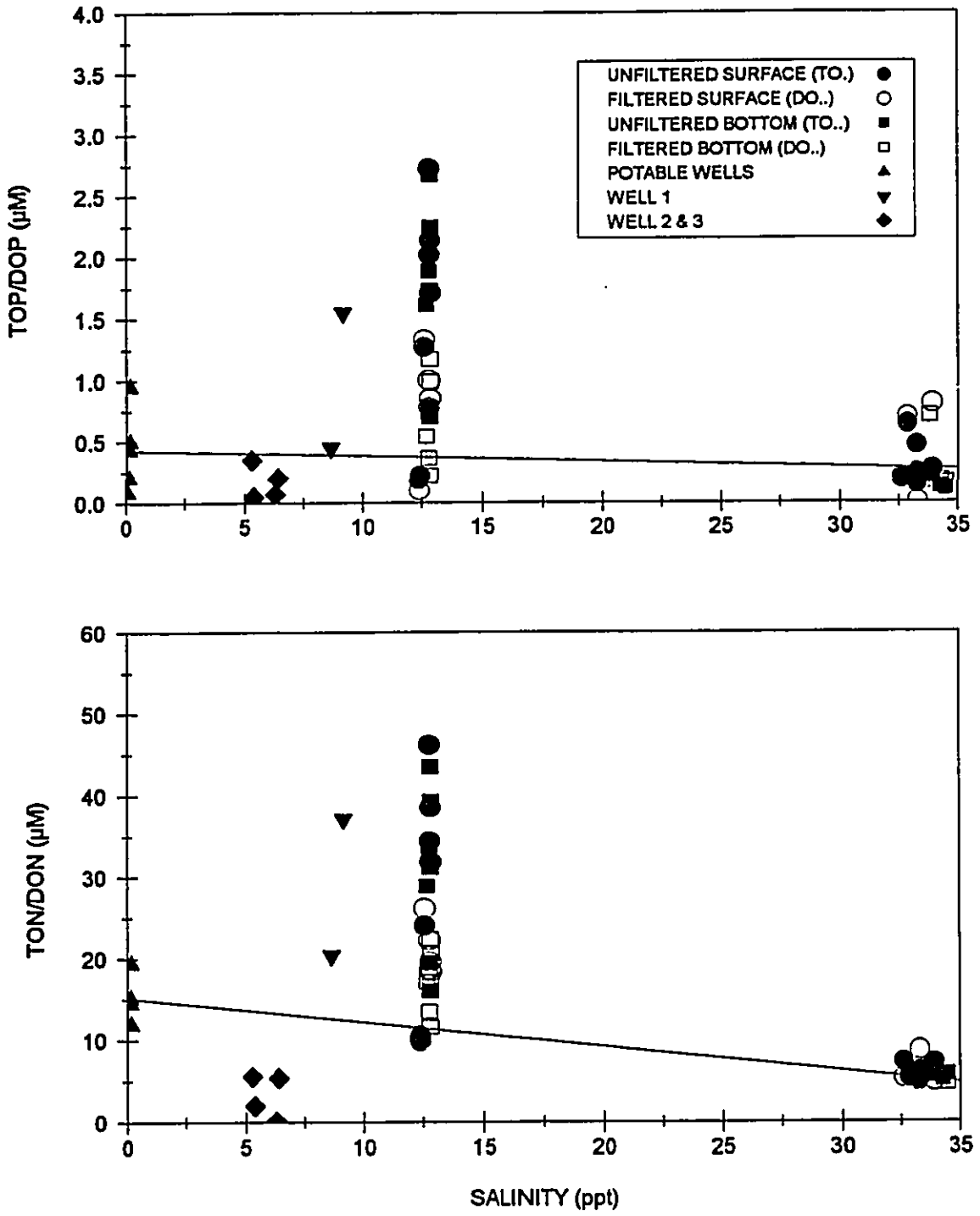


FIGURE 18. Plots of total organic phosphorus (TOP) and total organic nitrogen (TON) , and dissolved organic phosphorus (DOP) and dissolved organic nitrogen (DON) as functions of salinity measured in water samples collected on a transect through Aimakapa pond in December 2001. Also shown are data from potable wells upslope of the Kaloko-Honokohau region, and three brackish monitoring wells near Kaloko and Aimakapa ponds (Well 1 is directly mauka of Aimakapa Pond). The solid line is the conservative mixing line connecting endpoint concentrations in open ocean water and high level (potable) groundwater.

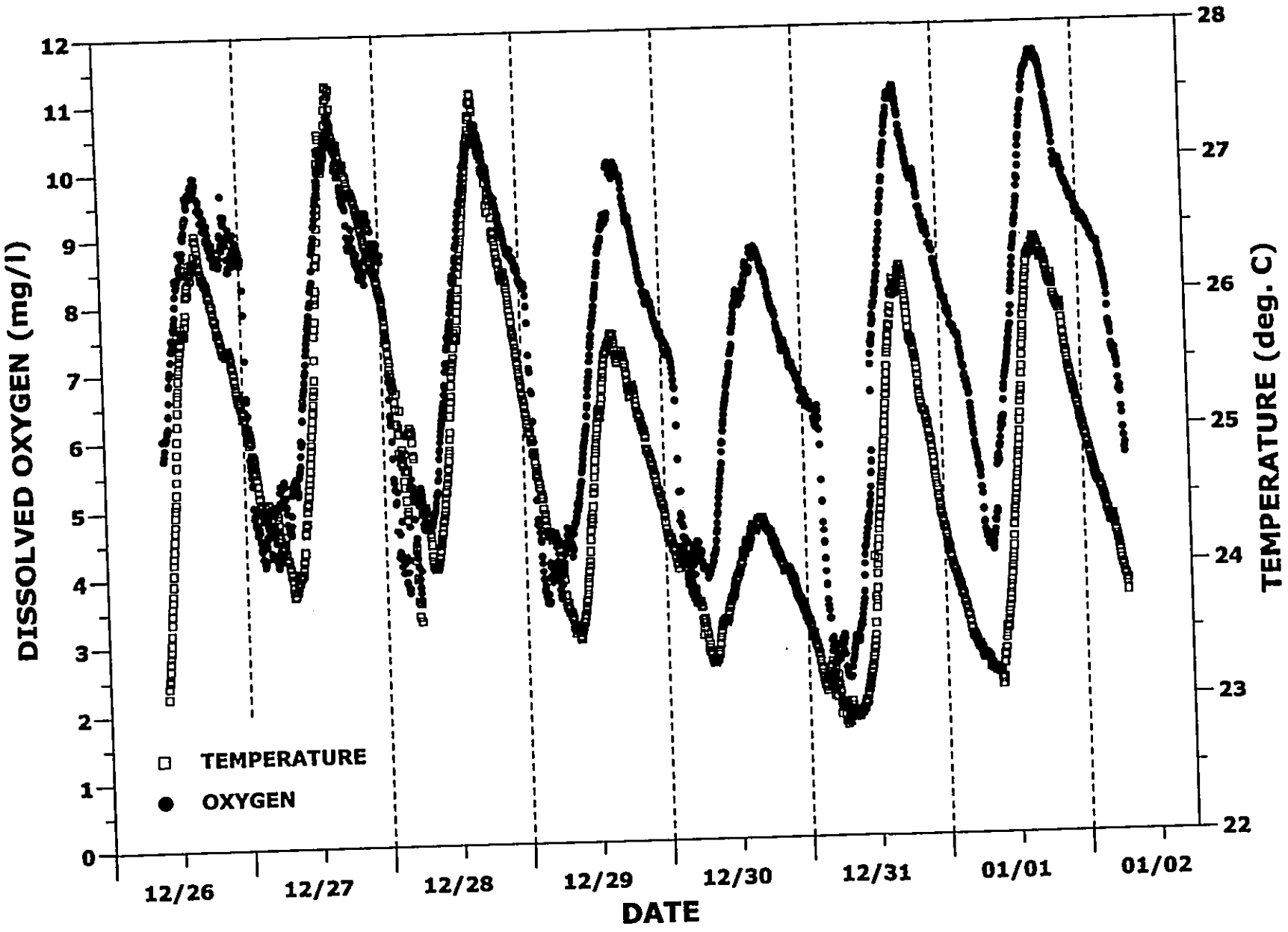


FIGURE 19. Plots of continuous recording of dissolved oxygen and temperature in Aimakapa Pond from December 26, 2001 to January 2, 2002. Data was recorded at 5-minute intervals over the 7-day deployment. Dashed lines represent midnight.

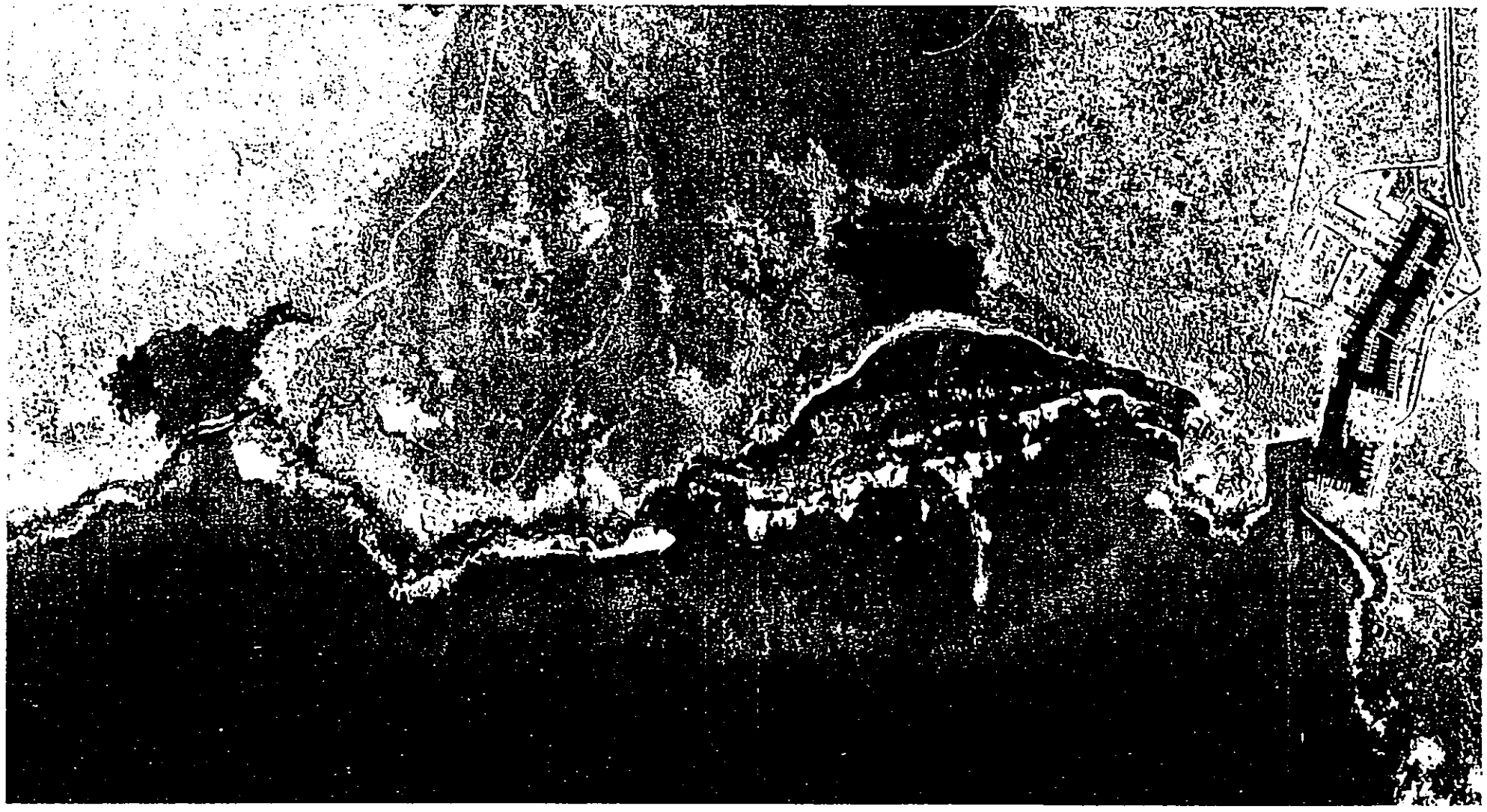
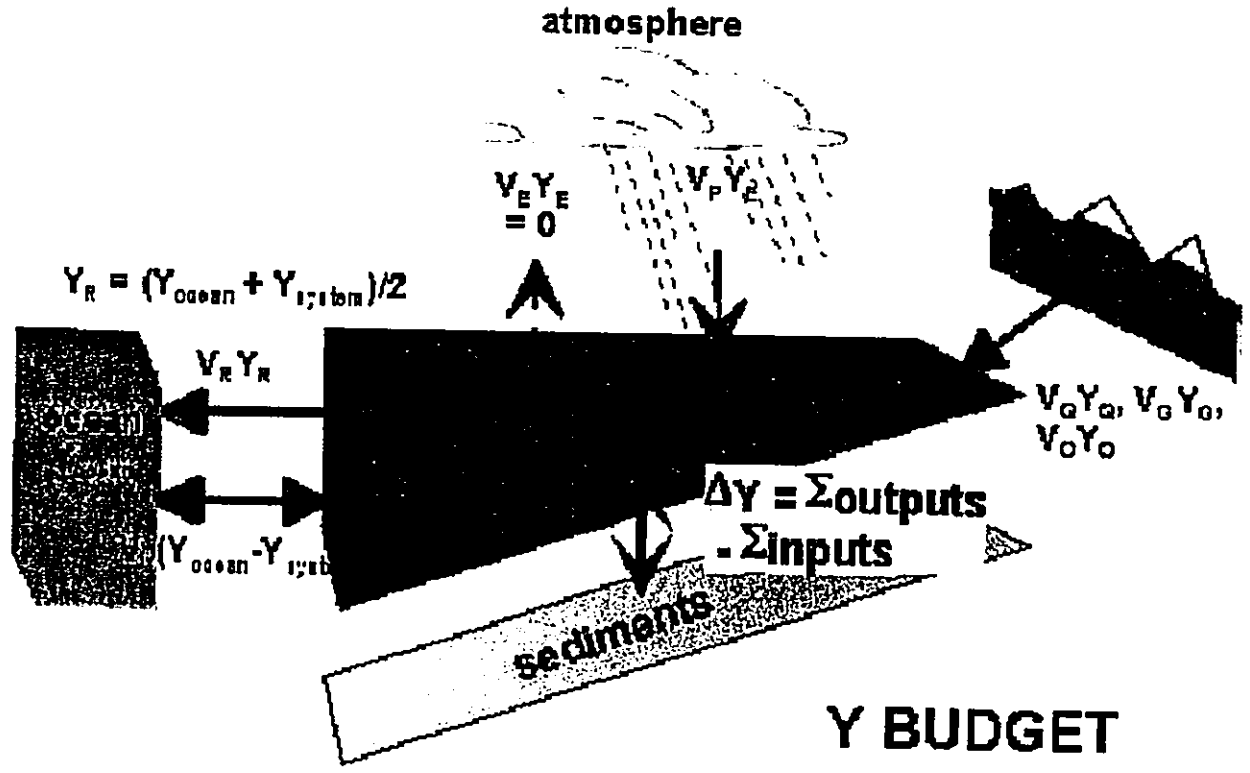


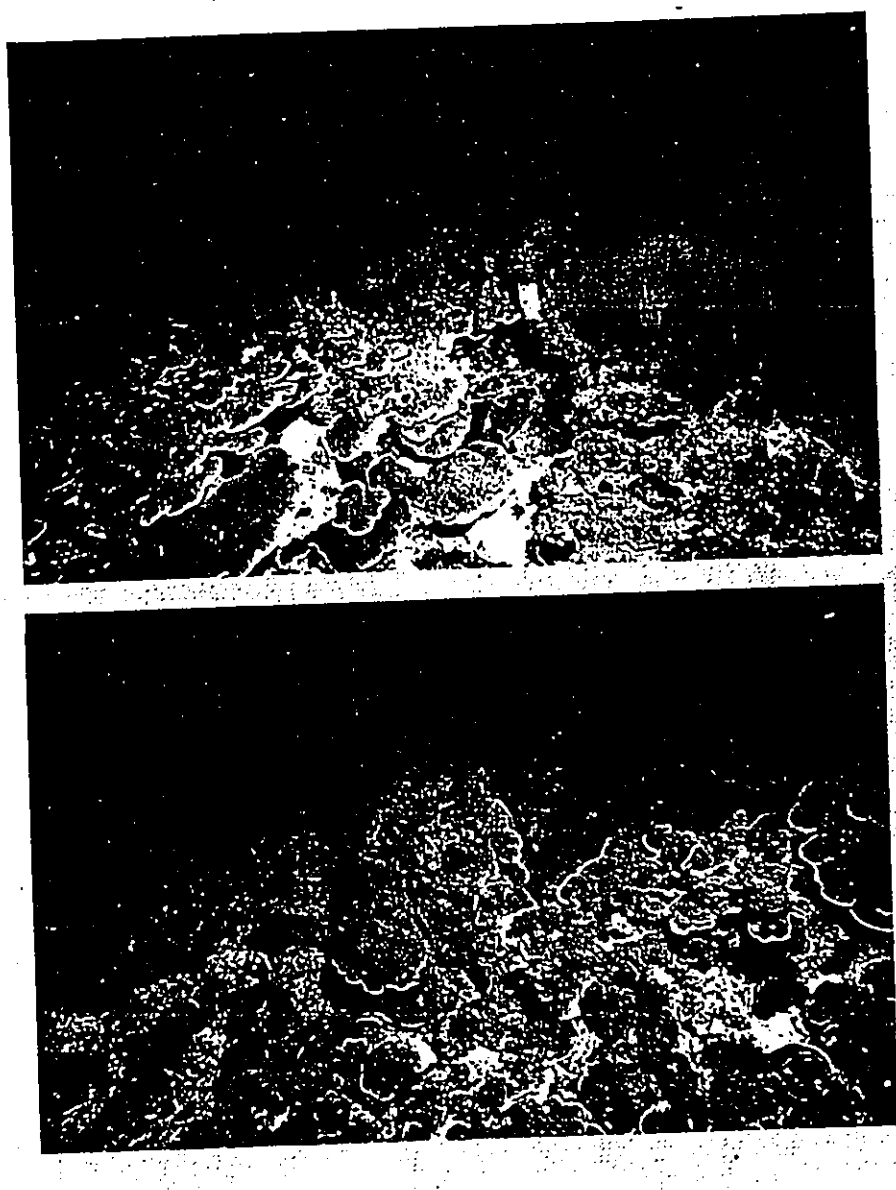
FIGURE 20. High altitude aerial photograph taken in 1993 of Kaloko-Honokohau area showing Kaloko Pond (left), Aimakapa Pond (denter) and Honokohau Harbor (right). The shallow reef platform fronting Aimakapa Pond focuses wave energy to a greater extent than any other area along the shoreline.

➢Calculate non-conservative nutrient fluxes



$$d(VY)/dt = V_Q Y_Q + V_G Y_G + V_O Y_O + V_P Y_P + V_E Y_E + V_R Y_R + V_X(Y_{ocn} - Y_{syst}) + \Delta Y$$

FIGURE 21. Box model for a one-compartment system such as an anchialine pond between land coastal ocean showing various sources and sinks for non-conservative nutrient fluxes. Of particular importance in the case of Aimakapa Pond is the exchange between the pond sediments and water column (red double-headed arrow)



Sewage discharge on coral reefs: not always pollution

Most of the literature describing negative impacts of sewage discharge on coral reefs is limited to studies of lagoons or embayments – environments with relatively long residence times that can result in buildup of nutrients and sediments to detrimental levels (Johannes 1975; Pastorok and Bilyard 1985; Smith et al. 1981). In open coastal areas, however, discharge of treated sewage effluent may have no negative effect on coral community structure and may in fact enhance coral growth by providing nutrient subsidies and additional surface area that is suitable for settlement and growth. The photographs at the reef site show two of difusser ports of the Tanguisson sewage outfall located in the Philippine Sea off the west coast of the island of Guam. The outfall, which discharges 2 million gallons per day of primary treated domestic effluent, is made up of 17 elevated diffuser ports, separated by about 10 m, aligned parallel to shore at a depth of about 20 m. Coral colonies, predominantly of the species *Porites rus*, have covered the discharge ports and adjacent reef areas that were excavated for placement of the diffuser pipe in the 10 years since the outfall was constructed. Effective engineering design of diffusers, which maximizes dilution and dispersion of treated plumes, and placement of outfalls in open coastal areas with high rates of water exchange appear to be important factors in preventing negative impacts on coral reef communities.

References

Johannes RE (1975) Pollution and degradation of coral reef communities. In: Ferguson Wood EJ, Johannes RE (eds), *Tropical marine pollution*. Elsevier, Amsterdam, pp 13-50

Pastorok RA, Bilyard GR (1985) Effects of sewage pollution on coral-reef communities. Mar Ecol Prog Ser 21:175-189

Smith SV, Kimmerer WJ, Laws EA, Brock RE, Walsh TW, Kaneohe Bay sewage diversion experiment: perspectives on ecosystem responses to nutritional perturbations. Pac Sci 35:279-402

S. Dollar, School of Ocean and Earth Science and Technology, University of Hawaii, Honolulu, HI 96822, USA

Reef sites

FIGURE 22.

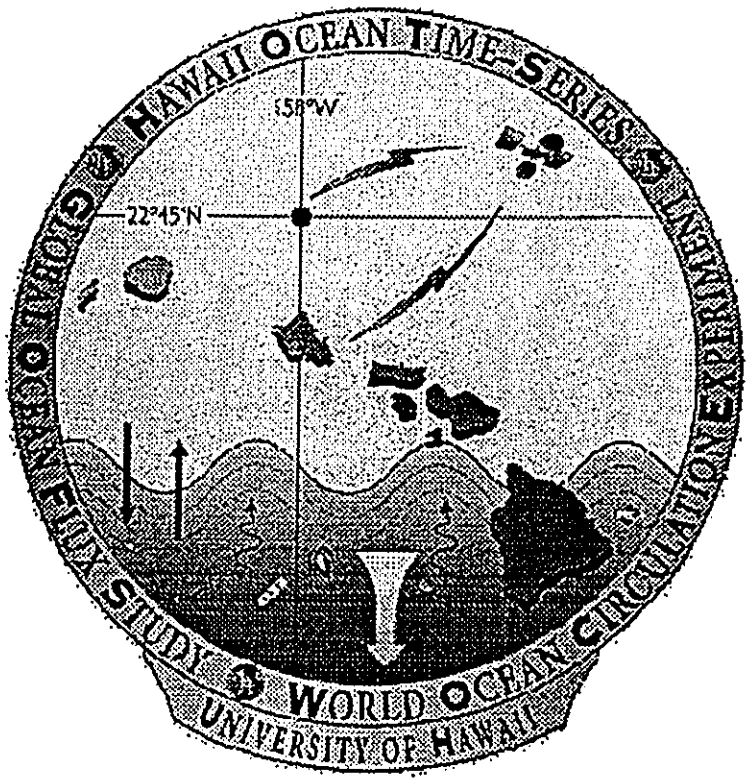
Figure 23. Views of two Loko Pu'oune type of fishponds (brackish fishponds separated from the ocean by a sand berm similar to Aimakapa) in West Hawaii. Top photo shows fishpond at Hualalai Resort; bottom photo shows Ku'uali'i Fishpond at Anaehoomalu Bay at the Waikoloa Resort. Both ponds are surrounded by development including golf courses, hotels, condominiums and landscaped grounds which contribute to the nutrient concentrations of groundwater that enters the ponds. Both ponds have high standing crops of fish, as well as deep sediment layers, and

Figure 24. Views of Wai'kauhi fishpond at Hualalai Resort in North Kona Hawaii. Wai'kauhi fishpond is a Loko Pu'oune separated from the ocean by an unbreached sand berm similar to Aimakapa Pond. Salinity of Wai'kauhi Pond ranges from about 3-7‰ indicating that it is composed primarily of groundwater rather than ocean water. The standing crops of fish are plentiful in the pond, and it is frequented by numerous species of birds. The pond is surrounded by resort development including golf courses, hotels, condominiums and landscaped grounds that contribute to the nutrient concentrations of groundwater entering the pond. The pond has a deep sediment layer and shows no indications of degraded conditions. Photographs taken on October 21, 2001.

APPENDIX A.

Field and Laboratory Protocols

Global Ocean Flux Study-World Ocean Circulation Experiment
Hawaii Ocean Time Series Program



Hawaii Ocean Time-series Program

What's New (and Updated)

Overview

- Introduction
  - Ancillary Projects Supported by HOT
  - HOT Core Projects
  - Locations of the HOT Water Column and Bottom Stations
  - Parameters Measured
- Cruise Schedules & Reports
- Principal Investigators & Staff
  - Past Cruise Participants
- HALE-ALOHA - physical/biogeochemical Mooring

Field & Laboratory Protocols

NITRATE, NITRITE and DISSOLVED ORGANIC NITROGEN

SUMMARY: Seawater is collected from known depths using CTD-rosette sampling protocols. Subsamples are carefully drawn and stored in acid-washed polyethylene bottles. Nitrate/nitrite is measured with an azo dye either before (nitrite) or after (nitrite plus nitrate) subsamples are passed through a cadmium reduction column. Dissolved organic nitrogen is determined after quantitative conversion to inorganic N by exposure to UV radiation.

1. Principle

In seawater the forms of dissolved nitrogen of greatest interest are, in order of decreasing oxidation state: nitrate, nitrite, ammonium and organic nitrogen. All these forms of nitrogen, as well as nitrogen gas (N2), are biochemically interconvertible and are components of the biological nitrogen cycle.

In this method nitrate is quantitatively reduced to nitrite in a copperized cadmium reduction column. The nitrite thus produced, along with any nitrite present in the original sample, is coupled with an aromatic amine, which in turn is reacted with a second aromatic amine to produce an azo dye. The extinction due to the dye is then read spectrophotometrically. A second subsample is analyzed without prior reduction in order to determine the nitrite level. Nitrate is calculated by difference between the [nitrate+nitrite] and nitrite concentrations, using standard solutions. For surface water samples (<100 m) where the [nitrate+nitrite] concentration is generally <0.05 uM, we have employed a low-level assay procedure which is based on the production and detection of nitrous oxides.

Total dissolved nitrogen (TDN) is determined by UV oxidation of the sample and subsequent analysis for dissolved inorganic nitrogen (DIN = nitrite + nitrate + ammonia). Dissolved organic nitrogen (DON) is computed from the relationship DON = TDN - DIN, where TDN is total dissolved nitrogen after UV oxidation and DIN is the sum of the dissolved inorganic nitrogen species before UV oxidation. As an alternative to the UV oxidation method, Walsh (1989) has described a high-temperature (1100oC) combustion method which has been applied to open ocean samples collected in the North Pacific Ocean. No significant differences were observed between these two procedures (Walsh, 1989).

2. Precautions

Contamination is the primary concern with these samples. This is particularly true with samples collected from the euphotic zone, where inorganic nutrient concentrations are extremely low (<0.2 uM). In order to avoid contamination, sample bottles must be meticulously cleaned with dilute HCl and rinsed with deionized distilled water (DDW) before use. Samples are stored frozen until analysis, generally within 1-2 weeks of sample collection.

3. Sampling Collection and Storage

NOTE: The currently held "dogma" in the oceanographic literature is that seawater samples must be processed fresh and on board ship for high-precision, low-level inorganic nutrient analyses (Morse et al., 1982; Venrick and Hayward, 1985). However, extensive results from automated analyses of nutrients in tropical seawaters (Ryle et al., 1981) and the VERTEX program (D. Karl and S. Moore, unpubl. results) which included direct comparisons of [NO3+NO2], PO4 and SiO2 determinations in fresh vs. frozen samples would suggest otherwise. Provided that caution is taken to collect and store the samples in an environment free of potential contamination, we found no significant treatment effect. A similar conclusion was presented by Walsh et al. (manuscript) following the analysis of a wide range of seawater samples that were either analyzed fresh or frozen and stored for varying periods of time. They conclude that, "Despite published and voiced opinions to the contrary, there appears to be no adequate basis either from the literature or from our experiments for across-the-board dismissal of high-precision nutrient analyses undertaken on properly stored seawater samples." As we are not able to take our autoanalyzer to sea on the HOT program cruises, we have focussed our attention on maintaining a contamination-free environment during collection and storage of nutrient samples.

3.1. Sample collection

3.1.1. Rinse the nutrient sample bottle (acid-washed, 125 ml polyethylene bottle) 3 times before filling. Fill to approximately 2/3 full, tighten cap and freeze.

3.1.2. Record cruise, cast and Niskin bottle number on the bottle and data sheet.

4. Sample Analysis

4.1. Standard procedure

Currently, GOFS and WOCE nutrients collected during the Hawaii Ocean Time Series cruises are analyzed by the Hawaii Institute of Marine Biology Analytical Facility. Mr. Ted Walsh has provided us with the following procedure for the analysis of dissolved N.

4.1.1. Nitrate (NO3-) plus Nitrite (NO2-)

[NO3-+NO2-] analyses are performed on a four-channel Technicon Autoanalyzer IIR continuous flow system. The automated wet chemistries generally follow the standard methods of seawater analysis as given by Technicon (1977), which involve: (1) reduction of nitrate to nitrite using a copperized cadmium reduction column, (2) reaction of nitrite with sulfanilamide for diazotization and (3) coupling with N-1-napthylethylenediamine dihydrochloride (NED) forming a purple azo dye (Armstrong et al., 1967). The dye absorbance is read through a 15 mm pathlength flowcell at 550 nm. The reduction column is looped in line using a Hamilton 4-way valve and can be by-passed for nitrite analysis only. Both nitrate and nitrite standards are run to check column efficiency. If speciation is desired, nitrite is determined separately by omitting the reduction step. Nitrate is calculated by difference.

4.1.2. Dissolved Organic Nitrogen (DON)

The method for DON involves initial UV digestion of a seawater sample followed by autoanalysis of the digestion products for

[nitrate+nitrite], as above, and ammonium using the Berthelot (indophenol) method. The modified photooxidation technique (Armstrong et al., 1966) utilizes a 24 hour irradiation. Details are given in Walsh (1989). Periodic calibration checks of the UV lamp efficiency are made using a dissolved organic nitrogen (2,2-bypyridyl) standard. As a general rule, the UV lamp is replaced after approximately 700-800 hr of use. DON is calculated by difference between the sum of [nitrate+ nitrite+ammonium] before and after UV treatment.

4.2. Low-level procedures for nitrate (NO3-) and nitrite (NO2-) by chemiluminescence

Nanomolar quantitites of nitrate and nitrite are routinely analyzed using the chemiluminescence techniques of Cox (1980) and Garside (1982). This technique relies on the wet chemical reduction of nitrate and nitrite to nitric oxide in a highly acidic solution of sulfuric acid, ferrous ammonium sulfate, and ammonium molybdate. The reduced nitric oxide is carried by an inert carrier gas (argon), scrubbed of acid and water vapors in a cold finger filled with 6 M sodium hydroxide solution followed by an anhydrous sodium carbonate filled drying tube. The gas stream is then routed through a membrane dryer and the nitric oxide is combined with ozone and simultaneously exposed to a photomultiplier tube. The nitric oxide is further oxidized to excited nitrogen dioxide emitting a photon as it returns to ground state, and the emitted light is detected by the photomultiplier.

4.2.1. [NO3-+ NO2-] determinations

[NO3-+ NO2-] analyses are performed on an Antek model 720 nitrogen oxide analyzer. Ten ml of concentrated sulfuric acid (36 N) plus 2 ml each of ferrous ammonium sulfate (4%, w/v) followed by ammonium molybdate (2%, w/v) are dispensed into the reaction tube. The reaction tube is inserted into the carrier gas line and the reagents degassed. A 10 ml water sample or standard solution is introduced into the reaction tube with a syringe through a septum fitted to the side arm of the reaction tube. Total reaction light emission is recorded using an automated integrator.

4.2.2. NO3- determinations

Sample analysis is conducted, as above (Chapter 7, section 4.2.1), except that the sample (10 ml) is pretreated with 0.2 ml of sulfanilamide prior to injection into the reaction tube. Since sulfanilamide quantitatively binds nitrite, the integral is the result of nitrate only. Therefore, nitrite can be obtained from the difference of the two analyses.

5. Calibration, Data Reduction and Calculations

5.1. Calibration stocks and regression standards

The calibration of dissolved inorganic nutrients in the autoanalysis of seawater samples is performed using standard solutions containing N, P and Si. A nutrient stock solution is prepared by dissolving dried (65oC, 72 hours) analytical grade reagent chemicals with distilled-deionized water in 1 liter glass volumetric flasks containing 1 ml of chloroform. Once dissolved, this stock solution is immediately transferred into 1 liter amber polypropylene bottles and stored at 4oC. The reagent chemicals and concentrations are: phosphate (KH_2PO_4, 1 mM), nitrate (KNO_3, 5 mM) and silica (Na_2SiF_6, 4 mM).

Working standards are prepared daily by volumetric dilutions of the stock using glass pipettes and a plastic (polymethylpentene; PMP) volumetric flask. All pipettes and PMP flasks are acid-washed (1 M HCl) and gravimetrically calibrated prior to use. The daily regression standards are prepared by diluting the working standard with low nutrient natural seawater diluent (SWDIL). The SWDIL is filtered open ocean surface seawater that is stored in a carboy at room temperature. By using this technique all standards are matrix-matched with the seawater samples and any cross-nutrient interference effect should be accounted for.

Cross-nutrient interference and reagent contamination was evaluated by preparing separate solutions, as above, but with one of the three standards omitted. Only phosphate showed a slightly measurable increase (+0.014 uM) in the presence of 40 uM-NO3 and 160 uM-Si. The linear regressions of the standards were applied to all seawater sample peaks for calculating each batch of cruise samples. Typical correlations produced r2 values that were between 0.9999 and 0.99999.

5.2. Blank corrections

All seawater standard absorbance peaks were corrected for the absorbance of the seawater diluent (SWDIL). All seawater sample peaks were corrected for the refractive index absorbance for each unique nutrient detection system. The refractive index corrections (in apparent uM units) ranged from approximately 0.13 (for P), 0.23 (for N) to 2.41 (for Si), and represent the increase in absorbance that is due strictly to the presence of dissolved salts in seawater when compared to the distilled-deionized water baseline. These corrections are made running seawater (35 o/oo salinity) through the autoanalyzer with DDW only in reagent lines. The Levor surfactant used routinely in the phosphate channel was omitted from the DDW lines during the refractive index measurement because Levor reacts erratically with seawater in the absence of the acidic color reagent.

6. Accuracy and Precision

The detection limit for nitrate plus nitrite is approximately 0.03 uM with a coefficient of variation for field-collected replicates of 0.3%. The detection limit for DON is 0.05 with a coefficient of variation of 4%.

7. Equipment/Supplies

Niskin bottles and rosette/CTD unit
acid-washed, 125 ml polyethylene bottles
Autoanalyzer (Technicon Corp.) and accessories
UV oxidizer unit
nitrogen oxide analyzer (Antek model #720, operated in vacuum mode)
reaction tube, cold finger and drying tube glassware array

8. Reagents

glass distilled deionized water (DDW)
1 M HCl for cleaning
concentrated H2SO4 (36 N)
Ammonium Chloride Reagent: Dissolve 10 g of ammonium chloride in DDW, adjust pH to 8.5 with concentrated ammonium hydroxide and dilute to 1 liter. Add 0.5 ml Brij-35 (Technicon No. T21-0110).
Color Reagent: To approximately 1500 ml of distilled water, add 200 ml of concentrated phosphoric acid and 20 g of sulfanilamide.

Dissolve completely (heat if necessary). Add 1 g of N-1-naphthyl-ethylenediamine dihydrochloride and dissolve. Dilute to 2 liters. Add 1.0 ml of Brij-35. Store in a cold, dark place. Stability: one month.

Cadmium Powder (Technicon No. T11-5063): Use coarse cadmium powder (99% pure). Rinse the powder once or twice with a small quantity of clean diethyl ether and 1 M HCl to remove grease and dirt. Follow with a DDW rinse. Allow the metal to air-dry and store in a well-stoppered bottle.

Ferrous Ammonium Sulfate (4% w/v): Dissolve 4 g of reagent grade ferrous ammonium sulfate in 100 ml DDW. Prepare fresh daily.

Ammonium molybdate (2% w/v): Dissolve 2 g reagent grade ammonium molybdate in 100 ml DDW. Prepare fresh daily.

Sulfanilamide (1% in 10% HCl). Dissolve 1 g reagent grade sulfanilamide in 100 ml of 10% HCl.

Sodium hydroxide (6 M): Dissolve 240 g of reagent grade sodium hydroxide and make up to 1 liter with DDW.

Preparation of Reduction Column: See Technicon Industrial System, 1977.

Stock Standard (1000 uM): Dissolve 0.101 g of potassium nitrate in DDW and dilute to 1 liter. Store in a dark bottle. Add 1 ml of chloroform as a preservative.

Working Standard (50 uM): Dilute 5 ml of stock standard in a volumetric flask with DDW or seawater diluent.

9. References

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Water and Seawater. Autoanalyzer II R Industrial Method No. 155-71W. W. Tarrytown, New York 10591.

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Walsh, T. W. 1989. Total dissolved nitrogen in seawater: A new high temperature combustion method and a comparison to photo-oxidation. Marine Chemistry, 26, 295-311.

POSTSCRIPT: During year 1 of the HOT program, we routinely measured NH4+ concentrations using the standard Berthelot (indophenol) method. Concentrations of NH4+ were consistently at, or below, our detection limits (<0.05 uM) throughout the water column. Although a new method has been described for low-level determinations of NH4+ in seawater (Brzezinski, 1988, Limnology and Oceanography, 33, 1176-1182), we have not yet successfully adapted this procedure for our routine determinations. Until that method, or a suitable alternative, is available we have decided to delete NH4+ measurements from our list of "standard procedures."

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Field & Laboratory Protocols

ORTHOPHOSPHATE AND DISSOLVED ORGANIC PHOSPHORUS

SUMMARY: Seawater is collected from known depths using CTD- rosette sampling protocols. Subsamples are drawn and stored in acid-washed polyethylene bottles. Soluble reactive phosphorus (SRP) is measured spectrophotometrically following the formation of phosphomolybdic acid. Total dissolved phosphorus (TDP) is measured in a separate sample after exposure to ultraviolet (UV) light and dissolved organic phosphorus (DOP) is estimated by difference.

1. Principle

Phosphorus (P) is one of several macronutrients required for the growth of marine organisms. In open ocean marine ecosystems, P is often present in low and, perhaps, limiting concentrations for microalgal and bacterial populations. Therefore, P is a central element in oceanic biogeochemical cycles.

In seawater, inorganic phosphorus (also referred to as orthophosphate or soluble reactive phosphorus, SRP) occurs chiefly as ions of HPO_4^{2-}, with a small percentage present as PO_4^{3-}. Dissolved organic phosphorus (DOP) exists in a variety of forms (primarily P-esters) which result from excretion, decomposition, death and autolysis.

In this analytical procedure, we make direct measurements of SRP and total dissolved phosphorus (TDP). The latter includes all organic and inorganic phosphorus compounds. Bound phophorus is released from organic matter by ultraviolet light (UV) oxidation and the liberated orthophosphate is reacted with an acidified molydate reagent and potassium antimonyl tartrate. The resulting compound, a heteropoly acid (phosphomolybdic acid), is reduced to the intensely colored molybdenum blue by ascorbic acid and measured spectrophotometrically. SRP samples are prepared in the same manner as TDP samples, but without the prior UV oxidation step. DOP is calculated by difference (i.e., TDP-SRP).

2. Precautions

Contamination is the primary concern with P determinations. This is particularly true with samples collected from the euphotic zone, where SRP concentrations are extremely low (<0.2 uM). In order to avoid contamination, sample bottles must be meticulously cleaned with dilute HCl and rinsed with deionized distilled water (DDW) before use.

3. Sample Collection and Storage

3.1. Sample collection (also see "NOTE" in Chapter 7, section 3)

3.1.1. Rinse the nutrient sample bottle (acid-washed, 125 ml polyethylene bottle) 3 times before filling. Fill to

approximately 2/3 full, tighten cap and freeze.

3.1.2. Record cruise, cast and Niskin bottle number on the bottle and data sheet.

4. Sample Analysis

Currently, GOFS and WOCE nutrient samples collected during the Hawaii Ocean Time Series cruises are analyzed by the Hawaii Institute of Marine Biology Analytical Facility. Mr. Ted Walsh has provided us with the following procedure for the analysis of phosphate.

Phosphorus analyses are performed on a four-channel Technicon Autoanalyzer II continuous flow system. The automated wet chemistries generally follow the standard methods of seawater analysis as given by Technicon (1973). Slight modifications have been incorporated to achieve the optimum range and sensitivity for each nutrient at concentration levels specific for the Station ALOHA seawaters.

4.1. Soluble Reactive Phosphorus (SRP)

This method employs a single color reagent consisting of an acidified solution of ammonium molybdate, ascorbic acid and antimony-tartrate. The blue phosphomolybdenum complex formed is read colorimetrically through a 50 mm pathlength flowcell at 880 nm (Murphy and Riley, 1962). The specific automated method used is described in Technicon (1973) with the following modifications:
sample pump tube size is increased to allow for a flow rate of 0.8 ml min-1, and the color reagent solution concentration is diluted by a factor of 2.

4.2. Total Dissolved Phosphorus (TDP)

The method for TDP involves initial UV digestion of a seawater sample followed by autoanalysis of the digestion product (SRP; see Chapter 8, section 4.1). The modified photoxidation technique (Armstrong et al., 1966) utilizes a 2 hour UV irradiation period. Exact details of the photoxidation unit are described in Walsh (1989). Periodic calibration checks of the UV lamp efficiency are made using dissolved organic phosphorus (beta-glycerol-phosphate) standards. As a general rule, the UV lamp is replaced after approximately 700-800 hr of use.

4.3. Low-level procedures

We have recently developed a method for the determination of P dissolved in seawater at low concentrations (<0.1 uM; Karl and Tien, in preparation). The method is based upon the quantitative removal of SRP by co-precipitation with magnesium hydroxide which is formed by the addition of high purity sodium hydroxide to selected seawater samples. The precipitate is collected by centrifugation, washed with a solution of weak sodium hydroxide (0.01 M) and then dissolved in a known volume of high purity hydrochloric acid. At this point, the concentrated samples are treated as above (see Chapter 8, section 4.1) for the determination of SRP. The detection limit is determined by the volume of seawater initially used (50-250 ml for our routine assays), but P concentrations as low as 5 nM can be easily and reproducibly detected. All low level P determinations are corrected for arsenic interference by thiosulfate reduction of dissolved arsenate (Johnson, 1971).

5. Calibration, Data Reduction and Calculations

5.1. Calibration stocks and regression standards

The calibration of dissolved inorganic nutrients in the autoanalysis of seawater samples is performed using standard solutions containing N, P and Si. A nutrient stock solution is prepared by dissolving dried (65oC, 72 hours) analytical grade reagent chemicals with distilled-deionized water in 1 liter glass volumetric flasks containing 1 ml of chloroform. Once dissolved, this stock solution is immediately transferred into 1 liter amber polypropylene bottles and stored at 4oC. The reagent chemicals and concentrations are: phosphate (KH2PO4, 1 mM), nitrate (KNO3, 5 mM) and silica (Na2SiF6, 4 mM).

Working standards are prepared daily by volumetric dilutions of the stock using glass pipettes and a plastic (polymethyl-pentene; PMP) volumetric flask. All pipettes and PMP flasks are acid-washed (1M HCl) and gravimetrically calibrated prior to use. The daily regression standards are prepared by diluting the working standard with low nutrient natural seawater diluent (SWDIL). The SWDIL is filtered open ocean surface seawater that is stored in a carboy at room temperature. By using this technique all standards are matrix-matched with the seawater samples and any cross-nutrient interference effect should be accounted for.

Cross-nutrient interference and reagent contamination was evaluated by preparing separate solutions, as above, but with one of the three standards omitted. Only phosphate showed a slightly measurable increase (+0.014 uM) in the presence of 40 uM-NO3 and 160 uM-Si. The linear regressions of the standards were applied to all seawater sample peaks for calculating each batch of cruise samples. Typical correlations produced r2 values that were between 0.9999 and 0.99999.

5.2. Blank corrections

All seawater standard absorbance peaks were corrected for the absorbance of the seawater diluent (SWDIL). All seawater sample peaks were corrected for the refractive index absorbance for each unique nutrient detection system. The refractive index corrections (in apparent uM units) ranged from approximtely 0.13 (for P), 0.23 (for N) to 2.41 (for Si), and represent the increase in absorbance that is due strictly to the presence of dissolved salts in seawater when compared to the distilled-deionized water baseline. These corrections are made by running sampling seawater (35 o/oo salinity) through the autoanalyzer with DDW only in reagent lines and also with all reagents except the color producing reagent. The Levor surfactant used routinely in the phosphate channel was omitted from the DDW lines during the refractive index measurement.

6. Accuracy and Precision

The detection limit for phosphorus is approximately 0.02 uM with a coefficient of variation for field-collected replicates of 0.3% For DOP the detection limit is 0.02 uM with a coefficient of variation of 1%.

7. Equipment/Supplies

Niskin bottles and rosette/CTD unit
acid-washed, 125 ml polyethylene sample bottles
Autoanalyzer (Technicon Corp.) and accessories

8. Reagents

glass distilled deionized water (DDW)
HCl (1M) for cleaning
concentrated H2SO4
ultrapure NaOH and HCl for low-level P determinations
Ammonium molybdate solution: Dissolve 40 g of ACS grade ammonium paramolybdate [(NH4)6M O7O24 . 4H2O] into 800 ml DDW and dilute to 1 liter in a volumetric flask. Store in plastic bottle in the dark. Solution is stable indefinitely.
Ascorbic acid solution (Prepare fresh): Dissolve 1.8 g of ACS ascorbic acid into 100 ml DDW (1.8% wt/vol).
Antimony potassium tartrate solution: Dissolve 3.0 g of ACS antimony potassium tartrate (C8H4K2O12Sb2 . 3H2O) into 800 ml DDW and dilute to 1 liter in a volumetric flask. Solution is stable for several months.
Mixed reagent (Prepare fresh): Mix together in the following order 15 ml ammonium molybdate, 50 ml 5 N sulfuric acid, 30 ml 1.8% ascorbic acid and 5 ml potassium antimony tartrate.
Stock phosphate standard solution (1 mM): Dissolve 0.1361 g of dry (65oC for 72 hours) potassium phosphate monobasic (KH2PO4) into 800 ml of DDW and dilute to 1 liter in a volumetric flask. Store in a dark bottle with 1 ml of chloroform.
Working phosphate standard (40 uM): Dilute 4.0 ml of the stock standard to 100 ml (use volumetric flask). Then dilute the working standard to prepare a series of standards to cover a range of P concentrations.

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Field & Laboratory Protocols

SOLUBLE REACTIVE SILICA

SUMMARY: Seawater is collected from known depths using CTD- rosette sampling protocols. Subsamples are drawn and stored in acid-washed polyethylene bottles. Soluble reactive silica is measured spectrophotometrically following the formation of silico- molybdic acid from the reaction of ammonium molybdate and silica at acidic pH.

1. Principle

Silicon is the second most abundant element in the Earth's crust. Subaerial weathering processes produce orthosilicic acid $Si(OH)_4$ which eventually is deposited in the oceans. In seawater, various groups of organisms (diatoms, radiolarians, silicoflagellates, sponges and some fungi) utilize silica primarily as a structural component.

The analysis of soluble reactive silica is based upon the formation of yellow silicomolybdic acid from the reaction of ammonium molybdate and silica at low pH. Phosphate also reacts to produce a positive interference due to the formation of molybdophosphoric acid. The addition of oxalic acid eliminates the phosphate interference. The sensitivity of the analysis is increased by a further reduction of the yellow silicomolybdic acid using ascorbic acid, in order to produce "molybdenum blue".

2. Precautions

Contamination is the primary concern with these samples. This is particularly true with samples collected from the euphotic zone, where inorganic nutrient concentrations are extremely low. In order to avoid contamination, all sample bottles must be meticulously cleaned with dilute HCl and rinsed with deionized distilled water (DDW) before use. It is important to realize that silica is leached from glass at seawater pH. Therefore, plastic should be used for sample handling and storage. Finally, special care must be taken when performing dissolved Si analyses on frozen seawater samples (Macdonald et al., 1986).

3. Sample Collection and Storage (also see "NOTE" in Chapter 7, section 3)

3.1. Rinse the nutrient sample bottle (acid-washed, 125 ml polyethylene bottle) 3 times before filling. Fill to approximately 2/3 full, tighten cap and freeze.

3.2. Record cruise, cast and Niskin bottle number on the bottle and data sheet.

4. Sample Analysis

Currently, GOFS and WOCE nutrient samples collected during the Hawaii Ocean Time Series cruises are analyzed by the Hawaii Institute of Marine Biology Analytical Facility. Mr. Ted Walsh has

provided us with the following procedure for the analysis of reactive Si.

Si analyses are performed on a four-channel Technicon Autoanalyzer II continuous flow system. The automated wet chemistries generally follow the standard methods of seawater analysisas given by Technicon (1977). This method involves a reaction of the sample with oxalic acid, molybdate, and ascorbic acid. The absorbance is read at 660 nm using a 15 mm pathlength flowcell.

5. Calibration, Data Reduction and Calculations

5.1. Calibration stocks and regression standards

The calibration of dissolved inorganic nutrients in the autoanalysis of seawater samples is performed using standard solutions containing N, P and Si. Nutrient stock solution "A" is prepared by dissolving dried (65oC, 72 hours) analytical grade reagent chemicals with distilled-deionized water in 1 liter glass volumetric flasks containing 1 ml of chloroform. Once dissolved, this stock solution is immediately transferred into 1 liter amber polypropylene bottles and stored at 4oC. The reagent chemicals and concentrations are: *phosphate* (KH_2PO_4, 1 mM), nitrate (KNO_3, 5 mM) and silica (Na_2SiF_6, 4 mM).

Working standards are prepared daily by volumetric dilutions of the stock using glass pipettes and a plastic (polymethylpentene; PMP) volumetric flask. All pipettes and PMP flasks are acid-washed (1 M HCl) and gravimetrically calibrated prior to use. The daily regression standards are prepared by diluting the working standard with low nutrient natural seawater diluent (SWDIL). The SWDIL is filtered open ocean surface seawater that is stored in a carboy at room temperature. By using this technique all standards are matrix-matched with the seawater samples and any cross-nutrient interference effect should be accounted for.

Cross-nutrient interference and reagent contamination was evaluated by preparing separate solutions, as above, but with one of the three standards omitted. Only phosphate showed a slightly measurable increase (+0.014 uM) in the presence of 40 uM-NO_3 and 160 uM-Si. The linear regressions of the standards were applied to all seawater sample peaks for calculating each batch of cruise samples. Typical correlations produced r2 values that were between 0.9999 and 0.99999.

5.2. Blank corrections

All seawater standard absorbance peaks were corrected for the absorbance of the seawater diluent (SWDIL). All seawater sample peaks were corrected for the refractive index absorbance for each unique nutrient detection system. The refractive index corrections (in apparent uM units) ranged from approximately 0.13 (for P), 0.23 (for N) to 2.41 (for Si), and represent the increase in absorbance that is due strictly to the presence of dissolved salts in seawater when compared to the distilled-deionized water baseline. These corrections were measured by sampling seawater (35 o/oo salinity) with DDW only in reagent lines and also with all reagents except the color producing reagent. The Levor surfactant used routinely in the phosphate channel was omitted from the DDW lines during the refractive index measurement.

6. Accuracy and Precision

The detection limit for dissolved Si is approximately 0.3 uM. The

coefficient of variation of field-collected replicates is 6%.

7. Equipment/Supplies

Niskin bottles and rosette/CTD unit
acid-washed, 125 ml polyethylene bottles
Autoanalyzer (Technicon Corp.) and accessories

8. Reagents

Because Si is the principle component of glass, all solutions should be made up and contained in plastic. Glass distilled deionized water will have minimal silica leaching due to the low pH of distilled water.

Glass distilled deionized water (DDW)
Ammonium molybdate solution: Dissolve 10 g of ammonium molybdate into 1 liter of sulfuric acid (0.1 N). Filter and store in an amber plastic container.
Oxalic acid (0.56 M): Dissolve 50 g of oxalic acid into 900 ml of DDW and dilute to 1 liter.
Ascorbic acid solution (1.76% wt/vol): Dissolve 17.6 g of ACS quality ascorbic acid in 500 ml of DDW containing 50 ml of acetone. Mix and dilute to 1 liter with DDW. Add 0.5 ml of Levor V per liter of reagent.

9. References

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Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 5

Toxic Substances/Pollution Prevention Plan

POTENTIAL EFFECTS ON GROUNDWATER RESOURCES
KALOKO-HONOKOHAU BUSINESS PARK
KALOKO, NORTH KONA, ISLAND OF HAWAII

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EXECUTIVE SUMMARY

The planned development of the Kaloko-Honokohau Business Park is proposed by developing approximately 337 acres, envisioned to occur in three phases over a period of more than 20 years. This report has been prepared to address the potential for contaminants from industrial activities in the proposed business park to affect the local groundwater system and the ponds within the Kaloko-Honokohau National Historic Park located west (makai) of the Queen Kaahumanu Highway.

The project property will be rezoned as ML, Limited Industrial District and MCX, Industrial-Commercial Mixed District. The most likely releases to the environment from ML and MCX land uses are petroleum products or petroleum-based products, i.e. gasoline and diesel fuels, motor oil, solvents, and petroleum-based pesticides.

The most likely form of release would be non-point source accumulations such as parking or maintenance areas drippings which are washed away by rainfall and percolate into the subsurface. Such accumulations are likely to be minimal, and are exposed to volatilization and natural remediation processes. This potential pollutant source is unlikely to affect groundwater in the area.

A release from a subsurface or surface petroleum storage tank could pose more of a threat but would be more unlikely under current environmental controls and regulations. Both underground and surface storage of petroleum are strictly regulated by Federal and State laws. The requirements for monitoring of storage tanks and the requirements for spill prevention control and countermeasures (SPCC) plans make it highly unlikely that large releases would occur without containment. The worst case scenario would be the rapid release of most or all of a tank's petroleum volume, typically 5,000 to 10,000 gallons, followed by rapid percolation into the subsurface environment.

Petroleum flow is inhibited in the site's subsurface regime, due to the interactions of petroleum, groundwater, soil and rock, tidal fluctuations, and bedding. A previous study of 13 common petroleum compounds found that they could be grouped into four categories based on their environmental fate tendencies: those that adsorb to soil particles, those that volatilize in air, those that solubilize in groundwater, and those that have multiple pathways.

The release of up to 10,000 gallons of petroleum hydrocarbon in a single event was assessed based on the evaluated subsurface hydrogeology and petroleum hydrocarbon characteristics. It is very difficult to predict the exact extent of lateral spreading which would occur during the course of migration down to the water table. However, we can evaluate whether the relatively high ground surface elevations would enable the unsaturated zone to absorb the bulk of a potential hydrocarbon release. Based on a conservative residual hydrocarbon level of 0.15%, analyses indicate that very little lateral spreading would be required for the hypothetical release to be adsorbed by the 80 feet of rock and gravel above

the water table, and that the release would be adsorbed and contained before it moved significantly from the industrial park. Even if some of the petroleum, say 1,000 gallons of the hypothetical release, reached the groundwater, tidal fluctuations would create a smear zone where petroleum would be adsorbed and contained within a migration distance of a few hundred feet.

A 1999 USGS study included groundwater monitoring of three wells downgradient of the existing Phases I and II of the Kaloko industrial park, within the existing Kaloko-Honokohau National Historic Park. Testing was conducted for an unusually large number of chemical constituents (151 in all), including trace metals, volatile organic compounds, semi-volatile organic compounds, and organochlorine and organophosphate pesticides. Testing of three downgradient wells and one upgradient well did not detect any of the petroleum constituents, with the exception of trace levels of phenol at levels approximately 20,000 times lower than EPA standards for cleanup of drinking water. The levels are also much lower than State of Hawaii water quality standards.

The proposed action is the creation of a business park with land uses similar to the existing industrial park. The existing industrial park therefore serves as a "field test" for the proposed development. The groundwater monitoring conducted by the USGS provides a measurement of the results of the "field test".

The presence of phenol and the absence of other petroleum hydrocarbon constituents would appear to be a "field test" validation of the analytical assessment of the environmental fate of released petroleum hydrocarbons described in this report. The presence of phenol and no other organic constituent indicates that while petroleum hydrocarbons have been released to the environment, all but the most soluble constituent, phenol, has been retained and likely naturally remediated within the subsurface environment in the vicinity of the existing Industrial Park. The very low levels of phenol are also confirmation of the very active subsurface environment which promotes the degradation of such organic compounds.

We conclude that releases of petroleum product within the proposed Kaloko-Honokohau Business Park would be highly unlikely to affect the groundwater in the Kaloko-Honokohau National Historic Park as has been historically the case.

1.0 INTRODUCTION

Lanihau Partners, L.P. proposes the planned development of the Kaloko-Honokohau Business Park by developing approximately 337 acres. The northern half of the Kaloko-Honokohau National Historic Park is located directly across Queen Kaahumanu Highway. The Historic Park contains two ponds that are brackish bodies of water separated from the ocean by a basaltic rock wall (Kaloko Pond) and a sand beach berm (Aimakapa Pond). Kaloko Pond is approximately 11 acres in size and Aimakapa Pond is approximately 15 acres in size.

This report has been prepared to address the potential for contaminants from industrial activities in the proposed Business Park to affect the local groundwater system and the ponds within the Kaloko-Honokohau National Historic Park. This report is complemented by a Pollution Prevention Plan (P2 Plan) which will be used by individual lot owners and tenants/operators of the proposed industrial/commercial lots. The P2 Plan evaluates potential contaminants from industrial operations, identifies applicable Federal, State, and local regulations, and makes recommendations on management practices and plans.

An adjacent project, the proposed Phases III and IV of the Kaloko Industrial Park, is currently seeking approval from the State Land Use Commission. Masa Fujioka and Associates has been retained to similarly investigate the potential effects on groundwater. Although separate reports assessing potential impacts for both of these projects have been prepared by Masa Fujioka and Associates, all of the field and research data and most of the analytical methods are essentially the same for both assessments.

2.0 PROJECT CONSIDERATIONS AND SCOPE OF ASSESSMENT

An Environmental Impact Statement (EIS) is under preparation to reclassify approximately 337 acres of land currently in the State Conservation District into the Urban District in order to develop the Kaloko-Honokohau Business Park. Development of the Business Park for industrial and commercial uses, as well as the retention and expansion of ongoing quarrying activities, is envisioned to occur in three phases over a period of more than 20 years.

An analysis of the project's potential affect on water resources was conducted by Tom Nance Water Resources Engineering (Nance, 2000). The report assessed the following aspects of development: (i) the use of groundwater for potable supply; (ii) the manner and location of wastewater disposal; (iii) the manner of stormwater disposal; and (iv) the potential for excess irrigation and wash water reaching the underlying groundwater.

The focus of our assessment is on the potential effects of industrial pollutants on the underlying groundwater and the ponds within the Kaloko-Honokohau National Historic Park. For this analysis the following were assessed:

(i) Types and potential magnitudes of releases of potential contaminants.

(ii) Characteristics of the subsurface environment and effects on migration, retardation, and subsurface remediation of potential contaminants.

(iii) Characteristics of potential contaminants and effects on the likely fate of the contaminants in the subsurface environment.

(iv) Based on the above, analytical assessment, using qualitative analytical modeling, of likely environmental fate of potential contaminants with regard to subsurface migration, retardation, and remediation.

(v) Comparison of the results of analytical assessment with available groundwater monitoring results.

3.0 ASSESSMENT OF POTENTIAL GROUNDWATER CONTAMINATION FROM INDUSTRIAL OPERATIONS

3.1 Potential Contaminants Based on Allowable Land Uses

All lands in the State are classified into four land use districts, i.e., Urban, Agricultural, Conservation, and Rural, by the State Land Use Commission. The developers have proposed changing the use district for the proposed project property from Conservation to Urban.

The Hawaii County Zoning Code regulates the use of lands on the island of Hawaii. The project property will be reclassified as ML, Limited Industrial District (approximately 66 acres) and MCX, Industrial-Commercial Mixed District (approximately 36 acres). Example uses permitted under the respective County zoning designations are identified in Table 1.

The ML, Limited Industrial District, "applies to areas for business and industrial uses which are generally in support of but not necessarily compatible with those permissible activities in other commercial districts." The purpose of the MCX, Industrial-Commercial Mixed district "is to allow mixing of some industrial uses with commercial uses. The intent of this district is to provide for areas of diversified businesses and employment opportunities by permitting a broad range of uses, without exposing non industrial uses to unsafe and unhealthy environments. This district is intended to promote and maintain a viable mix of light industrial and commercial uses."

Table 1. Permitted Uses, Limited Industrial (ML) and Industrial-Commercial Mixed Use (MCX) Districts

Permitted Use	ML	MCX	Contaminants of Concern
Agricultural products processing, minor	√	√	petroleum, pesticides
Airfields, heliports, and private landing strips	√		petroleum
Amusement and recreation facilities, indoor		√	none
Animal hospitals and quarantine stations	√		none
Aquaculture activities	√		none
Art galleries, museums		√	none
Automobile and truck storage facilities	√		petroleum
Automobile sales and rentals	√	√	petroleum
Automobile service stations		√	petroleum
Bakeries	√		none
Bars and nightclubs	√	√	none
Broadcasting stations	√	√	none
Business services		√	none
Car washing	√	√	petroleum
Carpentry, hardwood products and furniture manufacturing and storage establishments	√		none
Catering establishments	√	√	none
Cemeteries and mausoleums	√	√	none
Churches, temples, and synagogues	√	√	none
Cleaning and dyeing plants	√		hazmat/waste
Cleaning plants using only non- flammable hydrocarbons in a sealed unit as the cleaning agent		√	hazmat/waste
Commercial parking lots and garages	√	√	petroleum
Community buildings	√	√	none
Contractors' yards for equipment, material, and vehicle storage, repair, or maintenance	√		petroleum
Convenience stores		√	none
Data processing facilities		√	none
Day-care centers	√	√	none
Financial institutions	√	√	none
Food manufacturing and processing facilities	√	√	petroleum, food oil
Greenhouses, plant nurseries	√		pesticides
Heavy equipment sales, service, and rental	√		petroleum
Home improvement centers	√	√	none
Junk yards, provided that the building site is not less than one acre	√		petroleum, hazmat/waste
Kennels in sound attenuated buildings		√	none

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Table 1 (continued). Permitted Uses, Limited Industrial (ML) and Industrial-Commercial Mixed Use (MCX) Districts

Permitted Use	ML	MCX	Contaminants of Concern
Laboratories, medical and research	√	√	hazmat/waste
Laundries	√		none
Lumber and building material yards, not including concrete/asphalt mixing and fabrication by riveting or welding of steel bldg frames	√		hazmat/waste
Manufacturing, processing and packaging establishments, light	√	√	petroleum, hazmat/waste
Medical clinics		√	hazmat/waste
Meeting facilities		√	none
Motion picture and television production studios	√	√	none
Offices		√	none
Photographic processing	√	√	hazmat/waste
Photography studios		√	none
Plant nurseries		√	pesticides
Plumbing, electrical, air conditioning, and heating establishments	√		none
Public uses and structures	√	√	none
Publishing plants (newspapers, books, magazines, printing shops, cartographing); duplicating processes (blueprinting/photostating)	√	√	hazmat/waste
Recycling centers, which do not involve processing of materials	√		none
Repair establishments, minor	√	√	none
Restaurants	√	√	none
Retail establishments		√	none
Sales and service of machinery used in agricultural production		√	petroleum
Schools, business, photography, art, music, and dance		√	none
Schools, vocational	√	√	none
Self-storage facilities	√	√	none
Storage and sale of seed, feed, fertilizer and other products essential to agricultural production	√		pesticides
Telecommunications antennas	√	√	none
Temporary real estate offices	√	√	none
Theaters		√	none
Transportation and tour terminals	√		petroleum
Truck, freight and draying terminals	√		petroleum
Utility facilities, public and private, including offices or yards for equipment, material, vehicle storage, repair or maintenance	√		petroleum
Utility substations	√	√	none
Veterinary establishments	√		hazmat/waste
Warehousing		√	hazmat/waste
Wholesaling and distribution operations	√		none

Based on review of the types of activities common with ML and MCX land uses, the most likely releases to the environment from ML and MCX land uses are petroleum products or petroleum-based products, including gasoline and diesel fuels, motor oil, solvents, and petroleum-based pesticides.

The most likely form of release would be due to non-point source accumulations such as parking or maintenance area drippings which are washed away by rainfall and percolate into the subsurface. These are likely to consist of relatively small quantities of residues on parking and maintenance areas. Because such residues are exposed to air and the sun, they typically undergo significant evaporation and biodegradation during the course of accumulation. Most of the chemical pollutants which are typically mobile in the subsurface environment are therefore removed prior to washoff and percolation.

A release from a subsurface or surface petroleum storage tank could pose a significant threat but would be more unlikely under current environmental controls and regulations. Such tanks could be found at gasoline dispensing stations, contractor yards, and light manufacturing facilities. A large food manufacturing facility may also store vegetable oils.

The existing industrial park contains few underground storage tanks (USTs), an indication of the limited use of USTs in this type of industrial/commercial development. An EcoSearch records search of the existing industrial park area indicates that two facilities, Tesoro Gas Express and Honsador Lumber, have USTs. Tesoro Gas Express has three 12,000-gallon tanks, two used to store gasoline and one used to store diesel fuel. Honsador Lumber is reported to have had a leaking UST. According to the State Department of Health (DOH) UST Section, the 1,000-gallon tank was removed in 1998 and the site was given a "no further action" ruling by the DOH in 1999, indicating that the site had been cleaned up to DOH's satisfaction.

Both underground and surface storage of petroleum are strictly regulated by Federal and State laws. The requirements for monitoring of storage tanks and the requirements for spill prevention control and countermeasures (SPCC) plans make it highly unlikely that large releases would occur without containment. The worst case scenario would be the rapid release of most or all of a tank's petroleum volume, typically 5,000 to 10,000 gallons, followed by rapid percolation into the subsurface environment. An analytical assessment of this scenario is discussed below.

3.2 Hydrogeologic Characteristics of the Subsurface Environment

The ground surface in the general area consists of thin to no soil over basaltic lava flows. As a result, there is a very high rate of water percolation which results in no surface runoff even during intense rainfalls. All rainfall either evaporates or enters the subsurface regime. With the combination of high infiltration rates and a highly permeable subsurface,

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groundwater flow is characterized by high rates of flow and high flow velocities, generally towards the ocean. Fresh water tends to become somewhat mixed with salt water and flows towards the ocean as a thin lens overlying the salt water.

The subsurface regime is highly conducive to the flow of single phase fluids such as air and water. Lava flows generally are bedded at a slope which approximates the surface slope of the parent volcano, in this case Hualalai. Clinker zones, consisting of highly porous and permeable gravel, are often found between very recent lava flows. With depth and age, the clinker zones tend to become more compressed and weathered. With advancing age of the volcano, lava flows become sufficiently intermittent that thin soil layers form between lava flows. However, the frequency of Hualalai eruptions is likely sufficient to have prevented significant formation of soil between lava flows.

Because of the bedding which slopes downward towards the ocean, the subsurface tends to preferentially direct groundwater flow towards the ocean. The hydraulic gradient is also towards the ocean as landward sources of groundwater, primarily inland rainfall, flows towards the ocean.

Air movement within the subsurface is naturally limited to the zone above the water table, but is likely to be rapid because of the high permeabilities of the basaltic rock and clinker zones. The ready availability of air is important in assessing the fate of petroleum contaminants due to the role of air in evaporation of volatile organic constituents and in degradation of less volatile constituents. Unlike many subsurface soil regimes, where the non-availability of oxygen tends to quickly result in anaerobic conditions unsuitable for petroleum degradation, the naturally rapid flow of air in the subsurface at the subject site results in the availability of oxygen not likely being a constraining factor to subsurface degradation of petroleum.

Subsurface movement of petroleum hydrocarbons is much more complex than groundwater or air flow. Petroleum is generally immiscible with water with the exception of the soluble constituents of petroleum hydrocarbons. Petroleum and water therefore tends to form separate phases of flow. The flow down to the groundwater table is therefore an example of a multi-phase flow consisting of simultaneous petroleum, air and water flow. Upon reaching the groundwater table, petroleum tends to flow laterally on top of the groundwater. Because air is always present near the top of the groundwater surface, the flow remains a multi-phased flow of air, water and petroleum.

Petroleum flow is inhibited in the described subsurface regime for a number of reasons:

(i) Water has preferential wetting characteristics over petroleum, and petroleum therefore tends to flow more slowly than water, i.e. the petroleum has a greater tendency to adsorb to the rocks and gravels it is moving through than does water.

(ii) The presence of air near the groundwater/air/petroleum interface tends to inhibit both water and petroleum flow at and near the interface. Generally the permeability of a porous media for a particular fluid is lowered in the presence of air.

(iii) The high tidal reaction of the groundwater regime tends to move the floating petroleum hydrocarbons up and down, resulting in a relatively large "smear" zone at the groundwater surface. More petroleum is left adsorbed to the rocks and gravel within the smear zone. This also further exposes the petroleum to air and promotes volatilization and degradation.

(iv) The downward bedding which facilitates groundwater flow actually inhibits petroleum flow. Bedding planes intersect the groundwater table and petroleum, which generally can only flow laterally along the water table and cannot flow downward along the bedding plane, has a tendency to become trapped in pockets where relatively solid basalt intersects the water table. Typically, an Aa basalt formation consists of 25% to 50% solid basalt with some fracturing interlayered with clinker zones.

3.3 Contaminant Migration Characteristics

Petroleum products are complex mixtures of hydrocarbons. Each constituent in a petroleum mixture has different physical and chemical characteristics that control its behavior in a soil system. Despite the large number of compounds present, insights can be gained by the study of individual hydrocarbon compounds which are considered representative. Fleischer et. al. (1986) studied 13 specific compounds because of their presence in petroleum products, their tendency to be released to the subsurface environment, and their potential toxicity. The common constituents of petroleum compounds are listed below:

Gasoline and Fuel Oils:	Heavy Oils and Waste Oils:
Benzene	Benz (a) Anthracene
Ethylbenzene	Benzo (a) Pyrene
(n) Heptane	Napthalene
Pentane	Phenanthrene
(n) Hexane	
1- Pentene	
(o) Xylene	
Toluene	
Phenol	

The potential environmental fate of these organic compounds was examined by Fleischer, et al using a computer simulation model SESOIL (Seasonal Soil Compartment Model) developed for the U.S. EPA Office of Toxic Substances (Bonazountas and Wagner, 1984). Results of the SESOIL simulation modeling are presented in Table 2.

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Table 2. Relative Environmental Partitioning of Petroleum Constituents Based on SESOIL Results

Petroleum Compound	Adsorption onto Soil Particles (%)	Volatilization (%)	Soluble Portion in Groundwater and Soil Moisture (%)
Benzene	3	62	35
Ethylbenzene	21	59	20
(n) Heptane	0.1	99.8	0.1
(n) Hexane	0.1	99.8	0.1
(n) Pentane	0.1	99.8	0.1
Benz (a) Anthracene	100	0	0
Benzo (a) Pyrene	100	0	0
Napthalene	61	8	31
Phenanthrene	88	2	10
1-Pentene	0.1	99.8	0.1
Phenol	9	0.01	91
Toluene	3	77	20
(o) Xylene	15	54	31

Source: Fleischer et al., 1986.

Based on the SESOIL results, the petroleum hydrocarbon constituents studied can be grouped into four categories based on their environmental fate tendencies. These categories are presented in Table 3.

Table 3. Categories of Migration Pathways

Adsorb to Soil Particles	Volatilize in Air	Solubilize in Groundwater	Multiple Pathways
Benzo (a) Pyrene	(n) Hexene	Phenol	Benzene
Phenanthrene	(n) Heptane		Ethylbenzene
Benz (a) Anthracene	(n) Pentane		Napthalene
	1-Pentene		(o) Xylene

Source: Fleischer et al., 1986.

3.4 Results of Analytical Assessment of Potential Petroleum Hydrocarbon Release

The release of up to 10,000 gallons of petroleum hydrocarbon in a single event was assessed based on the evaluated subsurface hydrogeology and petroleum hydrocarbon characteristics.

Adsorption and degradation of hydrocarbon in the unsaturated zone

The proposed new industrial park has ground surface elevations ranging from approximately 50 feet along the Queen Kaahumanu Highway to 300 feet above mean sea level. Based on the existing industrial park, development would likely not occur immediately along the highway, but would likely occur at approximately a minimum elevation of 80 feet. A release from an underground storage tank or above ground storage tank would be a point source release at approximately a minimum elevation of 80 feet.

The initial phase of migration from the near surface down to the water table would be affected both by the relatively high permeability of the subsurface materials and by the high anisotropy of the bedded volcanic materials. Bedding of the lava flows results in horizontal permeabilities on the order of 10 times greater than vertical.

During the course of a tortuous and somewhat convoluted migration to the water table, there would a tendency for lateral spreading of the hydrocarbons on top of hard basaltic rock layers combined with relatively direct vertical movements through fractures and interlayered clinkers. The bedding of the lava flows is generally on a downward slope towards the ocean. There would be a significant tendency for lateral spreading to occur in the makai direction rather than in directions parallel to the coastline, and there would be relatively little tendency for lateral spreading in the mauka direction.

It is very difficult to predict the exact extent of lateral spreading which would occur during the course of migration down to the water table. However, we can evaluate whether the relatively high ground surface elevations would enable the unsaturated zone to absorb the bulk of a potential hydrocarbon release. Assuming an 80 foot thick column, we can evaluate how much lateral spreading would need to occur to adsorb a 10,000 gallon release. A typical soil would retain a high percentage of the petroleum hydrocarbon which passes through it. Initially, the percent of retention would be approximately equal to the porosity of the material, typically on the order of 30% of the total volume of soil. As hydrocarbons are further pushed downward by downward migrating rainfall, the percentage of hydrocarbon retention is reduced to a level often referred to as the residual hydrocarbon, which is typically on the order of 3% to 4% of the total volume of soil.

The porosity of a basaltic rock formation is lower than that for a typical soil. The hard rock layers have effective porosities on the order of 10% while the interlayered clinkers for Aa flows have porosities on the order of 30%. Basaltic flows also have little or no fine materials which provide much of the adsorption surface to which hydrocarbon would stick to. Based on the lack of fines and lower overall porosities, the residual hydrocarbon levels would likely be significantly lower.

In calculating the capability of a soil to retain hydrocarbons, two factors are normally evaluated: R (soil retention capacity) and C (an approximate correction factor based on the bulk hydrocarbon viscosity). Recommended values of R range from 5 liters/cubic meter for

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stone to coarse gravel to 40 liters/cubic meter for fine sand to silt (American Petroleum Institute, 1972). Between 50% to 75% of a typical lava formation could be considered to consist of coarse gravel, while the remainder consists of hard basaltic rock. Based on the composition of the basaltic rock formation, an R value on the order of 3 liters/cubic meter would be appropriate. The C value is normally 0.5 for gasoline. The combination of the two gives a corrected R value of 1.5 liters/cubic meter. This translates to a residual hydrocarbon level of 0.15%.

Based on a residual hydrocarbon level of 0.15%, analyses indicate that relatively little lateral spreading would be required for all of a 10,000 gallon release to be adsorbed by the 80 feet of rock and gravel above the water table. This would be on the order of 105 feet in all directions, or alternatively 60 feet laterally in each direction parallel to the ocean and 280 feet in the makai direction. Since it is likely that significant lateral spreading would occur, the most likely scenario is that most of the hypothetical 10,000-gallon point source release would be adsorbed within the 80-foot column.

Upon adsorption to rock and gravel surfaces, the hydrocarbon would be subject to natural remediation due to volatilization and biological degradation. The high permeability of the basaltic formations would enable ready access to air and moisture which would promote volatilization and biological activity.

Adsorption and degradation of hydrocarbon in the capillary fringe

The analysis presented in the above section indicates that a "worst case" release of 10,000 gallons of gasoline would likely be contained within the unsaturated zone, where it would be subject to volatilization and biological degradation.

In this section, we examine the possibility that some of the hydrocarbons migrates to the water table. Considering the adsorption, volatilization and degradation processes discussed above, a value of 10% of the total release (1,000 gallons) reaching the water table is assumed.

As discussed in Section 3.2, basaltic rock formations are not fully amenable to rapid flow to hydrocarbons to the shoreline and vicinity, and petroleum flow is likely inhibited in the given subsurface regime for a number of reasons. These inhibiting factors tend to retard and trap the hydrocarbons in the course of movement towards the shoreline. The net effect is that the width of the hydrocarbon plume floating on the water table widens as it migrates towards the shoreline. We estimate that the width of the plume would increase at approximately the same rate as the migration distance.

Using the same value of residual hydrocarbon calculated above, 0.15%, and considering the measured tidal fluctuations presented in the Nance report, we can calculate the area required to enable complete adsorption of the gasoline within the smear zone formed by the tidal fluctuations. The tidal fluctuations measured in wells in the area range from

approximately 0.5 to 1.0 feet in response to a tidal range of approximately 2.5 feet measured at Honokohau Harbor (Nance, 2000). For a smear zone ranging from 0.5 to 1.0 feet, 1,000 gallons of gasoline would be contained within a migration distance of approximately 300 feet, which may result in migration under the Queen Kaahumanu Highway for a worst case release from a UST located near the makai boundary of the industrial park. The nearest anchialine pond is located approximately 2000 feet makai of the Highway.

The hydrocarbons contained within the smear zone would be subject to extremely rapid degradation due to the presence of air and the presence of the groundwater which would promote high rates of biological activity.

4.0 COMPARISON OF THE RESULTS OF ANALYTICAL ASSESSMENT WITH AVAILABLE GROUNDWATER MONITORING RESULTS

The above analytical assessment primarily applies to three of the four categories of petroleum hydrocarbon constituents presented in Section 3.3. Of the four categories, the above analytical assessment applies to Categories 1, 2, and 4:

1. Petroleum constituents which tend to adsorb to soil.
2. Petroleum constituents which tend to volatilize in air.
3. Petroleum constituents which tend to solubilize in groundwater.
4. Petroleum constituents with multiple pathways (mixed tendencies).

The third category of constituent, those that solubilize in groundwater, i.e., phenol, would migrate relatively rapidly with groundwater.

A study was conducted by the USGS (Oki, et al., 1999) in cooperation with the National Park Service, which included groundwater monitoring of three wells downgradient of the existing Phases I and II of the Kaloko Industrial Park. One of the stated purposes of the study was to describe the "concentrations of trace metals and organic contaminants from three wells in the Park (Kaloko-Honokohau National Historic Park)".

The locations of the wells within the National Historic Park are indicated on Figure 1. A total of 151 chemical constituents were tested for, an unusually high number. The results of the testing are shown in Table 4. The chemical constituents tested included trace metals, volatile organic compounds, semi-volatile organic compounds, and organochlorine and organophosphate pesticides.

The groundwater testing conducted by the USGS included testing of the constituents analyzed by Fleischer, et al. using SESOIL, with the exception of the highly volatile hydrocarbon constituents, which are not likely to be present due to the rapid rates at which they would volatilize upon release to the environment. The testing included the following categories and specific petroleum hydrocarbon constituents.

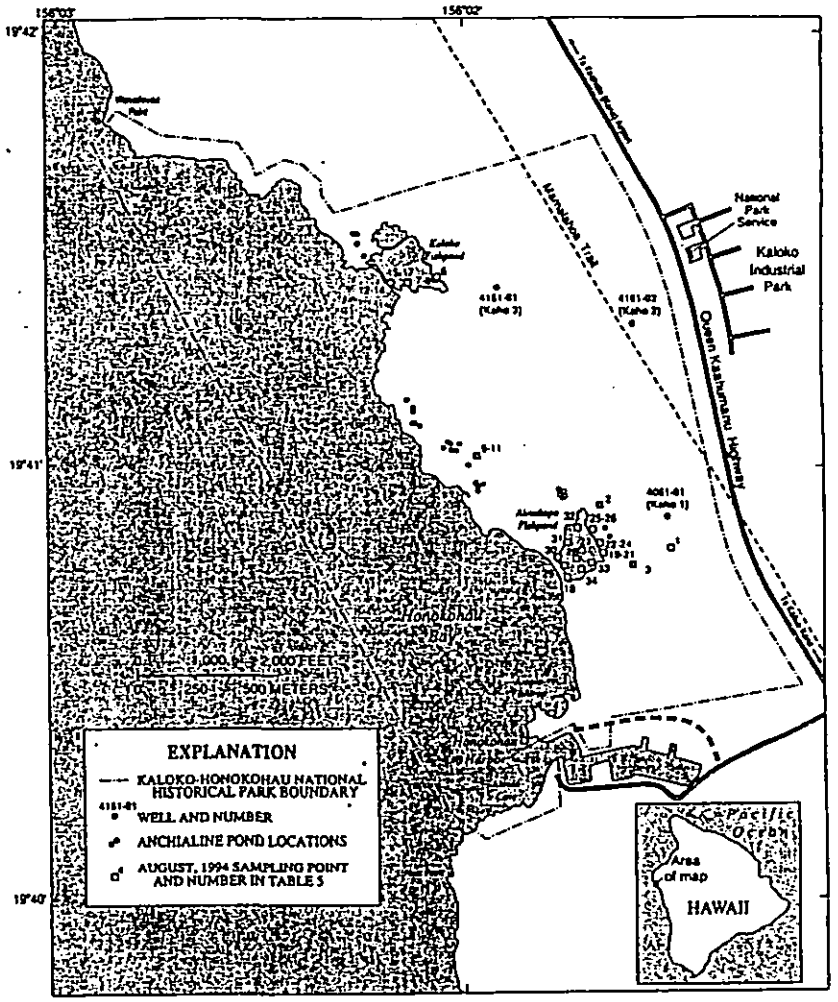

Figure 1. Koloko-Honokahau National Historical Park, Island of Hawaii (modified from National Park Service, 1994). Anchialine pond locations from National Park Service.

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Table 4. Concentrations of trace metals and organic contaminants in water from three wells in Kaloko-Honokohau National Historical Park, Island of Hawaii, and one well upgradient of industrial activity

[---, constituent was not detected by the analysis at the standard minimum reporting level; E, estimated concentration for detection below the minimum reporting level; µg/L, micrograms per liter]

	Well no. and name				Minimum reporting level	Units
	4061-01 (Kaho 1)	4161-02 (Kaho 2)	4161-01 (Kaho 3)	4358-01 (Kalaoa)		
Trace metals (USGS lab schedule 700)						
Antimony	---	---	---	---	1	µg/L
Arsenic	---	---	---	---	1	µg/L
Beryllium	---	---	---	---	10	µg/L
Cadmium	<5	---	---	---	1	µg/L
Chromium	3	1	2	3	1	µg/L
Copper	5	4	5	1	1	µg/L
Cyanide	---	---	---	---	0.010	mg/L
Lead	---	---	---	---	1	µg/L
Nickel	---	---	1	---	1	µg/L
Selenium	---	---	---	1	1	µg/L
Silver	---	---	---	---	1	µg/L
Zinc	---	10	---	---	10	µg/L
Volatile organic compounds (USGS lab schedule 1380)						
1,1,1,2-Tetrachloroethane	---	---	---	---	0.200	µg/L
1,1,1-Trichloroethane	---	---	---	---	0.200	µg/L
1,1,2,2-Tetrachloroethane	---	---	---	---	0.200	µg/L
1,1,2-Trichloroethane	---	---	---	---	0.200	µg/L
1,1,2-Trichlorotrifluoroethane	---	---	---	---	0.200	µg/L
1,1-Dichloroethane	---	---	---	---	0.200	µg/L
1,1-Dichloroethylene	---	---	---	---	0.200	µg/L
1,1-Dichloropropene	---	---	---	---	0.200	µg/L
1,2,3-Trichlorobenzene	---	---	---	---	0.200	µg/L
1,2,3-Trichloropropane	---	---	---	---	0.200	µg/L
1,2,4-Trichlorobenzene	---	---	---	---	0.200	µg/L
1,2,4-Trimethylbenzene	---	---	---	---	0.200	µg/L
1,2-Dibromo-3-chloropropane	---	---	---	---	1.00	µg/L
1,2-Dibromoethane	---	---	---	---	0.200	µg/L
1,2-Dichlorobenzene	---	---	---	---	0.200	µg/L
1,2-Dichloroethane	---	---	---	---	0.200	µg/L
1,2-Dichloropropane	---	---	---	---	0.200	µg/L
1,3,5-Trimethylbenzene	---	---	---	---	0.200	µg/L
1,3-Dichlorobenzene	---	---	---	---	0.200	µg/L
1,3-Dichloropropane	---	---	---	---	0.200	µg/L
1,4-Dichlorobenzene	---	---	---	---	0.200	µg/L
2,2-Dichloropropane	---	---	---	---	0.200	µg/L
2-Chlorotoluene	---	---	---	---	0.200	µg/L
4-Chlorotoluene	---	---	---	---	0.200	µg/L
4-Isopropyl-1-methylbenzene	---	---	---	---	0.200	µg/L
Benzene	---	---	---	---	0.200	µg/L
Bromobenzene	---	---	---	---	0.200	µg/L
Bromochloromethane	---	---	---	---	0.200	µg/L
Bromodichloromethane	---	---	---	---	0.200	µg/L
Bromoform	---	---	---	---	0.200	µg/L
Bromomethane	---	---	---	---	0.200	µg/L
Butylbenzene	---	---	---	---	0.200	µg/L
Chlorobenzene	---	---	---	---	0.200	µg/L
Chloroethane	---	---	---	---	0.200	µg/L
Chloroform	---	---	---	---	0.200	µg/L
Chloromethane	---	---	---	---	0.200	µg/L
cis-1,2-Dichloroethylene	---	---	---	---	0.200	µg/L
cis-1,3-Dichloropropene	---	---	---	---	0.200	µg/L
Dibromochloromethane	---	---	---	---	0.200	µg/L

Table 4. Concentrations of trace metals and organic contaminants in water from three wells in Kaloko-Honokohau National Historical Park, Island of Hawaii, and one well upgradient of industrial activity--Continued

[---, constituent was not detected by the analysis at the standard minimum reporting level; E, estimated concentration for detection below the minimum reporting level; µg/L, micrograms per liter]

	Well no. and name				Minimum reporting level	Units
	4061-01 (Kaho 1)	4161-02 (Kaho 2)	4161-01 (Kaho 3)	4358-01 (Kalaoa)		
Volatile organic compounds (USGS lab schedule 1380)--Continued						
Dibromomethane	---	---	---	---	0.200	µg/L
Dichlorodifluoromethane	---	---	---	---	0.200	µg/L
Dichloromethane	---	---	---	---	0.200	µg/L
Ethylbenzene	---	---	---	---	0.200	µg/L
Hexachlorobutadiene	---	---	---	---	0.200	µg/L
Isopropylbenzene	---	---	---	---	0.200	µg/L
Naphthalene	---	---	---	---	0.200	µg/L
Propylbenzene	---	---	---	---	0.200	µg/L
sec-Butylbenzene	---	---	---	---	0.200	µg/L
Styrene	---	---	---	---	0.200	µg/L
tert-Butyl methyl ether	---	---	---	---	0.200	µg/L
tert-Butylbenzene	---	---	---	---	0.200	µg/L
Tetrachloroethylene	---	---	---	---	0.200	µg/L
Tetrachloromethane	---	---	---	---	0.200	µg/L
Toluene	---	---	---	---	0.200	µg/L
trans-1,2-Dichloroethylene	---	---	---	---	0.200	µg/L
trans-1,3-Dichloropropene	---	---	---	---	0.200	µg/L
Trichloroethylene	---	---	---	---	0.200	µg/L
Trichlorofluoromethane	---	---	---	---	0.200	µg/L
Vinyl chloride	---	---	---	---	0.200	µg/L
Xylene	---	---	---	---	0.200	µg/L
Semi-volatile organic compounds (USGS lab schedule 1383)						
1,2-Diphenylhydrazine	---	---	---	---	5.00	µg/L
2,4,6-Trichlorophenol	---	---	---	---	20.0	µg/L
2,4-Dichlorophenol	---	---	---	---	5.00	µg/L
2,4-Dimethylphenol or Dichlorprop	---	---	---	---	5.00	µg/L
2,4-Dinitrophenol	---	---	---	---	20.0	µg/L
2,4-Dinitrotoluene	---	---	---	---	5.00	µg/L
2,6-Dinitrotoluene	---	---	---	---	5.00	µg/L
2-Chloronaphthalene	---	---	---	---	5.00	µg/L
2-Chlorophenol	---	---	---	---	5.00	µg/L
2-Nitrophenol	---	---	---	---	5.00	µg/L
3,3'-Dichlorobenzidine	---	---	---	---	20.0	µg/L
4,6-Dinitro-2-methylphenol	---	---	---	---	30.0	µg/L
4-Bromophenylphenylether	---	---	---	---	5.00	µg/L
4-Chloro-3-methylphenol	---	---	---	---	30.0	µg/L
4-Chlorophenyl phenyl ether	---	---	---	---	5.00	µg/L
4-Nitrophenol	---	---	---	---	30.0	µg/L
Acenaphthene	---	---	---	---	5.00	µg/L
Acenaphthylene	---	---	---	---	5.00	µg/L
Anthracene	---	---	---	---	5.00	µg/L
Benz[a]anthracene	---	---	---	---	10.0	µg/L
Benzidine	---	---	---	---	40.0	µg/L
Benzo[a]pyrene	---	---	---	---	10.0	µg/L
Benzo[b]fluoranthene	---	---	---	---	10.0	µg/L
Benzo[ghi]perylene	---	---	---	---	10.0	µg/L
Benzo[k]fluoranthene	---	---	---	---	10.0	µg/L
bis(2-Chloroethoxy)methane	---	---	---	---	5.00	µg/L
bis(2-Chloroethyl)ether	---	---	---	---	5.00	µg/L
bis(2-chloroisopropyl) ether	---	---	---	---	5.00	µg/L
Bis(2-ethylhexyl) phthalate	---	---	---	---	5.00	µg/L
Butylbenzyl phthalate	---	---	---	---	5.00	µg/L

Table 4. Concentrations of trace metals and organic contaminants in water from three wells in Kaloko-Honokohau National Historical Park, island of Hawaii, and one well upgradient of industrial activity--Continued

(---, constituent was not detected by the analysis at the standard minimum reporting level; E, estimated concentration for detection below the minimum reporting level; µg/L, micrograms per liter)

	Well no. and name				Minimum reporting level	Units
	4061-01 (Kaho 1)	4161-02 (Kaho 2)	4161-01 (Kaho 3)	4358-01 (Kalaoa)		
Semi-volatile organic compounds (USGS lab schedule 1383)--Continued						
Chrysene	---	---	---	---	10.0	µg/L
Di-n-butyl phthalate	---	---	---	---	5.00	µg/L
Di-n-octyl phthalate	---	---	---	---	10.0	µg/L
Dibenz[a,h]anthracene	---	---	---	---	10.0	µg/L
Diethyl phthalate	---	---	---	---	5.00	µg/L
Dimethyl phthalate	---	---	---	---	5.00	µg/L
Fluoranthene	---	---	---	---	5.00	µg/L
Fluorene	---	---	---	---	5.00	µg/L
Hexachlorobenzene	---	---	---	---	5.00	µg/L
Hexachlorocyclopentadiene	---	---	---	---	20.0	µg/L
Hexachloroethane	---	---	---	---	5.00	µg/L
Indeno[1,2,3-cd]pyrene	---	---	---	---	10.0	µg/L
Isophorone	---	---	---	---	5.00	µg/L
N-Nitrosodi-n-propylamine	---	---	---	---	5.00	µg/L
N-Nitrosodimethylamine	---	---	---	---	5.00	µg/L
N-Nitrosodiphenylamine	---	---	---	---	5.00	µg/L
Nitrobenzene	---	---	---	---	5.00	µg/L
Pentachlorophenol	---	---	---	---	30.0	µg/L
Phenanthrene	---	---	---	---	5.00	µg/L
Phenol	7.14	9.17	E4.33	---	5.00	µg/L
Pyrene	---	---	---	---	5.00	µg/L
Organochlorine and organophosphate pesticides (USGS lab schedule 1334)						
Aldrin	---	---	---	---	0.010	µg/L
alpha-Endosulfan	---	---	---	---	0.010	µg/L
Carbophenothion	---	---	---	---	0.010	µg/L
Chlordane, technical mix	---	---	---	---	0.100	µg/L
Chlorpyrifos	---	---	---	---	0.010	µg/L
DEF	---	---	---	---	0.020	µg/L
Diazinon	---	---	---	---	0.010	µg/L
Dieldrin	---	---	---	---	0.010	µg/L
Disulfoton	---	---	---	---	0.030	µg/L
Endrin	---	---	---	---	0.010	µg/L
Ethion	---	---	---	---	0.010	µg/L
Fonofos	---	---	---	---	0.010	µg/L
Heptachlor	---	---	---	---	0.010	µg/L
Heptachlor epoxide	---	---	---	---	0.010	µg/L
Lindane	---	---	---	---	0.010	µg/L
Malathion	---	---	---	---	0.050	µg/L
Mirex	---	---	---	---	0.010	µg/L
p,p'-DDD	---	---	---	---	0.010	µg/L
p,p'-DDE	---	---	---	---	0.010	µg/L
p,p'-DDT	---	---	---	---	0.010	µg/L
p,p'-Methoxychlor	---	---	---	---	0.010	µg/L
Parathion	---	---	---	---	0.010	µg/L
Parathion-methyl	---	---	---	---	0.100	µg/L
Perthane	---	---	---	---	0.010	µg/L
Phorate	---	---	---	---	0.100	µg/L
Polychlorinated biphenyls	---	---	---	---	0.10	µg/L
Polychlorinated naphthalenes	---	---	---	---	1.00	µg/L
Toxaphene	---	---	---	---		

1. Petroleum constituents which tend to adsorb to soil
   Benzo(a) Pyrene
   Phenanthrene
   Benz (a) Anthracene

3. Petroleum constituents which tend to solubilize in groundwater
   Phenol

4. Petroleum constituents with multiple pathways (mixed tendencies)
   Benzene
   Ethylbenzene
   Napthalene
   Toluene
   (o) Xylene

Testing of three downgradient wells and one upgradient well did not detect any of the petroleum constituents with the exception of trace levels of phenol at levels approximately 20,000 times lower than EPA standards for cleanup of drinking water. The levels are also much lower than State of Hawaii water quality standards.

The testing did not indicate the presence of any other organic constituents, although approximately 130 organic constituents were tested for. Two trace metals were detected, but were also found in an upgradient well, and are believed to be likely due to decomposition of volcanic materials.

The proposed action is the creation of a new phase of the existing industrial park, with similar land uses. The existing industrial park therefore serves as a "field test" for the proposed expansion. The groundwater monitoring conducted by the USGS provides a measurement of the results of the "field test". The presence of phenol in the USGS monitoring wells indicates that some petroleum hydrocarbons have been released during the approximate 15-year history of the existing industrial park. Although phenol can be found in many industrial products, the use and storage of petroleum based fuels, oils, solvents, and pesticides is the most likely source of a phenol release from the existing industrial park.

The presence of phenol and the absence of other petroleum hydrocarbon constituents would appear to be a "field test" validation of the analytical assessment of the environmental fate of released petroleum hydrocarbons described in this report. The presence of phenol and no other organic constituent indicates that while petroleum hydrocarbons have been released to the environment, all but the most soluble constituent, phenol, has been retained and likely naturally remediated within the subsurface environment in the vicinity of the existing Industrial Park. The very low levels of phenol are also confirmation of the very active subsurface environment which promotes the degradation of such organic compounds.

5.0 CONCLUSIONS

The environmental fate analysis indicates that the constituents of even a worst-case spill of 10,000 gallons of gasoline from a point source would be adsorbed and contained within the immediate vicinity of the Business Park, with some migration possible under the adjacent Queen Kaahumanu Highway for a worst case release from a site adjacent to the Highway. This is particularly true for the constituents that sorb readily to soil, such as benz (a) pyrene, and which have mixed tendencies (sorb to soil, volatilize readily and are soluble in groundwater), such as benzene. The most soluble constituent may migrate beyond the boundaries of the Business Park and the Highway in the event of a release, but the very active environment would result in rapid natural remediation due to degradation and volatilization.

The results of the environmental fate analysis are supported by the groundwater monitoring conducted by the USGS, which indicate trace levels of phenol downgradient of the existing Industrial Park.

We conclude that releases of petroleum product within the proposed Business Park would be highly unlikely to affect the groundwater in the Kaloko-Honokohau National Historic Park, as has been historically the case.

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POLLUTION PREVENTION PLAN
KALOKO-HONOKOHAU BUSINESS PARK
NORTH KONA, ISLAND OF HAWAII

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Appendices

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State Form "Certification of Underground Storage Tank Installation"

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Appendix C — Portions of HAR §11-23 (Underground Injection Control)
State Application for Underground Injection Control Permit

Appendix D — EPA's Fact Sheet for Generators and Transporters of Hazardous Waste
EPA Form 8700-12 "Notification of Regulated Waste Activity"
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Portions of HAR §11-263 Hazardous Waste Management; Standards Applicable to Transporters of Hazardous Waste

Appendix E — Portions of HAR §4-66 Pesticides

LIST OF ACRONYMS AND ABBREVIATIONS

AAQS	Ambient Air Quality Standards
ACM	asbestos-containing material
BMP	Best Management Practice
CAB	Clean Air Branch (State Department of Health)
CWB	Clean Water Branch (State Department of Health)
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CERFA	Community Environmental Response Facilitation Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
DOA	Department of Agriculture
DOH	Department of Health (State of Hawaii)
DOT	Department of Transportation
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
HAR	Hawaii Administrative Rules
HEPCRA	Hawaii Emergency Planning and Community Right-to-Know Act
HRS	Hawaii Revised Statutes
MCX	Industrial-Commercial Mixed District
MFA	Masa Fujioka & Associates
ML	Limited Industrial District
NPDES	National Pollutant Discharge Elimination System
OSWM	Office of Solid Waste Management (State Department of Health)
PCB	polychlorinated biphenyl
POTW	publicly owned treatment works
SDWB	Safe Drinking Water Branch (State Department of Health)
SPCC	Spill Prevention, Control, and Countermeasures Plan
TSCA	Toxic Substances Control Act
UIC	Underground Injection Control
US	United States
USC	United States Code
UST	underground storage tank
WQS	Water Quality Standards

1.0 INTRODUCTION

1.1 Project Description

Lanihau Partners, L. P. proposes to develop the Kaloko-Honokohau Business Park in the Kaloko area, North Kona, Island of Hawaii. The park would consist of approximately 337 acres, situated on the mauka side of Queen Kaahumanu Highway. Existing Phases I and II and the proposed Phases II & IV of the Kaloko Industrial Park are situated immediately north of the proposed Kaloko-Honokohau Business Park. The existing Honokohau Business Park is located immediately south of the proposed Kaloko-Honokohau Business Park.

Development of the Kaloko-Honokohau Business Park for industrial and commercial uses and for the retention and expansion of ongoing quarrying activities is envisioned to occur in three phases over a period of more than 20 years. Of the site's 337 acres, 285 would be in roadways and unused areas.

1.2 Purpose

The proposed Kaloko-Honokohau Business Park is situated east of the Kaloko-Honokohau National Historic Park. The Historic Park contains two ponds that are brackish bodies of water separated from the ocean by a basaltic rock wall (Kaloko Pond) and a sand beach berm (Aimakapa Pond). Kaloko Pond is approximately 11 acres in size and Aimakapa Pond is approximately 15 acres in size.

This Pollution Prevention Plan (P2 Plan) has been prepared in conjunction with a study that addresses the potential for contaminants from industrial activities in the proposed Business Park to affect the local groundwater system and the ponds (*Potential Impact on Groundwater Resources, Kaloko-Honokohau Business Park, North Kona, Island of Hawaii. Masa Fujioka & Associates, January 2001*). Limiting potential contamination can be accomplished by adherence to the applicable laws and regulations and implementation of appropriate Best Management Practices (BMPs). Handling and storage of potential contaminants are strictly controlled under State and Federal laws. Businesses that deal with these substances are required under law to implement BMPs and are subject to oversight by Federal, State, and local agencies. The Plan evaluates potential contaminants from industrial operations, identifies applicable Federal, State, and local regulations, and provides BMPs.

1.3 Users

This P2 Plan will be provided to all individual lot owners and tenants/operators of the proposed industrial/commercial lots.

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1.4 Format and Organization

The P2 Plan assesses potential contaminants from industrial operations and provides owners/operators with guidance for environmental compliance for likely contaminants that might affect the Kaloko-Honokohau National Historic Park ponds. Section 2.0 discusses limitations of the P2 Plan. Section 3.0 identifies allowable land uses and potential sources of contamination that might result from those land uses.

Section 4.0 discusses the requirements mandated by environmental regulations applicable to the potential contaminants. For most potential pollutants, the environmental laws and regulations specify certain actions which must be taken. In this section, we have summarized the actions specified by the regulations. Sections are preceded by a checklist for use by owners/operators.

Section 5.0 discusses the applicability of Best Management Practices (BMPs) to mitigate the release of potential pollutants. For most of the potential contaminant sources, structural BMPs are not applicable, but some BMPs are required by the regulations and are summarized.

Section 6.0 contains contact information for regulatory agencies.

2.0 LIMITATIONS

This P2 Plan provides guidance regarding the environmental laws and regulations that are likely to apply to specific types of light industrial/commercial activities anticipated at the proposed development. Since the chief environmental concern at the subject site is contamination of the groundwater and Kaloko-Honokohau National Historic Park ponds, the Plan addresses the types of activities and resulting contaminants that have the potential to result in groundwater contamination.

Other types of activities at the industrial park may be regulated under other environmental regulations (e.g., clean air, solid waste, environmental response, community-right-to-know) that are not relevant to potential contamination of groundwater and the ponds and that are not discussed in this plan. The exclusion of such environmental issues from this plan does not relieve owners/operators from fulfilling their obligations under applicable regulations.

Also, because of anticipated changes to environmental laws and regulations, a reader addressing a specific environmental issue should consult the latest version of the laws and regulations.

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3.0 POTENTIAL CONTAMINANTS FROM INDUSTRIAL OPERATIONS

3.1 Allowable Land Uses

All lands in the State are classified into four land use districts, i.e., Urban, Agricultural, Conservation, and Rural, by the State Land Use Commission. The developers have proposed changing the use district for the proposed project property from Conservation to Urban.

The Hawaii County Zoning Code regulates the use of lands within the State Urban, Agricultural, and Rural Districts on the island of Hawaii. The project property will be reclassified as ML, Limited Industrial District and MCX, Industrial-Commercial Mixed District.

The ML, Limited Industrial District, "applies to areas for business and industrial uses which are generally in support of but not necessarily compatible with those permissible activities in other commercial districts." The purpose of the MCX, Industrial-Commercial Mixed district "is to allow mixing of some industrial uses with commercial uses. The intent of this district is to provide for areas of diversified businesses and employment opportunities by permitting a broad range of uses, without exposing nonindustrial uses to unsafe and unhealthy environments. This district is intended to promote and maintain a viable mix of light industrial and commercial uses."

Uses in both of these districts are limited to those which have few environmental impacts. Permitted uses in the ML and MCX Districts are shown in Table 1.

3.2 Potential Sources of Contaminants

The proposed development will be limited to light industrial and industrial-commercial activities, limiting potential sources of contaminants. Also, today's strict environmental controls and regulations effectively limit the likelihood that releases of contaminants would occur.

The majority of permitted uses within the ML and MCX districts are not expected to have associated environmental concerns that could affect the groundwater and ponds. For each permitted use, Table 1 also contains a list of contaminants of concern that could potentially affect groundwater if a release occurred. The potential contaminants can be categorized into three main groups: petroleum products; hazardous material/waste (hazmat/waste) and pesticides.

A number of the permitted uses, including automobile sales and rentals, automobile service stations, car washing, manufacturing and processing, automobile and truck storage

facilities, contractors' yards, heavy equipment sales, and transportation and tour terminals, may use and store petroleum products at their facilities. Two facilities, Tesoro Gas Express and Honsador Lumber, at the existing Kaloko Industrial Park have underground storage tanks (USTs), and other facilities at the existing park use petroleum products in maintenance operations. Similar uses might be expected in the proposed Phase III and IV.

The potential for petroleum products to reach the ocean/ponds from a non-point source (e.g., petroleum entrained in stormwater flow) or a point source (e.g., storage tank release) was considered. However, given the site characteristics, neither scenario is likely.

Surface water (including stormwater) flow to the ponds/ocean is highly unlikely, due to:

(1) the location of the proposed industrial park, i.e., its distance from the ponds and ocean;

(2) the highly permeable nature of the rock in the project area; and

(3) the lack of natural or manmade waterways that can deliver surface water flow from the industrial park area to the ponds/ocean.

Therefore, National Pollutant Discharge Elimination System (NPDES) permits, required under the Clean Water Act for any discharges to waters of the United States, would not be required for industrial generators of stormwater, since that water would not reach the ocean (or ponds). Structural BMPs to control or limit contamination in stormwater or to limit the flow of stormwater would also not be required.

The potential for petroleum products to reach the ocean/ponds from releases from underground or aboveground storage tanks was also considered. In a study of the potential impact of a large release on area groundwater resources (*Potential Impact on Groundwater Resources, Kaloko-Honokohau Business Park, North Kona, Island of Hawaii. Masa Fujioka & Associates, January 2001*), it was determined that subsurface soil and groundwater characteristics limit the likelihood that even a significant petroleum release would migrate much beyond the industrial park boundaries. Also, while releases from storage tanks have occurred in the past throughout the State, these releases occurred prior to the implementation of strict regulatory requirements for double containment and monitoring. These current environmental regulations now make such releases very unlikely. These regulations are summarized in Section 4.0 of this P2 plan; they must be followed by any owner/operator of a storage tank. BMPs that can be used to control the release of contamination from underground and aboveground storage tanks are discussed in Section 5.0.

Light manufacturing and processing facilities may generate hazardous waste. One facility, Costco Wholesale, at the nearby Kaloko Industrial Park is listed as a RCRA large quantity generator. According to a Costco manager, Costco conducts silver recovery as part

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of their one-hour photo processing; the silver is removed from the site as waste. Due to the nature of permitted uses in ML and MCX districts, hazardous waste issues are anticipated to be minimal and hazardous waste releases would be unlikely to migrate to groundwater and affect the ocean/ponds. However, some waste oil or other petroleum product may be regulated as a hazardous waste, so the applicable regulations are discussed in Section 4.0.

Pesticides may be used at the site and may also be stored by plant nurseries. Use of pesticides at the site is highly unlikely to affect the ocean/ponds, due to the limited quantities likely to be used (likely limited to minimal use on small landscaped areas), the distance from the park to the ocean/ponds, and the lack of surface water flow from the park to the ocean/ponds. Applicable regulations regarding pesticides are discussed in Section 4.0.

Quarry operations at the proposed Business Park have not resulted in and are highly unlikely to result in contamination of the ocean/ponds. Operation and maintenance of heavy equipment in the quarry area may result in generation of waste petroleum products or other waste. These items would be covered under the sections addressing petroleum products and hazardous waste (Sections 4.2, 4.3, 5.2, and 5.3).

Table 1. Permitted Uses, Limited Industrial (ML) and Industrial-Commercial Mixed Use (MCX) Districts

Permitted Use	ML	MCX	Contaminants of Concern
Agricultural products processing, minor	√	√	petroleum, pesticides
Airfields, heliports, and private landing strips	√		petroleum
Amusement and recreation facilities; indoor		√	none
Animal hospitals and quarantine stations	√		none
Aquaculture activities	√		none
Art galleries, museums		√	none
Automobile and truck storage facilities	√		petroleum
Automobile sales and rentals	√	√	petroleum
Automobile service stations		√	petroleum
Bakeries	√		none
Bars and nightclubs	√	√	none
Broadcasting stations	√	√	none
Business services		√	none
Car washing	√	√	petroleum
Carpentry, hardwood products and furniture manufacturing and storage establishments	√		none
Catering establishments	√	√	none
Cemeteries and mausoleums	√	√	none
Churches, temples, and synagogues	√	√	none
Cleaning and dyeing plants	√		hazmat/waste
Cleaning plants using only non- flammable hydrocarbons in a sealed unit as the cleaning agent		√	hazmat/waste
Commercial parking lots and garages	√	√	petroleum
Community buildings	√	√	none
Contractors' yards for equipment, material, and vehicle storage, repair, or maintenance	√		petroleum
Convenience stores		√	none
Data processing facilities		√	none
Day-care centers	√	√	none
Financial institutions	√	√	none
Food manufacturing and processing facilities	√	√	petroleum, food oil
Greenhouses, plant nurseries	√		pesticides
Heavy equipment sales, service, and rental	√		petroleum
Home improvement centers	√	√	none
Junk yards, provided that the building site is not less than one acre	√		petroleum, hazmat/waste
Kennels in sound attenuated buildings		√	none

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Table 1 (continued). Permitted Uses, Limited Industrial (ML) and Industrial-Commercial Mixed Use (MCX) Districts

Permitted Use	ML	MCX	Contaminants of Concern
Laboratories, medical and research	√	√	hazmat/waste
Laundries	√		none
Lumber and building material yards, not including concrete/asphalt mixing and fabrication by riveting or welding of steel bldg frames	√		hazmat/waste
Manufacturing, processing and packaging establishments, light	√	√	petroleum, hazmat/waste
Medical clinics		√	hazmat/waste
Meeting facilities		√	none
Motion picture and television production studios	√	√	none
Offices		√	none
Photographic processing	√	√	hazmat/waste
Photography studios		√	none
Plant nurseries		√	pesticides
Plumbing, electrical, air conditioning, and heating establishments	√		none
Public uses and structures	√	√	none
Publishing plants (newspapers, books, magazines, printing shops, cartographing); duplicating processes (blueprinting/photostating)	√	√	hazmat/waste
Recycling centers, which do not involve processing of materials	√		none
Repair establishments, minor	√	√	none
Restaurants	√	√	none
Retail establishments		√	none
Sales and service of machinery used in agricultural production		√	petroleum
Schools, business, photography, art, music, and dance		√	none
Schools, vocational	√	√	none
Self-storage facilities	√	√	none
Storage and sale of seed, feed, fertilizer and other products essential to agricultural production	√		pesticides
Telecommunications antennas	√	√	none
Temporary real estate offices	√	√	none
Theaters		√	none
Transportation and tour terminals	√		petroleum
Truck, freight and draying terminals	√		petroleum
Utility facilities, public and private, including offices or yards for equipment, material, vehicle storage, repair or maintenance	√		petroleum
Utility substations	√	√	none
Veterinary establishments	√		hazmat/waste
Warehousing		√	hazmat/waste
Wholesaling and distribution operations	√		none

4.0 REQUIREMENTS OF APPLICABLE REGULATIONS

4.1 Overview

The majority of permitted uses within the ML and MCX districts are not expected to have associated environmental concerns that could affect the groundwater and ponds. Potential contaminants that might originate from the park can be categorized into three main groups: petroleum products; hazardous material/waste (hazmat/waste) and pesticides. The applicable environmental regulations for these substances are summarized in this section. If these substances are of concern at a particular facility, the owner/operator should refer to the applicable regulations for complete information.

4.2 Petroleum Products

Underground Storage Tanks

The storage of petroleum in underground tanks is strictly regulated by the State Department of Health (DOH) and the Federal Environmental Protection Agency (EPA). DOH is seeking delegation of its underground storage tank program from EPA and, as part of the delegation process, has adopted new State UST rules (Hawaii Administrative Rules (HAR) §11-281). Portions of HAR §11-281 are attached in Appendix A.

A permit is required for installation of USTs in Hawaii. The Application for an Underground Storage Tank Permit is attached in Appendix A. Once the USTs are installed, a completed Certificate of Underground Storage Tank Installation (also contained in Appendix A) must be submitted to DOH's Underground Storage Tank Section. Several types of USTs are exempted from state and federal regulation by definition; the rules should be checked for the terms of such exemptions.

The rules contain requirements for performance standards for USTs; installation of USTs; notifications and permits; spill and overflow control; release detection; release reporting, investigation and confirmation; release response action; and closure. These standards have been designed to protect the environment from releases from USTs. The following requirements were extracted from the applicable regulations, but the applicable State and Federal regulations must be consulted for the complete requirements:

- Tank requirements

  Each UST must be properly designed, constructed and installed, and any portion underground that routinely contains product must be protected from corrosion. The regulations give the corrosion protection standard and examples of corrosion

protection methods, such as constructing the tank of fiberglass-reinforced plastic, cathodically protected steel, or steel-fiberglass-reinforced plastic composite.

- Piping requirements

  The piping that routinely contains regulated substances and is in contact with the ground must be properly designed, constructed, and protected from corrosion. The regulations give the corrosion protection standard and examples of corrosion protection methods, such as constructing the piping of fiberglass-reinforced plastic, or cathodically protected steel.

- Spill and overfill protection

  To prevent spilling and overfilling associated with product transfer to a UST or tank system, owners/operators of tanks filled by transfers of more than 25 gallons at one time must use both spill and overfill prevention equipment. Spill prevention equipment must prevent release of product to the environment when the transfer hose is detached from the fill pipe. Overfill prevention equipment must automatically shut off flow into the UST or trigger a high-level alarm when the UST reaches certain fill percentages. Spill and overfill prevention methods that rely on the use of alarms must have the alarms clearly labeled and located where the delivery person can clearly see or hear the alarm in order to immediately stop delivery of the product.

- Installation

  All USTs and piping must be properly installed to prevent damage that may result in releases. Owners/operators must ensure that the installation is appropriately certified, tested, or inspected. Certification, testing, and inspection requirements are specified in the regulations.

- Permits

  DOH has a number of permit requirements for installation and operation of USTs; copies of the most recent version (June, 1999) **"Application for an Underground Storage Tank Permit"** and **"Certification of Underground Storage Tank Installation"** are attached in Appendix A. Other permit requirements are specified in the regulations.

- Secondary Containment

  Secondary containment systems must be designed, constructed, and installed to contain regulated substances released from the UST or tank system until they are detected and removed; prevent the release of regulated substances to the environment at any time during the operational life of the UST or tank system; and provide release detection so that the system can be checked for evidence of a

release at least every thirty calendar days. Secondary containment may consist of double-walled USTs or external liners; requirements for these containment methods are contained in the regulations.

Underground piping must also be equipped with secondary containment (e.g., trench liners, double-walled pipes, etc.). In addition, pressurized piping must be equipped with an automatic line leak detector.

- Release Detection

Owners and operators of new USTs or tank systems must provide release detection that can detect a release from any portion of the UST and connected underground piping. Release detection must be installed, calibrated, operated, and maintained in accordance with the manufacturer's instructions, including routine maintenance and service checks for operability (every twelve months or in a timeframe specified by the manufacturer). Release detection methods must meet specific performance requirements for tanks and for piping, as specified in the regulations.

Tanks must be monitored at least every thirty days for releases using automatic tank gauging; vapor monitoring; interstitial monitoring; or other methods that meet DOH's performance criteria. Groundwater monitoring, described as a release detection method in the HAR, cannot be used as a release detection method at this site because the groundwater is more than twenty feet from the ground surface.

Piping must also be monitored. A test every twelve months of the operation of the piping leak detector must be conducted in accordance with the manufacturer's requirements.

- Release Detection Recordkeeping

Owners/operators of USTs or tank systems must keep and maintain records demonstrating compliance with all applicable release detection requirements. The records must be kept at least one year, unless otherwise specified; requirements are contained in the regulations.

Owners/operators of USTs or tank systems must notify the department within 24 hours if a release is suspected or known.

- Release Response

Upon confirmation of a release, or after a release from the UST or tank system is identified in any other manner, owners and operators must perform the following **immediate response actions within 24 hours** following the confirmation:

(1) Report the release to the department (e.g., by telephone or fax);

(2) Identify and mitigate any safety hazards (such as fire, explosion, and vapor hazards) posed by the release of the regulated substance;
(3) Take necessary actions to prevent any further release of the regulated substance into the environment, including removal of as much of the regulated substance from the UST or tank system as possible; and
(4) Take necessary action to minimize the spread of contamination.

Owners and operators must submit to the DOH a **written notice of confirmation within seven days.** The notice shall include the source of the release; method of discovery and confirmation; estimated quantity and type of substance released; immediate hazards; release impact; migration pathways; and actions taken. Other information may be requested by DOH.

After a release has been confirmed, owners and operators must perform **initial release abatement and control measures within 90 days** of confirmation of a release or sooner if directed by the DOH. Abatement and control measures are detailed in the regulations.

While carrying out the above release response actions, owners and operators must concurrently assemble information about the characteristics of the site and the nature of the release in order to adequately assess the impact or potential impact the release has on human health and the environment.

At sites where investigations indicate the presence of free product, owners and operators must remove free product to the maximum extent practicable, as determined by the DOH, while continuing, as necessary, other release response actions. Owners/operators shall initiate **free product removal as soon as practicable but no later than 90 days following confirmation** of a release or sooner if directed by the DOH. Requirements for free product removal are detailed in the regulations.

For confirmed releases, owners/operators must determine the extent and location of the soil contaminated by the release and the presence and concentrations of dissolved product contamination in the groundwater and must conduct investigations of the release, the release site, and the surrounding area possibly affected by the release. Owners/operators must remediate soil, water, and materials contaminated by releases from USTs or tank systems in a manner which is protective of human health and the environment and achieves cleanup satisfactory to DOH.

The DOH may require that the owner/operator submit a written **corrective action plan** for responding to a release, if the release poses, among other criteria, a **probable adverse impact to natural resources.**

No later than 90 days following the confirmation of a release, owners and operators must submit to DOH a **written report** describing all release response actions taken during the first ninety-day period following the release; and a plan

for future release response actions. Beginning 180 days following confirmation of a release, owners and operators must submit written quarterly progress reports (unless response actions have met the requirements of DOH and a final quarterly report has been submitted).

- Tank Closure

  The regulations provide guidance for closure of tanks that are not in service, to prevent releases from such tanks. Owners and operators must perform a site assessment in permanently closing or changing the service of an UST or tank system. Before permanent closure or a change-in-service is completed, owners and operators must measure for the presence of a release of regulated substance where contamination is most likely to be present at the UST or tank system site.

Spill Prevention Control and Countermeasures Plan

Facilities who store petroleum in the proposed industrial park could also be subject to EPA Clean Water Act regulations, since they could "discharge oil in harmful quantities into or upon navigable waters or adjoining shorelines". Preparation and implementation of a Spill Prevention Control and Countermeasure (SPCC) plan, designed to prevent discharge of oil to navigable waters and adjacent shorelines, is described in Code of Federal Regulations (CFR) Title 40, Part 112 (portions contained in Appendix B). Prior to the installation of above-ground or underground storage tanks, the applicable State and Federal regulations must be consulted for the complete requirements.

An SPCC plan must be prepared and implemented for oil storage facilities that meet the following:

1. The underground buried storage capacity of the facility is greater than 42,000 gallons; or
2. The total above ground storage capacity of the facility is greater than 1,320 gallons or a single above ground container has a capacity in excess of 660 gallons.

40 CFR §112.7 contains guidelines for the preparation and implementation of a SPCC Plan (Appendix B), as well as for monitoring and employee training. The following information was extracted from applicable Federal regulations, but the applicable regulations must be consulted for the complete requirements:

- Preparation of the SPCC Plan

  The SPCC Plan must be prepared within six months after the date a regulated facility begins operations and must be fully implemented not later than one year after a facility begins operations. The SPCC plan must be reviewed and certified

by a Registered Professional Engineer. A complete copy of the Plan must be maintained at the facility if the facility is normally attended at least 8 hours per day, or at the nearest field office if the facility is not so attended.

Owners/operators must amend the SPCC Plan whenever there is a change in facility design, construction, operation or maintenance which materially affects the facility's potential for the discharge of oil. Such amendments must be made as soon as possible, but no later than six months after such change occurs. Amendments must be certified by a Professional Engineer.

Owners/operators must review and evaluate the SPCC Plan at least once every three years. As a result of the review and evaluation, the owner/operator will amend the SPCC Plan within six months of the review to include more effective prevention and control technology if (1) such technology will significantly reduce the likelihood of a spill event from the facility, and (2) if such technology has been field-proven at the time of the review. Amendments must be certified by a Professional Engineer.

- Elements of the SPCC Plan

The SPCC Plan must contain the following information:

(1) Description of spills, corrective action taken and plans for preventing recurrence;
(2) A prediction of the direction, rate of flow, and total quantity of oil which could be discharged from the facility as a result of equipment failures.
(3) Appropriate containment and/or diversionary structures or equipment to prevent discharged oil from reaching a navigable water course.

Sections of the Plan should include a complete discussion of conformance with the regulatory guidelines for facility drainage; bulk storage tanks; facility transfer operations, pumping, and in-plant processes; facility tank truck loading/ unloading racks; and security measures.

The plan should specify requirements for inspections and record-keeping. Inspections should be in accordance with written procedures developed for the facility by the owner or operator. These written procedures and a record of the inspections, signed by the appropriate supervisor or inspector, should be made part of the SPCC Plan and maintained for a period of three years.

The plan should specify requirements for personnel training and spill prevention procedures. Owners or operators are responsible for properly instructing their personnel in the operation and maintenance of equipment to prevent the discharges of oil and applicable pollution control laws, rules and regulations. Each applicable facility should have a designated person who is accountable for oil spill

prevention and who reports to line management. Owners or operators should schedule and conduct spill prevention briefings for their operating personnel at intervals frequent enough to assure adequate understanding of the SPCC Plan for that facility. Such briefings should highlight and describe known spill events or failures, malfunctioning components, and recently developed precautionary measures.

Potential industrial park facilities would be unlikely to meet the criteria triggering the requirement for preparation of a Facility Response Plan. Therefore, the EPA would not likely require preparation and submittal of a Facility Response Plan (described in CFR 40 §112.20) or Facility Response Training (described in CFR 40 §112.21) for industrial park owners/operators.

Vehicle washing facilities

Mechanized vehicle washing facilities may be restricted by the County Planning Department from allowing water runoff onto adjacent properties or public rights-of-way. Vehicle washing facilities may be required to recycle their water, or they may be able to discharge water to an injection well or wastewater system with potential pretreatment requirements.

Injection wells are regulated under the Safe Drinking Water Act, and in Hawaii are administered by the State's Safe Drinking Water Branch (SDWB) under HAR §11-23, "Underground Injection Control" (portions contained in Appendix C). The State's underground injection control (UIC) program establishes standards which govern the location, construction, and operation of injection wells so that the injected fluids do not migrate or pollute groundwater.

Injection wells are categorized by the State by the type of fluids which are injected into the well and the aquifer characteristics. According to DOH's UIC Map for Keahole Point quadrant (DOH, 1983), the site is located below the UIC line and, therefore, the underlying aquifer is "exempt". Injection wells at the site would, therefore, be classified as Subclass AB (injection wells which inject only into exempted aquifers), category B (industrial disposal wells).

UIC regulations consist of certain practices for construction and operation of the injection well, designed to protect groundwater from contaminated injection well effluent. Prior to the installation of injection wells, we recommend that the applicable State and Federal regulations be consulted for the complete requirements. Permits are required to construct, operate, modify or abandon an injection well or wells. Current (December 2000) permit applications are contained in Appendix C. The following information was extracted from applicable State regulations:

- Injection Well Construction

  An injection well shall be designed for its intended use, in accordance with good engineering practices as recommended by the Honolulu Board of Water Supply's "Water System Standards", dated March, 1977. If a large void, such as a lava tube, is encountered during drilling, where the drill rod drops more than three feet, measures shall be taken to prevent unacceptable migration of the injected fluids, as described in the rules.

- Injection Well Monitoring and Reporting

  The operator of any injection well or wells must keep detailed records of the operation of the well or wells, including, but not limited to, the type and quantity of injected fluids, and the method and rate of injection for each well. If the operation of the injection well or wells is additionally regulated by other pollution control programs, the adherence to their monitoring and reporting requirements are considered a requirement of this chapter.

- Injection Well Plugging and Abandonment

  The DOH may require an abandoned well to be plugged in a manner which will not allow detrimental movement of fluids between formations. Plugging may be performed by grouting with the tremie method or by some other method acceptable to the DOH. The DOH may order an injection well to be plugged and abandoned when it no longer performs its intended purpose, or when it is determined to be a threat to the ground water resource. Requirements for plugging and abandonment of a well are found in the regulations.

Vehicle washing facilities who discharge water to injection wells or to private or public wastewater systems may have pretreatment requirements, such as oil/water separation, imposed by the system manufacturer or public works authority. Use of oil/water separators is not subject to specific environmental regulations, i.e., a separator is not regulated as a tank. Oil water separators are considered a BMP and are further discussed in Section 5.0.

Other Vehicle and Maintenance Fluids

Minor releases of vehicle fluids, such as motor oil, transmission fluids and the like, are not a concern with respect to potential contamination of the ocean/ponds. Such releases to paved or ground surfaces within the industrial park would not migrate far, as surface water flow in the area is limited, and the subsurface regime limits subsurface migration. The same situation is true of maintenance or cleaning fluids, such as solvents, that may be used in the industrial park.

The DOH publishes guidance addressing handling and disposition of vehicle fluids, such as battery acid, used motor oil, etc., and for recycling of solvents. DOH guidance should be consulted by owners/operators who handle or dispose of such materials.

4.3 Hazardous Material/Waste

Generators and transporters of hazardous waste are regulated under the federal Resource Conservation and Recovery Act (RCRA). The State's hazardous waste rules are similar to those under the federal RCRA program. All wastes defined as "hazardous" are regulated under HAR §11-260 to §11-279. Hazardous waste is defined to include all solid wastes or combination of solid wastes or combination of solid wastes which may (1) cause or significantly contribute to an increase in mortality or an increase in a serious or irreversible or incapacitating reversible illness, or (2) pose a substantial existing or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed. HAR §11-261 further identifies the characteristics of hazardous waste.

The rules establish standards applicable to generators, transporters, treatment, storage or disposal facilities, and persons who deal with hazardous waste fuel. The standards include operating practices, record keeping requirements, corrective action plans and other standards. In the event of a hazardous waste release from a facility that handles hazardous wastes, the facility may be required to take response actions, including corrective measures which are necessary to protect human health or the environment.

Due to the nature of allowed ML and MCX land uses, we do not anticipate that hazardous waste treatment, storage, or disposal facilities will be located in the proposed industrial park. Portions of the State regulations concerning hazardous waste generators are contained in Appendix D. Applicable State and Federal regulations must be referenced prior to an hazardous waste activities.

The regulations largely consist of requirements for tracking, containerizing, and monitoring of hazardous wastes. The following practices were extracted from regulations for generators of hazardous wastes:

- **Waste activity**

  An owner/operator must not generate, transport, or offer for transportation, hazardous waste without having received an EPA identification number, using EPA form 8700-12 "Notification of Regulated Waste Activity" (Appendix D).

  The regulations contain a number of limits regarding accumulation times and quantities. Facilities that exceed these limits may be considered storage or treatment facilities, triggering a number of additional requirements.

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A number of other regulations regarding transportation and manifesting requirements for generators of hazardous waste are described in HAR §11-262. Before transporting hazardous waste or offering hazardous waste for transportation off-site, a generator must package, label, and mark the waste according to applicable Department of Transportation (DOT) regulations.

Under some circumstances, the generator must have available at least one employee either on the premises or on call (i.e., available to respond to an emergency by reaching the facility within a short period of time) with the responsibility for coordinating all emergency response measures. The generator must ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures, relevant to their responsibilities during normal facility operations and emergencies. The emergency coordinator or designee must respond to any emergencies that arise.

The following actions are applicable to generators responding to an emergency situation:

(1) In the event of a fire, call the fire department or attempt to extinguish it using a fire extinguisher;

(2) In the event of a spill, contain the flow of hazardous waste to the extent possible, and as soon as is practicable, clean up the hazardous waste and any contaminated materials or soil;

(3) In the event of a fire, explosion, or other release which could threaten human health outside the facility or when the generator has knowledge that a spill has reached surface water, the generator must immediately notify the federal National Response Center (using their 24-hour toll free number 800/424-8802) and the Hawaii Department of Health's Hazard Evaluation and Emergency Response Office via the State Hospital at (808) 247-2191 after business hours or directly at (808) 586-4249 during business hours. The report must include the following information:
   (a) The name, address, and U.S. EPA identification number of the generator;
   (b) Date, time, and type of incident (e.g., spill or fire);
   (c) Quantity and type of hazardous waste involved in the incident;
   (d) Extent of injuries, if any; and
   (e) Estimated quantity and disposition of recovered materials, if any.

Transportation of hazardous materials is regulated under HAR §11-263 (Hazardous Waste Management; Standards Applicable to Transporters of Hazardous Waste) and federal Department of Transportation Regulations: 49 CFR, Subchapter C - Hazardous Materials Regulations (Parts 171-177). The regulations describe the reporting, packaging, marking, labeling, and transport requirements for hazardous materials.

4.4 Pesticides

Pesticides are regulated by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). The licensing, sale and use of pesticides in Hawaii are governed by the Hawaii Pesticides Law. Although the federal FIFRA places ultimate supervisory responsibility for uniform control of pesticides with the EPA, the State may regulate the sale or use of pesticide used intra-state and may regulate the sale or use of pesticides which are not prohibited by FIFRA. The Hawaii Department of Agriculture (DOA) is responsible for the administration of the Pesticide Law, under HAR §4-66, "Pesticides" (Table of Contents contained in Appendix E).

Pesticides that are received, used, sold, offered for sale or distributed within Hawaii must be licensed by the Board of Agriculture (Board). The application for the license must contain a description of the pesticide, a copy of the labeling, claims made for the pesticide including directions for use and information about the license. Any pesticide which is sold, distributed or transported in violation of the Pesticides Law or rules may be seized.

Pesticides must be used and applied in a manner consistent with their labeling, or at a concentration, frequency or dosage less than that specified on the labeling. Pesticide containers must be stored, transported and discarded in a manner which does not have unreasonable adverse effects on the environment. The applicable State and Federal regulations must be further consulted for requirements concerning pesticides and storage of pesticides.

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5.0 BEST MANAGEMENT PRACTICES

5.1 Overview

BMPs are measures or controls that are used to prevent pollution from being discharged to a receiving water, i.e., stormwater or surface water. BMPs may be structural, such as berms or oil/water separators; procedural, such as training in spill response procedures; or administrative, such as record keeping.

The majority of BMPs are designed to prevent contamination of stormwater by point source or non-point source pollution. As previously discussed, contamination of stormwater is not a significant concern for this project, as stormwater or surface water flow does not reach the ocean/ponds. However, a number of BMPs are also indicated by regulations for petroleum handling, including storage tanks; hazardous wastes; and pesticides. BMPs are discussed below.

5.2 Petroleum Products

Underground Storage Tanks

There are few BMPs associated with USTs, since strict regulations govern every aspect of construction and operation of USTs, limiting the need for BMPs. However, the regulations have some requirements that are essentially BMPs, such as the use of spill catchment basins to fulfill spill prevention requirements.

Structural BMPs for use with USTs include:
- use of double containment;
- installation of spill and overflow protection; and
- use of release detection methods.

Procedural BMPs for use with USTs include:
- discouraging topping off of fuel tanks;
- training in spill response procedures; and
- encouraging employee participation in UST management activities.

Administrative BMPs for use with USTs include:
- keeping records of release detection monitoring; and
- conducting appropriate release notification and response.

Spill Prevention Control and Countermeasures Plan

A SPCC Plan requires appropriate practices to prevent discharged oil from reaching a navigable water course. The SPCC Plan requires BMPs for bulk storage tanks; for drainage from containment areas; for facility transfer operations, pumping, and in-plant processes; for facility tank truck loading/unloading racks; and for facility security. The BMPs are summarized below:

Aboveground bulk storage tanks

For abovegound bulk storage tanks, structural BMPs include:

- use of tank material that is compatible with materials stored;
- use of high liquid-level alarms and cut-off devices where possible; and
- construction of secondary containment that will accommodate the entire contents of the largest single tank plus sufficient freeboard to allow for precipitation, and made of materials sufficiently impervious to contain spilled oil. The following structural BMPs may be used, sometimes in combination, to provide the necessary secondary containment:
  - Dikes, berms or retaining walls sufficiently impervious to contain spilled oil;
  - Curbing;
  - Culverting, gutters or other drainage systems;
  - Weirs, booms or other barriers;
  - Spill diversion ponds;
  - Retention ponds;
  - Sorbent materials.

For abovegound bulk storage tanks, procedural BMPs include:

- periodic integrity testing;
- frequent inspection of the outside of the tank by operating personnel;
- regular testing of liquid level sensing devices;
- prompt correction of visible oil leaks which result in loss of oil from tank seams, gaskets, rivets and bolts sufficiently large to cause the accumulation of oil in diked areas;

For abovegound bulk storage tanks, administrative BMPs include:

- maintaining records of integrity testing.

Secondary containment for aboveground bulk storage tanks

Table 2 describes the most common secondary containment systems for diked areas (e.g., storage tank areas).

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Table 2. Commonly Used Secondary Containment Systems

Type of System:	Poured Concrete Walls
Description:	Strong, fairly watertight, and resistant to petroleum penetration if adequately designed and maintained according to good engineering practices.
Limitations:	• Conventional concrete is not totally impervious to petroleum; any spill left inside a containment area may eventually penetrate the concrete and could contaminate groundwater sources. Therefore, spills inside diked areas should be cleaned up as soon as possible. • The expansion and contraction of piping which runs through containment walls create potential areas of weakness. • Grouting in expansion joints requires maintenance to prevent weak points, which may allow petroleum penetration.
Type of System:	Containment Curbs
Description:	Similar to speed bumps and are often used where vehicles need to access the containment area.
Limitations:	• They fill up with rainwater more rapidly than higher containment areas. • They can be worn down as a result of vehicle crossings.
Type of System:	Containment Pits/Trenches
Description:	Belowgrade containment structures, which may be covered with metal grates and lined with concrete.
Limitations:	• Earthen structures have the potential for groundwater contamination unless constructed with appropriate materials. • If pits and trenches are not properly supported, they deteriorate quickly. • They pose a danger since people can fall into them if grates are not properly maintained.
Type of System:	Earthen Berms
Description:	Berms containing clay or bentonite mixtures are commonly used at very large oil storage facilities.
Limitations:	• Subject to water and wind erosion and require frequent rebuilding. • Sandy soil does not effectively contain oil spills; groundwater contamination may result. Impervious liners of clay or synthetic membranes may be required to contain oil spills. • Vegetation inside bermed areas is a fire hazard and restricts the operator's ability to detect spills or defective equipment. In addition, the root systems of plants, such as trees, shrubs or bushes, could degrade the berm and promote leakage.
Type of System:	Concrete Block Walls
Description:	Commonly used for containment.
Limitations:	• Settling eventually separates or cracks the blocks and destroys the integrity of the wall. • Concrete blocks are very porous therefore they do not form liquid-tight seals between mortared joints.

Drainage from Containment Areas

For facility drainage, structural BMPs include:

- use of valves or other positive means to prevent a spill or other excessive leakage of oil from diked storage areas;
- use of manual, open-and-closed design valves instead of flapper-type valves;
- direction of flow from uncontained areas into containment areas; and
- use of a diversion system that could, in the event of an uncontrolled spill, return the oil to the plant.

For facility drainage, procedural BMPs include:

- manual startup of pumps or ejectors, following assessment of the condition of the accumulation, before starting, to be sure no oil will be discharged;
- opening of valves to drain rainwater and resealing following drainage by trained and authorized facility personnel only;
- examination of accumulated rainwater to determine that it is free of oil contamination before drainage occurs; and
- use of an alternate method of draining the diked area if any oil sheen or accumulation of oil is observed.

For facility drainage, administrative BMPs include:

- maintaining records of drainage events (i.e., date, time, personnel names).

Facility transfer operations, pumping, and in-plant processes

For facility transfer operations, pumping, and in-plant processes, structural BMPs include:

- use of protective coating and cathodic protection on buried pipes;
- use of exposed pipe corridors or galleries; and
- design of pipe supports to minimize abrasion and corrosion and allow for expansion and contraction.

For facility transfer operations, pumping, and in-plant processes, procedural BMPs include:

- capping or blank-flanging, with origin marked, of pipeline not in service;
- regular examinations by operating personnel for assessment of the general condition of items, such as flange joints, expansion joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces;
- periodic pressure testing for piping where failure might lead to a spill event; and
- signage or other warning for vehicles that may, because of their size, damage aboveground piping.

Facility tank truck loading/unloading racks

For tank truck loading/unloading operations, structural BMPs include:

- use of a quick drainage system for tank truck loading and unloading areas where drainage does not flow into a catchment basin or treatment facility designed to handle spills, using a containment system designed to hold at least the maximum capacity of any single compartment of a tank car or tank truck loaded or unloaded at the facility; and
- use of an interlocked warning light or physical barrier system, or warning signs, in loading/unloading areas to prevent vehicular departure before complete disconnect of flexible or fixed transfer lines.

For tank truck loading/unloading operations, procedural BMPs include:

- loading/unloading procedures should meet the minimum requirements and regulation established by the Department of Transportation; and
- examination of the lowermost drain and all outlets of any tank truck prior to filling and departure to check for leakage and, if necessary, to tighten, adjust, or replace drains and outlets to prevent liquid leakage while in transit.

Security

For security, structural BMPs include:

- use of full fencing and entrance gates that are locked and/or guarded when the facility is not in use or is unattended; and
- use of facility lighting commensurate with the type and location of the facility, such that spills occurring during hours of darkness can be detected by operating personnel or non-operating personnel and that acts of vandalism that may result in spills are prevented.

For security, procedural BMPs include:

- securely locking the master flow and drain valves, and any other valves that will permit direct outward flow of the tank's content to the surface, in the closed position when in non-operating or non-standby status;
- locking the starter control on all oil pumps in the "off" position, or locating such controls at a site accessible only to authorized personnel when the pumps are in a non-operating or non-standby status; and
- capping or blank-flanging loading/unloading connections of oil pipelines when not in service or standby service for an extended time.

Vehicle washing facilities

Water from vehicle washing operations should be collected and directed to a pretreatment facility prior to disposal in injection wells. Filtering and recycling vehicle wash water should be considered. Other than potential pretreatment, there are no BMPs

associated with injections wells, except for following the DOH requirements for construction, operation, and abandonment of the wells.

If oil/water separators are proposed as a pretreatment BMP, a thorough analysis should be made to determine if an oil/water separator can treat the waste stream effectively, if a closed-loop system or connection to the sanitary sewer is possible, and if the design is suitable to contain any leaks or spills from the oil/water separator.

Structural BMPs for use with vehicle wash facilities include:
- design of a closed-loop (recycling) system;
- connection to the sanitary wastewater system if possible; and
- design suitable to contain any leaks or spills.

Procedural BMPs for use with vehicle wash facilities include:
- use of phosphate-free detergents.

Other Vehicle and Maintenance Fluids

Many vehicle and equipment maintenance operations use materials or create wastes that are harmful to humans and the environment. These hazardous substances include: vehicle maintenance products, such as antifreeze, oil and grease; used oil filters; solvents for oil and grease removal and disposal; engine, parts and equipment cleaners; lubricants; rust removers; paints and paint preparation products; brush or spray gun cleaners; and lead acid batteries. Oils, fuels and solvents used for cleaning metal parts contain toxic ingredients. Fortunately, there are good recycling opportunities for both solvents and waste oil.

Structural BMPs for use with vehicle maintenance facilities include:
- designing and locating maintenance facilities so that releases of hazardous materials/wastes do not occur.

Procedural BMPs for use with vehicle maintenance facilities include:
- check for leaking oil and fluids;
- use nontoxic, low-toxicity, and recycled materials;
- drain oil filters before disposal or recycling;
- don't pour liquid waste down drains;
- recycle engine fluids, used oil filters, antifreeze, and batteries;
- segregate and label wastes;
- rent a part washer from a solvent recycler; and
- use up old fuels whenever possible

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5.3 Hazardous Material/Waste

BMPs applicable to hazardous wastes are largely related to tracking, containerizing, and monitoring, which is also required by the regulations. Hazardous wastes are defined as materials that are ignitable, toxic, corrosive or explosive. Improper use of hazardous products may cause toxic health problems. Improper storage may allow chemicals to leak. Improper disposal may allow these chemicals to enter ground water. Two key steps to minimizing the risk of pollution from hazardous materials/wastes are to reduce the amount of waste produced and recycle when possible.

Structural BMPs for use with hazardous material/waste include:
- dike storage areas to prevent well contamination from spills if the volume of the stored products and wastes exceeds 10 gallons.

Procedural BMPs for use with hazardous material/waste include:
- return excess product, spills or drips to the original container;
- collect waste paint, solvents, antifreeze, oil and grease, and other hazardous chemicals for community recycling;
- contain any unusable wastes, spills and drips for appropriate disposal;
- locate all hazardous waste products and activities, including mixing and storage, on a surface which will prevent spilled materials from entering ground water;
- recycle engine fluids, used oil filters, antifreeze, and batteries;
- segregate different types of waste in storage to prevent dangerous chemical reactions that could release the products;
- have emergency equipment, such as adsorbents and shovels, ready to contain spills
- store chemicals in clearly labeled containers designed to contain that hazard category (flammables, poisons or corrosives);
- label wastes with the name of the waste and the date the waste was put into the container;
- store chemicals in a safe, well-ventilated, flame-free area with sturdy shelves;
- store flammable chemicals and batteries in an area shaded from direct sunlight; and
- store rags used to clean up solvent spills with the same care as other potentially flammable materials.

5.4 Pesticides

Pesticides, including those used for yard care, are referred to as acute hazardous substances because of their extreme toxicity. The only acceptable management practices for pesticides are to use them according to current label directions and to properly dispose of containers when all the pesticide has been used.

Procedural BMPs for use with pesticides include:

- handle all pesticides as directed on the label;
- pay particular attention to pesticides classified as 'restricted use' or state-limited-use;
- if pesticides have been stored for a while, remember that they might not have current warning labels, and some may even have been banned since the time of purchase;
- if pesticides are purchased in minibulk tanks or returnable containers any excess chemical can be returned;
- leftover pesticides that cannot be disposed of in any of these ways should be stored safely until they can be disposed of through a community or state sponsored hazardous waste collection program or a hazardous waste contractor;
- triple-rinse or high-pressure rinse plastic and metal containers, adding rinsate to a pesticide application tank for application following label instructions; and
- store rinsed containers in a dry, secure area until they can be taken to a state sponsored recycling event or licensed landfill.

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6.0 REGULATORY CONTACTS

DOH Clean Air Branch
919 Ala Moana Boulevard, Room 203
Honolulu, Hawaii 96814
(808) 586-4200
http://tako.icsd.hawaii.gov/doh/eh/cab

DOH Clean Water Branch
919 Ala Moana Boulevard, Room 301
Honolulu, Hawaii 96814
(808) 586-4309
http://tako.icsd.hawaii.gov/doh/eh/cwb

DOH Safe Drinking Water Branch
919 Ala Moana Boulevard, Room 308
Honolulu, Hawaii 96814
(808) 586-4258
http://tako.icsd.hawaii.gov/doh/eh/sdwb

DOH Solid & Hazardous Waste Branch
919 Ala Moana Boulevard, Room 250
Honolulu, Hawaii 96814
(808) 586-4240
http://tako.icsd.hawaii.gov/doh/eh/shwb

DOH Underground Storage Tank Program
DOH Hazardous Waste Program
919 Ala Moana Boulevard, Room 250
Honolulu, Hawaii 96814
(808) 586-4226
http://tako.icsd.hawaii.gov/doh/eh/shwb

DOH Office of Hazard Evaluation and Emergency Response
919 Ala Moana Boulevard, Room 206
Honolulu, Hawaii 96814
(808) 586-4249
http://tako.icsd.hawaii.gov/doh/eh/heer

County of Hawaii
Local Emergency Planning Committee
Attn: Jay Sasan, Industrial Safety Office
25 Aupuni Street
Hilo, Hawaii 96720
(808) 961-8215

County of Hawaii
Fire Department
Attn: Nelson Tsuji, Chief
777 Kilauea Avenue, Mall Lane, Room 6
Hilo, Hawaii 96720
(808) 961-8297

U.S. EPA Region 9
Hazardous Waste Management Division
75 Hawthorne Street
San Francisco, California 94105
(415) 744-2422
http://www.epa.gov/epaoswer/osw/index.htm

U.S. EPA Region 9
RCRA Notifications
75 Hawthorne Street
San Francisco, California 94105
((415) 495-8895
http://www.epa.gov/rcraonline

For complete federal environmental regulations, obtain the Code of Federal Regulations at:
http://www.access.gpo.gov/nara/cfr/cfr-table-search.html

For complete State environmental regulations, obtain the Hawaii Administrative Rules at:
http://swat.state.hi.us/VRC.htm

Appendix A

Portions of HAR §11-281 (Underground Storage Tanks)

State Application for Underground Storage Tank Permit

State Form "Certification of Underground Storage Tank Installation"

HAWAII ADMINISTRATIVE RULES

TITLE 11

DEPARTMENT OF HEALTH

CHAPTER 281

UNDERGROUND STORAGE TANKS

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SUBCHAPTER 1

SCOPE AND PROHIBITION

§11-281-01 Applicability. (a) The requirements of this chapter apply to all owners and operators of underground storage tanks or tank systems as defined in section 11-281-03 except as otherwise provided in subsections (b), (c), and (d). Any UST or tank system listed in subsection (c) must meet the requirements of section 11-281-02.

(b) The following USTs or tank systems are excluded from the requirements of this chapter:

(1) Any UST or tank system holding hazardous wastes listed or identified under chapter 342J, Hawaii Revised Statutes or the rules adopted thereunder, or Subtitle C of the federal Solid Waste Disposal Act, or a mixture of such hazardous waste and other regulated substances.

(2) Any wastewater treatment UST system that is part of a wastewater treatment facility regulated under chapter 342D, Hawaii Revised Statutes or section 402 or 307(b) of the federal Clean Water Act (33 U.S.C. section 1342 or 1317).

(3) Equipment or machinery that contains regulated substances for operational purposes such as hydraulic lift tanks and electrical equipment tanks.

(4) Any UST or tank system whose capacity is 110 gallons or less.

(5) Any UST or tank system that contains a de minimis concentration of regulated substances.

(6) Any emergency spill or overflow containment UST or tank system that is expeditiously emptied after use.

(c) Subchapters 2, 3, 4, 5, 6, 8, and 9 are deferred for the following types of USTs or tank systems:

(1) Wastewater treatment USTs or tank systems;

(2) Any USTs or tank systems containing radioactive material that are regulated under the federal Atomic Energy Act of 1954 (42 U.S.C. section 2011 and following);

(3) Any UST or tank system that is part of an emergency generator system at nuclear power

generation facilities regulated by the federal Nuclear Regulatory Commission under 10 C.F.R. Part 50, Appendix A;

(4) Airport hydrant fuel distribution USTs and tank systems; and

(5) USTs or tank systems with field-constructed USTs.

(d) Subchapter 5 does not apply to any UST or tank system that stores fuel solely for use by emergency power generators. [Eff] (Auth: HRS §342L-3) (Imp: 40 C.F.R. §280.10)

§11-281-02 Prohibition for deferred underground storage tanks or tank systems. (a) No person may install an UST or tank system listed in section 11-281-01(c) for the purpose of storing regulated substances unless the UST or tank system (whether of single- or double-wall construction):

(1) Will prevent releases due to corrosion or structural failure for the operational life of the UST or tank system;

(2) Is cathodically protected against corrosion, constructed of noncorrodible material, steel clad with a noncorrodible material, or designed in a manner to prevent the release or threatened release of any stored substance; and

(3) Is constructed or lined with material that is compatible with the stored substance.

(b) Notwithstanding subsection (a), an UST or tank system without corrosion protection may be installed at a site that is determined by a corrosion expert not to be corrosive enough to cause it to have a release due to corrosion during its operating life. Owners and operators must maintain records that demonstrate compliance with the requirements of this subsection for the remaining life of the UST or tank system.

NOTE: The National Association of Corrosion Engineers Standard RP0285-95, "Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems", may be helpful in

that deviates from, the requirements of this chapter that are more stringent than 40 CFR Part 280.

"Wastewater treatment tank" means an UST tank that is designed to receive and treat an influent wastewater through physical, chemical, or biological methods. [Eff] (Auth: HRS §342L-3) (Imp: 40 C.F.R. §280.12)

§§11-281-04 to 11-281-10 (Reserved)

SUBCHAPTER 2

DESIGN, CONSTRUCTION, AND INSTALLATION

§11-281-11 Performance standards for underground storage tanks and tank systems. (a) In order to prevent releases due to structural failure, corrosion, or spills and overfills for as long as the UST or tank system is used to store regulated substances, all owners and operators of hazardous substance USTs or tank systems installed after December 22, 1988, must meet the requirements of this subchapter.

(b) In order to prevent releases due to structural failure, corrosion, or spills and overfills for as long as the UST or tank system is used to store regulated substances, all owners and operators of petroleum USTs or tank systems installed after December 22, 1988, but before the effective date of these rules must meet all the requirements of this subchapter except for section 11-281-17.

(c) In order to prevent releases due to structural failure, corrosion, or spills and overfills for as long as the UST or tank system is used to store regulated substances, all owners and operators of petroleum USTs or tank systems installed on or after the effective date of these rules must meet the requirements of this subchapter. [Eff] (Auth: HRS §§342L-32) (Imp: 40 C.F.R. §280.20)

§11-281-12 Tank requirements. Each UST must be properly designed, constructed, and installed, and

any portion underground that routinely contains product must be protected from corrosion, in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory as specified below. All USTs must meet one of the following requirements:

(1) The UST is constructed of fiberglass-reinforced plastic; or

NOTE: The following industry codes may be helpful in complying with paragraph (1):

A. Underwriters Laboratories Standard 1316, "Standard for Glass-Fiber-Reinforced Plastic Underground Storage Tanks for Petroleum Products" ;

B. Underwriter's Laboratories of Canada CAN4-S615-M83; "Standard for Reinforced Plastic Underground Tanks for Petroleum Products";

C. American Society of Testing and Materials Standard D4021-86 "Standard Specification for Glass-Fiber-Reinforced Polyester Underground Petroleum Storage Tanks.".

(2) The UST is constructed of steel and shall be cathodically protected in the following manner:

(A) The UST shall be coated with a suitable dielectric material;

(B) Field-installed cathodic protection systems must be designed by a corrosion expert;

(C) Impressed current systems shall be designed to allow determination of current operating status as required in section 11-281-42; and

(D) Cathodic protection systems shall be operated and maintained in accordance with section 11-281-42; or

NOTE: The following codes and standards may be helpful in complying with paragraph (2):

A. Steel Tank Institute "Specification for

STI-P3 System of External Corrosion Protection of Underground Steel Storage Tanks";

B. Underwriters Laboratories Standard 1746, "Corrosion Protection Systems for Underground Storage Tanks";

C. Underwriters Laboratories of Canada CAN4-S603-M85, "Standard for Steel Underground Tanks for Flammable and Combustible Liquids", CAN4-G03.1-M85, "Standard for Galvanic Corrosion Protection Systems for Underground Tanks for Flammable and Combustible Liquids", and CAN4-S631-M84, "Isolating Bushings for Steel Underground Tanks Protected with Coatings and Galvanic Systems"; or

D. National Association of Corrosion Engineers Standard RP0285-85, "Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems", and Underwriters Laboratories Standard 58, "Standard for Steel Underground Tanks for Flammable and Combustible Liquids".

(3) The UST is constructed of a steel-fiberglass-reinforced-plastic composite; or

NOTE: The following industry codes may be helpful in complying with paragraph (3):

A. Underwriters Laboratories Standard 1746, "Corrosion Protection Systems for Underground Storage Tanks"; or

B. Association for Composite Tanks ACT-100, "Specification for the Fabrication of FRP Clad Underground Storage Tanks".

(4) The UST is constructed of metal without additional corrosion protection measures provided that:

(A) The UST is installed at a site that is determined by a corrosion expert not to be corrosive enough to cause it to have a release due to corrosion during its

operating life; and

(B) The owners and operators maintain records that document and demonstrate compliance with the requirements of subparagraph (4)(A) for the remaining life of the UST;

or

(5) USTs that do not comply with paragraph (1), (2), (3), or (4) may be used if the department determines that the UST construction and corrosion protection are designed to prevent the release or threatened release of any stored regulated substance in a manner that is no less protective of human health and the environment than the standards provided in paragraphs (1) through (4). [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.20)

§11-281-13 Piping requirements. The piping that routinely contains regulated substances and is in contact with the ground must be properly designed, constructed, and protected from corrosion in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory as specified below. All piping must meet one of the following requirements:

(1) The piping is constructed of fiberglass-reinforced plastic; or

NOTE: The following codes and standards may be helpful in complying with paragraph (1):

A. Underwriters Laboratories Subject 971, "UL Listed Non-Metal Pipe";

B. Underwriters Laboratories Standard 567, "Pipe Connectors for Flammable and Combustible and LP Gas";

C. Underwriters Laboratories of Canada Guide ULC-107, "Glass Fiber Reinforced Plastic Pipe and Fittings for Flammable Liquids"; and

D. Underwriters Laboratories of Canada Standard CAN 4-S633-M81, "Flexible

Underground Hose Connectors".

(2) The piping is constructed of steel and cathodically protected in the following manner:
   (A) The piping shall be coated with a suitable dielectric material;
   (B) Field-installed cathodic protection systems must be designed by a corrosion expert;
   (C) Impressed current systems shall be designed to allow determination of current operating status as required in section 11-281-42; and
   (D) Cathodic protection systems shall be operated and maintained in accordance with section 11-281-42;

   or

   NOTE: The following codes and standards may be helpful in complying with paragraph (2):
   A. National Fire Protection Association Standard 30, "Flammable and Combustible Liquids Code";
   B. American Petroleum Institute Publication 1615, "Installation of Underground Petroleum Storage Systems";
   C. American Petroleum Institute Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems"; and
   D. National Association of Corrosion Engineers Standard RP0169-92, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems".

(3) The piping is constructed of metal without additional corrosion protection measures provided that:
   (A) The piping is installed at a site that is determined by a corrosion expert to not be corrosive enough to cause it to have a release due to corrosion during its operating life; and

   (B) The owners and operators maintain records that demonstrate compliance with the requirements of subparagraph (3)(A) for the remaining life of the piping.

   NOTE: The following codes and standards may be helpful in complying with paragraph (3):
   A. National Fire Protection Association Standard 30, "Flammable and Combustible Liquids Code"; and
   B. National Association of Corrosion Engineers Standard RP0169-92, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems".

(4) Piping that does not comply with paragraph (1), (2), or (3) may be used if the department determines that the piping construction and corrosion protection are designed to prevent the release or threatened release of any stored regulated substance in a manner that is no less protective of human health and the environment than the requirements in paragraphs (1) through (3). [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.20)

§11-281-14 Spill and overfill prevention equipment. (a) Except as provided in subsection (b), to prevent spilling and overfilling associated with product transfer to an UST or tank system, owners and operators must use the following spill and overfill prevention equipment:
   (1) Spill prevention equipment that will prevent release of product to the environment when the transfer hose is detached from the fill pipe (for example, a spill catchment basin); and
   (2) Overfill prevention equipment that will:
      (A) Automatically shut off flow into the UST when the UST is more than ninety-five percent full;
      (B) Alert the transfer operator when the UST

is more than ninety percent full by restricting the flow into the UST or triggering a high-level alarm; or

(C) Restrict flow thirty minutes prior to overfilling, or alert the operator with a high-level alarm one minute before overfilling, or automatically shut off flow into the UST so that none of the fittings located on top of the UST are exposed to product due to overfilling.

(b) Owners and operators are not required to use the spill and overfill prevention equipment specified in subsection (a) if:

(1) Alternative equipment is used that is determined by the department to be no less protective of human health and the environment than the equipment specified in subsection (a); or

(2) The UST or tank system is filled by transfers of no more than twenty-five gallons at one time.

(c) Spill and overfill prevention methods that rely on the use of alarms must have the alarms clearly labeled and located where the delivery person can clearly see or hear the alarm in order to immediately stop delivery of the product. [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.20)

§11-281-15 Installation. All USTs and piping must be properly installed in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory and in accordance with the manufacturer's instructions.

NOTE: UST and piping system installation practices and procedures described in the following codes may be helpful in complying with the requirements of this section:

A. American Petroleum Institute Publication 1615, "Installation of Underground Petroleum Storage System"; or

B. Petroleum Equipment Institute Publication

RP100-94, "Recommended Practices for Installation of Underground Liquid Storage Systems"; or

C. American National Standards Institute Standard B31.3, "Petroleum Refinery Piping," and American National Standards Institute Standard B31.4 "Liquid Petroleum Transportation Piping System." [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.20)

§11-281-16 Certification of installation. (a) All owners and operators must ensure that one or more of the following methods of certification, testing, or inspection is used to demonstrate compliance with section 11-281-15:

(1) The installer has been certified by the UST and piping manufacturers;

(2) The installation has been inspected and certified by a licensed professional engineer with education and experience in UST or tank system installation;

(3) All work listed in the manufacturer's installation checklists have been completed and the checklists maintained; or

(4) The owner or operator has complied with another method for ensuring compliance with section 11-281-15 that is determined by the department to be no less protective of human health and the environment.

(b) All owners and operators shall certify compliance with subsection (a) by completing and submitting to the department one of the following forms:

(1) Notification for Underground Storage Tanks (Appendix I entitled "Notification for Underground Storage Tanks", dated June 1999, which is made a part of this chapter and attached at the end of this chapter);

(2) Certification of Underground Storage Tank Installation (Appendix III entitled "Certification of Underground Storage Tank Installation", dated June 1999, which is made

a part of this chapter and attached at the end of this chapter). [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.20)

§11-281-17 Secondary containment. (a) Secondary containment systems must be designed, constructed, and installed to:

(1) Contain regulated substances released from the UST or tank system until they are detected and removed;

(2) Prevent the release of regulated substances to the environment at any time during the operational life of the UST or tank system; and

(3) For hazardous substance USTs or tank systems installed after December 22, 1988, be checked for evidence of a release at least every thirty calendar days; and for petroleum USTs or tank systems installed on or after the effective date of these rules, provide release detection as required in section 11-281-51(e).

(b) Double-walled USTs must be designed, constructed, and installed to:

(1) Contain a release from any portion of the inner UST within the outer wall until removed; and

(2) Detect the failure of the inner and outer walls.

(c) External liners (including vaults) must be designed, constructed, and installed to:

(1) Contain one hundred percent of the capacity of the largest UST within its boundary;

(2) Prevent precipitation or ground water intrusion from interfering with the ability to contain or detect a release of regulated substances; and

(3) Surround the UST completely to effectively prevent lateral and vertical migration of regulated substances in the event of a release.

(d) Underground piping must be equipped with

secondary containment (e.g., trench liners, double-walled pipes, etc.) that meets the requirements of subsection (a). In addition, pressurized piping must be equipped with an automatic line leak detector that complies with section 11-281-53. [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.42)

§11-281-18 Upgrading of existing underground storage tanks and tank systems. (a) Not later than the effective date of these rules, all existing USTs or tank systems must comply with one of the following requirements:

(1) Performance standards established in sections 11-281-11 through 11-281-16;

(2) The upgrading requirements in subsections (b) through (d); or

(3) Change-in-service or closure requirements under subchapter 8, including applicable requirements for release response actions under subchapter 7.

(b) Not later than the effective date of these rules, existing steel USTs or UST systems must be upgraded to meet one of the following requirements in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory:

(1) An UST may be upgraded by internal lining if:

(A) The lining is installed in accordance with the requirements of section 11-281-44, and

(B) Within ten years after the installation of the lining, and every five years thereafter, the lined UST is internally inspected and found to be structurally sound with the lining still performing in accordance with original design specifications.

(2) An UST may be upgraded by cathodic protection if the cathodic protection system meets the requirements of sections 11-281-12(2)(B), (C) and (D), and the integrity of the UST is ensured using one of the following methods:

(A) The UST is internally inspected and assessed to ensure that the UST is structurally sound and free of corrosion holes prior to installing the cathodic protection system;

(B) The UST has been installed for less than ten years and is monitored monthly for releases in accordance with section 11-281-52;

(C) The UST has been installed for less than ten years and is assessed for corrosion holes by conducting two tightness tests that meet the requirements of section 11-281-52. The first tightness test must be conducted prior to installing the cathodic protection system. The second tightness test must be conducted between three and six months following the first operation of the cathodic protection system; or

(D) The UST is assessed for corrosion holes by a method that is determined by the department to prevent releases in a manner that is not less protective of human health and the environment than subparagraphs (b)(2)(A) through (C).

(3) An UST may be upgraded by both internal lining and cathodic protection if:

(A) The lining is installed in accordance with the requirements of section 11-281-44; and

(B) The cathodic protection system meets the requirements of section 11-281-12(2)(B) through (D).

NOTE: The following codes and standards may be helpful in complying with subsection (b):

A. American Petroleum Institute Publication 1631, "Recommended Practice for the Interior Lining of Existing Steel Underground Storage Tanks";

B. National Leak Prevention Association Standard 631, "Entry, Cleaning, Interior Inspection, Repair and Lining of Underground Storage

Tanks";

C. National Association of Corrosion Engineers Standard RP0285-85, "Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems"; and

D. American Petroleum Institute Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems."

(c) Not later than the effective date of these rules, all existing UST metal pipings that routinely contain regulated substances and are in contact with the ground must be cathodically protected in accordance with a code of practice developed by a nationally recognized association or independent testing laboratory and must meet the requirements in sections 11-281-13(2)(B) through (D).

NOTE: The following codes and standards may be helpful in complying with subsection (c):

A. National Fire Protection Association Standard 30, "Flammable and Combustible Liquids Code";

B. American Petroleum Institute Publication 1615, "Installation of Underground Petroleum Storage Systems";

C. American Petroleum Institute Publication 1632, "Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems"; and

D. National Association of Corrosion Engineers Standard RP0169-92, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems".

(d) To prevent spilling and overfilling associated with product transfer to the UST or tank system, all existing USTs or tank systems must comply with the performance standard for spill and overfill prevention equipment as specified in section 11-281-14 no later than the effective date of these rules.

(e) Any existing UST or UST system that fails to meet any of the requirements of subsections (b) through (d) must comply with paragraph (a)(1) or (a)(3) no

later than the effective date of these rules. [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.21)

§§11-281-19 to 11-281-20 (Reserved)

SUBCHAPTER 3

NOTIFICATION, PERMITS, AND VARIANCES

§11-281-21 Notification requirements for tanks brought into use before the effective date of these rules. As to tanks that were brought into use before the effective date of these rules:

(1) Any person who acquires ownership of an UST or tank system that has not been permanently closed pursuant to subchapter 8 shall, within thirty days of acquiring ownership, submit to the department an amendment to the notification submitted by the previous owner to the department pursuant to section 342L-30, HRS. The amendment shall be on the form prescribed in Appendix I entitled "Notification for Underground Storage Tanks", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter.

(2) Within thirty days following a change of operator of an UST or tank system, the owner shall submit to the department an amendment to the notification previously submitted pursuant to section 342L-30, HRS. The amendment shall be on the form prescribed in Appendix I entitled "Notification for Underground Storage Tanks", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter.

(3) For any other changes in information submitted to the department on the notification form, the owner shall submit an amended notification within thirty days following the change, except that

notifications of permanent closures and changes in service under subchapter 8 must be received by the department at least thirty days before commencement of the closure or change in service. The amendment shall be on the form prescribed in Appendix I entitled "Notification for Underground Storage Tanks", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter. Other changes in information shall include but not be limited to:

(A) Permanent or temporary closures, including the return to currently-in-use status;
(B) Changes in service under subchapter 8;
(C) Repairs as defined in section 11-281-03;
(D) Changes in piping;
(E) Changes in type of regulated substances stored;
(F) Changes in corrosion protection mechanism;
(G) Changes in secondary containment;
(H) Changes in product dispensing method;
(I) Changes in financial responsibility mechanism;
(J) Changes in leak detection method; and
(K) Changes in spill and overfill prevention method. [Eff] (Auth: HRS §342L-3) (Imp: HRS §342L-30)

§11-281-22 Notification requirements for tanks brought into use on or after the effective date of these rules. As to tanks that were brought into use on or after the effective date of these rules, the owners may satisfy the notification requirements of section 342L-30, HRS by complying with the permit requirements of sections 11-281-23 through 11-281-31 and 11-281-34 through 11-281-35. [Eff] (Auth: HRS §342L-3) (Imp: HRS §342L-30)

§11-281-23 Permit required. (a) No person shall install or operate an UST or tank system, brought into

use after the effective date of these rules, without first obtaining a permit from the director.

(b) The director shall approve an application for a permit only if the applicant has submitted sufficient information to the satisfaction of the director that the technical, financial, and other requirements of this chapter are or can be met and the installation and operation of the UST or tank system will be done in a manner that is protective of human health and the environment.

(c) A permit shall be issued only in accordance with chapter 342L, HRS and this chapter, and it shall be the duty of the permittee to ensure compliance with the law in the installation and operation of the UST or tank system.

(d) Issuance of a permit shall not relieve any person of the responsibility to comply fully with all applicable laws.

(e) Only one permit can be issued for each location which has any UST or tank system requiring a permit under this subchapter. The permit shall be issued to the owner or operator of the UST or tank system. [Eff] (Auth: HRS §342L-3) (Imp: HRS §342L-31)

§11-281-24 Application for a permit. (a) Every application for a permit shall be submitted to the department on forms prescribed in Appendix II entitled "Application for an Underground Storage Tank Permit", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter.

(b) A permit fee in accordance with section 11-281-35 shall accompany each application for a permit.

(c) The applicant shall submit sufficient information to enable the director to make a decision on the application. Information submitted shall include but not be limited to the following:

(1) General information on involved parties, including the landowner, UST owner, and UST operator; identification of location of the UST or tank system; and basic description of the UST or tank system;
(2) Age, size, location, and uses of the UST or

tank system;
(3) Other information required in Appendix II entitled "Application for an Underground Storage Tank Permit", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter, and
(4) Other information as the department may require.

(d) Every application shall be signed by the owner and the operator and shall constitute an acknowledgement that the applicant(s) assumes responsibility for the installation and operation of the UST or tank system in accordance with this chapter and the conditions of the permit, if issued. Each signatory shall be:

(1) In the case of a corporation, a principal executive officer of at least the level of vice president, or a duly authorized representative if that representative is responsible for the overall operation of the UST or tank system;
(2) In the case of a partnership, a general partner;
(3) In the case of a sole proprietorship, the proprietor; or
(4) In the case of a county, state, or federal entity, either a principal executive officer, ranking elected official, or other duly authorized employee. [Eff] (Auth: HRS §342L-3) (Imp: HRS §§342L-4, 342L-31)

§11-281-25 Permit. (a) Upon approval of an application for a permit to install and operate an UST or tank system, the director shall issue a permit for a term of five years except as noted in subsection (b).

(b) The owner or operator shall have one year from the issuance of the permit to install an UST or tank system. If the installation is not completed within one year, the permit expires and the owner or operator must apply for a new permit.

(c) The owner or operator must inform the department at least seven days prior to performing the

actual installation. The information shall include the permit number, name and address of the UST or tank system, the contact person, the contact person's phone number, and date and time of actual installation.

(d) The owner or operator must notify the department within thirty days after the installation of the UST or tank system. The notification shall be submitted on the form prescribed in Appendix III entitled "Certification of Underground Storage Tank Installation", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter. If information submitted on the form prescribed in Appendix II entitled "Application for an Underground Storage Tank Permit" dated June, 1999, which is made a part of this chapter and attached at the end of this chapter, has changed since the original application, Part IV of Appendix III entitled "Certification of Underground Storage Tank Installation", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter, must be completed and submitted. [Eff] (Auth: HRS §342L-3) (Imp: HRS §§342L-4, 342L-31)

§11-281-26 Permit renewals. (a) On application, a permit may be renewed for a term of five years.

(b) A renewal fee in accordance with section 11-281-35 shall accompany each application for renewal of a permit.

(c) An application for a renewal shall be received by the department at least one hundred and eighty days prior to the expiration of the existing permit and shall be submitted on forms prescribed in Appendix IV entitled "Application for Renewal of an Underground Storage Tank Permit", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter. [Eff] (Auth: HRS §342L-3) (Imp: HRS §§342L-4, 342L-31)

§11-281-27 Action on and timely approval of an application for a permit. (a) The director need not act upon nor consider any incomplete application

for a permit. An application shall be deemed complete only when:

(1) All required and requested information, including the application form, plans, specifications, and other information required by this subchapter have been submitted in a timely fashion;

(2) All fees have been paid as prescribed in section 11-281-35; and

(3) The director determines that the application is complete.

(b) The director shall approve, approve with conditions, or deny a complete application for a permit to install or operate an UST or tank system or a permit renewal, modification, or transfer, required under this chapter. The director shall notify the applicant of his or her decision, within one hundred and eighty days of receipt of a complete application per subsection (a). Otherwise, the application is deemed approved on the one hundred and eightieth day. [Eff] (Auth: HRS §342L-3) (Imp: HRS §§342L-4, 342L-31, Act 164, Haw. Sess. Laws)

§ 11-281-28 Permit conditions. The director may impose conditions on a permit that the director deems reasonably necessary to ensure compliance with this chapter and any other relevant state requirement, including conditions relating to equipment, work practice, or operation. Conditions may include, but shall not be limited to, the requirement that devices for measurement or monitoring of regulated substances be installed (including the requirements of section 11-281-25) and maintained and the results reported to the director, all costs and expenses to be borne by the applicant. [Eff] (Auth: HRS § 342L-3) (Imp: HRS §§ 342L-4, 342L-31)

§11-281-29 Modification of permit and notice of change. (a) The director may modify a permit if there is a change that requires a modification to an existing permit. Changes requiring a permit modification shall include but not be limited to:

(1) Changes in service under subchapter 8;
(2) Repairs as defined in section 11-281-3;
(3) Changes in piping;
(4) Changes in type of regulated substance stored;
(5) Changes in corrosion protection mechanism; and
(6) Changes in secondary containment.

(b) The following changes do not require a permit modification but do require a written notice to the department:
(1) Changes in product dispensing method;
(2) Changes in financial responsibility mechanism;
(3) Changes in leak detection method;
(4) Changes in spill and overfill prevention method; and
(5) Temporary and permanent closures.

(c) The holder of a permit shall apply to the department for modification of the permit if plans to renovate or modify an UST or tank system would cause the holder to be out of compliance with the permit.

(d) An application for modification of a permit shall be made in writing to the department and shall be accompanied by sufficient information on the planned renovation or modification to the UST or tank system to assist the director in making a determination as to whether the application for modification should be denied or granted.

(e) Applications for a permit modification shall be received by the department no later than thirty days following the occurrence of the event that prompted the application except that applications for change in service must be received by the department at least thirty days before the owner or operator begins the change in service. Applications shall be submitted on forms prescribed in Appendix II entitled "Application for an Underground Storage Tank Permit", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter.

(f) Written notices under subsection (b) shall be received by the department no later than thirty days following implementation of the change except that notices of permanent closures must be received by the

department at least thirty days before the owner or operator begins the closure under section 11-281-82.

(g) Owners and operators shall submit a permit application to add USTs or tank systems to an existing permit. If the director approves the addition, the existing permit shall be terminated, and a new permit shall be issued which covers the additional USTs as well as the already-permitted USTs. The term of the new permit shall be for the remaining term of the original permit. [Eff] (Auth: HRS §342L-3) (Imp: HRS §§342L-4, 342L-31)

§11-281-30 Revocation or suspension of permit. The director may revoke or suspend a permit if the director finds any one of the following:
(1) There is a release or threatened release of regulated substances that the department deems to pose an imminent and substantial risk to human health or the environment;
(2) The permittee violated a condition of the permit; or
(3) The permit was obtained by misrepresentation, or failure to disclose fully all relevant facts. [Eff] (Auth: HRS §342L-3) (Imp: HRS §§342L-4, 342L-31)

§11-281-31 Change in owner or operator for a permit. (a) No permit to install, own, or operate an UST or tank system shall be transferable unless approved by the department. Request for approval to transfer a permit from one owner to another owner must be made by the new owner. Request for approval to transfer a permit from one operator to another operator must be made by the owner.

(b) The transferred permit will be effective for the remaining life of the original permit.

(c) An application for the transfer shall be received by the department at least 30 days prior to the proposed effective date of the transfer and shall be submitted on forms prescribed in Appendix V entitled "Application for Transfer of an Underground Storage Tank Permit", dated June, 1999, which is made a part of

this chapter and attached at the end of this chapter. [Eff] (Auth: HRS §342L-3) (Imp: HRS §§342L-4, 342L-31)

§11-281-32 Variances allowed. Provisions of chapter 342L, Hawaii Revised Statutes, and the rules in this chapter relating to USTs or tank systems which are more stringent than the federal rules and regulations promulgated by the U.S. Environmental Protection Agency under Subtitle I of the federal Resource Conservation and Recovery Act of 1976, Public Law 94-580, as amended, may be varied by the director in accordance with sections 342L-5 and 342L-6, HRS and this chapter. No variance may be less stringent than the federal requirements. [Eff] (Auth: HRS §342L-3) (Imp: HRS §342L-5)

§11-281-33 Variance applications. (a) Every application for a variance shall be submitted to the department on forms prescribed in Appendix VI entitled "Application for an Underground Storage Tank Variance", dated June, 1999, which is made a part of this chapter and attached at the end of this chapter.

(b) A variance fee in accordance with section 11-281-35 shall accompany each application for a variance.

(c) Every application shall be signed by the owner and operator, and the signature shall be by one of the following:

(1) In the case of a corporation, by a principal executive officer of at least the level of vice president, or a duly authorized representative if that representative is responsible for the overall operation of the UST or tank system;

(2) In the case of a partnership, by a general partner;

(3) In the case of a sole proprietorship, by the proprietor; or

(4) In the case of a county, state, or federal entity, by a principal executive officer, ranking elected official, or other duly authorized employee.

(d) The director shall approve, approve with conditions, or deny a complete application for a variance or variance renewal or modification as required under this chapter and sections 342L-5 and 342L-6, HRS. The director shall notify the applicant of his or her decision, within one hundred and eighty days of receipt of a complete application. Otherwise, the application is deemed approved on the one hundred and eightieth day. [Eff] (Auth: HRS §342L-3) (Imp: HRS §342L-6, Act 164, Haw. Sess. Laws)

§11-281-34 Maintenance of permit or variance. (a) Permits and variances, including application documents, shall be maintained at the location of the UST or tank system for which the permit was issued and shall be made available for inspection upon request of any duly authorized representative of the department.

(b) No person shall wilfully deface, alter, forge, counterfeit, or falsify any permit or variance. [Eff] (Auth: HRS §342L-3) (Imp: HRS §§342L-4, 342L-6, 342L-31).

§11-281-35 Fees. (a) Every applicant for a permit or a variance, or applicant for modification or renewal of a permit or variance, or applicant for a transfer of a permit, shall pay the applicable fees as set forth below:

Type of Application	Permit	Variance
Permit or variance application	$150	$200
Application to modify	$100	$150
Application for renewal	$ 50	$100
Application for transfer	$ 25	NA

(b) Fees shall be submitted with the application

and are nonrefundable.

(c) Fees shall be made payable to the State of Hawaii.

(d) If more than one type of application is combined, the highest applicable fee will be assessed. However, a permit application and a variance application shall not be combined under one fee. [Eff] (Auth: HRS §342L-3) (Imp: HRS §342L-14)

§§11-281-36 to 11-281-40 (Reserved)

SUBCHAPTER 4

GENERAL OPERATING REQUIREMENTS

§11-281-41 Spill and overfill control. (a) Owners and operators must ensure that releases due to spilling or overfilling do not occur. Owners and operators must ensure that the volume available in the UST is greater than the volume of product to be transferred to the UST before the transfer is made and that the transfer operation is monitored constantly to prevent spilling and overfilling.

NOTE: The transfer procedures described in National Fire Protection Association Publication 385 may be helpful in complying with subsection (a). Further guidance on spill and overfill prevention appears in American Petroleum Institute Publication 1621, "Recommended Practice for Bulk Liquid Stock Control at Retail Outlets", and National Fire Protection Association Standard 30, "Flammable and Combustible Liquids Code".

(b) Owners and operators must report, investigate, and clean up any spills and overfills in accordance with section 11-281-64. [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.30)

§11-281-42 Operation and maintenance of corrosion protection systems. (a) All owners and operators of steel USTs or tank systems with corrosion protection must comply with the following requirements to ensure that releases due to corrosion are prevented for as long as the UST or tank system is used to store regulated substances:

(1) All corrosion protection systems must be operated and maintained to continuously provide corrosion protection to the metal components of that portion of the UST and piping that routinely contain regulated substances and are in contact with the ground.

(2) All USTs or tank systems equipped with cathodic protection systems must be inspected for proper operation by a qualified cathodic protection tester in accordance with the following requirements:

(A) Frequency. All cathodic protection systems must be tested within six months of installation and at least every three years thereafter; and

(B) Inspection criteria. The criteria that are used to determine that cathodic protection is adequate as required by this section must be in accordance with a code of practice developed by a nationally recognized association; and

NOTE: National Association of Corrosion Engineers Standard RP0285-85, "Control of External Corrosion on Metallic Buried, Partially Buried, or Submerged Liquid Storage Systems" may be helpful in complying with subparagraph (a)(2)(B).

(3) USTs or tank systems with impressed current cathodic protection systems must also be inspected every sixty days to ensure the equipment is operating properly.

(b) For USTs or tank systems using cathodic protection, records of the operation of the cathodic

protection must be maintained by the owners and operators in accordance with section 11-281-45 to demonstrate compliance with the performance standards in this section. These records must provide the following:

(1) The results of the last three inspections required in paragraph (a)(3); and

(2) The results of testing from the last two inspections required in paragraph (a)(2).

[Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.31)

§11-281-43 Compatibility. Owners and operators must use an UST or tank system made of or lined with materials that are compatible with the substance stored in the UST or tank system.

NOTE: Owners and operators storing alcohol blends may find it helpful to use the following codes to comply with the requirements of this section:

A. American Petroleum Institute Publication 1626, "Storing and Handling Ethanol and Gasoline-Ethanol Blends at Distribution Terminals and Service Stations"; and

B. American Petroleum Institute Publication 1627, "Storage and Handling of Gasoline-Methanol/Cosolvent Blends at Distribution Terminals and Service Stations". [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.32)

§11-281-44 Repairs. (a) Owners and operators of USTs or tank systems must ensure that repairs will prevent releases due to structural failure or corrosion for as long as the UST or tank system is used to store regulated substances.

(b) UST or tank system repairs must meet the following requirements:

(1) Repairs to USTs and tank systems must be properly conducted in accordance with a code of practice developed by a nationally recognized association or an independent

testing laboratory.

NOTE: The following codes and standards may be helpful in complying with paragraph (b)(1):

A. National Fire Protection Association Standard 30, "Flammable and Combustible Liquids Code";

B. American Petroleum Institute Publication 2200, "Repairing Crude Oil, Liquified Petroleum Gas, and Product Pipelines";

C. American Petroleum Institute Publication 1631, "Recommended Practice for the Interior Lining of Existing Steel Underground Storage Tanks";

D. National Leak Prevention Association Standard 631, "Entry, Cleaning, Interior Inspection, Repair and Lining of Underground Storage Tanks".

(2) Repairs to fiberglass-reinforced plastic USTs may be made by the manufacturer's authorized representatives or in accordance with a code of practice developed by a nationally recognized association or an independent testing laboratory.

(3) Metal pipe sections and fittings that have released product as a result of corrosion or other damage must be replaced. Fiberglass pipes and fittings may be repaired in accordance with the manufacturer's specifications.

(4) Repaired USTs and piping must be tightness tested in accordance with sections 11-281-52(3) and 11-281-53(2) within thirty days following the date of the completion of the repair, except as provided in subparagraphs (b)(4)(A) to (b)(4)(B):

(A) The repaired UST is internally inspected in accordance with a code of practice developed by a nationally recognized association or an independent testing laboratory; or

(B) The repaired portion of the UST or tank

system is monitored monthly for releases in accordance with a method specified in section 11-281-52(4) through (8).

(5) Within six months following the repair of any cathodically protected UST or tank system, the cathodic protection system must be tested in accordance with sections 11-281-42(a)(2) and (3) to ensure that it is operating properly.

(c) UST or tank system owners and operators must maintain records of each repair for the remaining operating life of the UST or tank system to demonstrate compliance with the requirements of this section. [Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.33)

§11-281-45 Reporting and recordkeeping. (a) Owners and operators of USTs or tank systems must cooperate fully with inspections, monitoring, and testing conducted by the department, as well as requests by the department for document submission, monitoring and testing by owners or operators in accordance with chapter 342L, Hawaii Revised Statutes.

(b) Owners and operators must submit the following information to the department:

(1) Notifications for all USTs or tank systems as required by section 342L-30, HRS and sections 11-281-21 and 11-281-22. When appropriate, notification shall include certification of installation for USTs or tank systems required under section 11-281-16;

(2) Reports of all releases including suspected releases as required in section 11-281-61, spills and overfills as required in section 11-281-64, and confirmed releases as required in section 11-281-72;

(3) Release response actions planned or taken including immediate response actions as required in section 11-281-72, posting of signs as required in section 11-281-73, initial abatement measures and site assessment as required in section 11-281-74, initial site characterization as required in

section 11-281-75, free product removal as required in section 11-281-76, soil and ground water investigations as required in section 11-281-77, site cleanup as required in section 11-281-78, notification of confirmed release as required in section 11-281-78.1, corrective action plan as required in section 11-281-79, documentation of public participation as required in section 11-281-80, and ninety-day report and quarterly progress reports as required in section 11-281-80.1; and

(4) Notification before permanent closure or change-in-service of an UST or tank system as required in section 11-281-82.

(c) Owners and operators must keep and maintain records of the following information for the remaining operating life of the UST or tank system unless otherwise specified:

(1) A corrosion expert's analysis of site corrosion potential if corrosion protection equipment is not used as allowed for under sections 11-281-12 and 11-281-13;

(2) Documentation of operation of corrosion protection equipment as required in section 11-281-42;

(3) Documentation of UST or tank system repairs as required in section 11-281-44(c);

(4) Record of compliance with release detection requirements as specified and according to the timeframes in section 11-281-54;

(5) Record of compliance with change-in-service or permanent closure requirements, including results of the site assessment, under subchapter 8, for at least three years after completion of permanent closure or change-in-service;

(6) Permits or variances or both, including all documentation, as specified in section 11-281-34(a); and

(7) Proof of current financial assurance mechanisms used to demonstrate financial responsibility as required by subchapter 9.

(d) Owners and operators must keep records at the

following locations:

(1) All documents, except the permanent closure records specified in paragraph (c)(5), shall be made immediately available for inspection by the department by:
  (A) Being maintained at the UST site; or
  (B) Another method as approved by the director.

(2) The permanent closure records specified in paragraph (c)(5) may be maintained at a readily available alternative site and shall be provided for inspection to the department upon request; or

(3) In the case of permanent closure records required under section 11-281-85, owners and operators may submit closure records to the department if they cannot be kept at the site or an alternative site as indicated above.

[Eff] (Auth: HRS §§342L-3, 342L-32) (Imp: 40 C.F.R. §280.34)

§§11-281-46 to 11-281-50 (Reserved)

SUBCHAPTER 5

RELEASE DETECTION

§11-281-51 General requirements for all underground storage tanks or tank systems. (a) Owners and operators of new and existing USTs or tank systems must provide a method, or combination of methods, of release detection that:

(1) Can detect a release from any portion of the UST and the connected underground piping that routinely contains product;

(2) Is installed, calibrated, operated, and maintained in accordance with the manufacturer's instructions, including routine maintenance and service checks for operability either every twelve months or in a timeframe specified by the manufacturer, whichever is more frequent; and

(3) Meets the performance requirements in section 11-281-52 or section 11-281-53. Owners and operators must also provide the department with the equipment manufacturer's or installer's written documentation of any performance claims and their manner of determination. In addition, methods used after December 22, 1990, except for inventory control or methods permanently installed prior to that date, must be capable of detecting the leak rate or quantity specified for that method in section 11-281-52 (2), (3), or (4) or section 11-281-53(1) or (2) with a minimum probability of detection (Pd) of 0.95 and a maximum probability of false alarm (Pfa) of 0.05.

(b) When a release detection method operated in accordance with the performance standards in section 11-281-52 and section 11-281-53 indicates a release may have occurred, owners and operators must notify the department in accordance with subchapter 6.

(c) Owners and operators of all USTs or tank systems must comply with the release detection requirements of this subchapter.

(d) Owners and operators of any UST or tank system that cannot apply a method of release detection that complies with the requirements of this subchapter must comply with change-in-service or closure procedures in subchapter 8.

(e) Owners and operators of USTs or tank systems must provide release detection for USTs and piping as follows:

(1) Tanks. USTs must be monitored at least every thirty days for releases using one of the methods listed in sections 11-281-52(4) through (8) except that:
  (A) USTs or tank systems that meet the performance standards in subchapter 2, and the monthly inventory control requirements in section 11-281-52(1) or (2), may use tank tightness testing (conducted in accordance with section 11-281-52(3)) at least:
    (i) Every five years until December 22,

1998;
(ii) Until ten years after the tank is installed; or
(iii) For tank or tank systems that meet the upgrading requirements of sections 11-281-18(b), (c), and (d), until ten years after the tank is upgraded under section 11-281-18(b),
whichever is latest.
(B) USTs or tank systems that do not meet the performance standards in subchapter 2 may use monthly inventory controls (conducted in accordance with section 11-281-52(1) or (2)) and tank tightness testing (conducted every twelve months and in accordance with section 11-281-52(3)) until December 22, 1998, when the tank must be upgraded under section 11-281-18 or permanently closed under section 11-281-82.
Hazardous substance USTs or tank systems installed after December 22, 1988, must meet the requirements of section 11-281-17(a)(3); and

(2) Piping. Underground piping that routinely contains regulated substances must be monitored for releases in a manner that meets one of the following requirements:
(A) Pressurized piping. Underground piping that conveys regulated substances under pressure must:
(i) Be equipped with an automatic line leak detector in accordance with section 11-281-53(1); and
(ii) Have a line tightness test conducted every twelve months and in accordance with section 11-281-53(2) or have monthly monitoring conducted in accordance with section 11-281-53(3).
(B) Suction piping. Underground piping that conveys regulated substances under suction must either have a line

tightness test conducted at least every three years and in accordance with section 11-281-53(2), or use a monthly monitoring method conducted in accordance with section 11-281-53(3). No release detection is required for suction piping that is designed and constructed to meet the following standards:
(i) The below-grade piping operates at less than atmospheric pressure;
(ii) The below-grade piping is sloped so that the contents of the pipe will drain back into the storage tank if the suction is released;
(iii) Only one check valve is included in each suction line;
(iv) The check valve is located directly below and as close as practical to the suction pump; and
(v) A method is provided that allows compliance with clauses (e)(2)(B)(ii) through (iv) to be readily determined.
Hazardous substance USTs or tank systems installed after December 22, 1988, must meet the requirements of only subparagraph (A)(i) and section 11-281-17(d). [Eff] (Auth: HRS §§342L-3, 342L-33) (Imp: 40 C.F.R. §§280.40 and 280.41)

§11-281-52 Methods of release detection for tanks. Each method of release detection for tanks used to meet the requirements of section 11-281-51(e) must be conducted in accordance with the following:
(1) Inventory control. Product inventory control (or another test of equivalent performance) must be conducted monthly to detect a release of at least one per cent of flow-through plus one hundred thirty gallons on a monthly basis in the following manner:
(A) Inventory volume measurements for regulated substance inputs,

withdrawals, and the amount still remaining in the tank are recorded each operating day;

(B) The equipment used is capable of measuring the level of product over the full range of the tank's height to the nearest one-eighth of an inch;

(C) If a manual measuring device is used (e.g. a gauge stick), the measurements must be made through a drop tube and one that extends to within one foot of the tank bottom. Level measurements shall be to the nearest one-eighth of an inch;

(D) The regulated substance inputs are reconciled with delivery receipts by measurement of the tank inventory volume before and after delivery;

(E) Deliveries are made through a drop tube that extends to within one foot of the tank bottom;

(F) Product dispensing is metered and recorded within the state standards for meter calibration; or for non-retail enterprises, calibrated to an accuracy of six cubic inches for every five gallons of product withdrawn (in both cases, the meter must be calibrated every twelve months); and

(G) The measurement of any water level in the bottom of the tank is made to the nearest one-eighth of an inch at least once a month.

NOTE: Practices described in the American Petroleum Institute Publication 1621, "Recommended Practice for Bulk Liquid Stock Control at Retail Outlets," may be helpful where applicable, in meeting the requirements of paragraph (1).

(2) Manual tank gauging. Manual tank gauging must meet the following requirements:

(A) Tank liquid level measurements are taken at the beginning and ending of a period

of at least 36 hours during which no liquid is added to or removed from the tank (of the period defined in the table below for the size of the tank);

(B) If a manual measuring device is used (e.g. a gauge stick), the measurements must be made through a drop tube that extends to within one foot of the tank bottom. Level measurements shall be to the nearest one-eighth of an inch and shall be based on the average of two consecutive gauge stick readings at both the beginning and ending of the period;

(C) The equipment used is capable of measuring the level of product over the full range of the tank's height to the nearest one-eighth of an inch;

(D) A leak is suspected and subject to the requirements of subchapter 6 if the variation between beginning and ending measurements exceeds the weekly or monthly standards in the following table:

Nominal Tank Capacity (in gallons)	Tank Dimensions	Weekly Standard (in gallons)	Monthly Standard (in gallons)	Minimum Test Duration
550	N/A	10	5	36 hrs.
551 - 1,000	N/A	13	7	36 hrs. *
1,000	64" dia. X 73" L	9	4	44 hrs.
1,000	48" dia. X 128" L	12	6	58 hrs.
1,001 - 2,000	N/A	26	13	36 hrs. *

* Must be combined with tank tightness testing

(E) Measurements shall be conducted each week of the month. If the month has five measurement periods, the weekly test with the smallest discrepancy shall

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not be used in calculating the average.

(F) Tanks of 1,000 gallons or less nominal capacity may use manual tank gauging as the sole method of release detection when using the standards in the above table except that where an asterisk is indicated tank tightness testing is required. Tanks of 551 gallons to 2,000 gallons may use manual tank gauging in place of inventory control in section 11-281-52(2) when using the standards in the above table that indicate with an asterisk that tank tightness testing is also required. Tanks of greater than 2,000 gallons nominal capacity may not use manual tank gauging to meet the requirements of this subchapter.

(3) Tank tightness testing. Tank tightness testing (or another test of equivalent performance) must be capable of detecting a 0.1 gallon per hour leak rate from any portion of the tank that routinely contains product while accounting for the effects of thermal expansion or contraction of the product, vapor pockets, tank deformation, evaporation or condensation, and the location of the water table at the time of the tank

(4) Automatic tank gauging. Equipment for automatic tank gauging that tests for the loss of product and conducts inventory control must meet the following requirements:

(A) The automatic product level monitor test can detect a 0.2 gallon per hour leak rate from any portion of the tank that routinely contains product; and

(B) Inventory control (or another test of equivalent performance) is conducted in accordance with the requirements of section 11-281-52(1). Inventory control is required only when the automatic tank gauging is not third party certified for detecting a release of 0.2 gallons per hour with a ninety-five per cent

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probability of detection and five per cent probability of false alarm and was installed prior to December 22, 1990.

(5) Vapor monitoring. Testing or monitoring for vapors within the soil gas of the excavation zone must meet the following requirements:

(A) The materials used as backfill are sufficiently porous (e.g., gravel, sand, crushed rock) to readily allow diffusion of vapors from releases into the excavation area;

(B) The stored regulated substance, or a tracer compound placed in the tank system, is sufficiently volatile (e.g., gasoline) to result in a vapor level that is detectable by the monitoring devices located in the excavation zone in the event of a release from the tank;

(C) The measurement of vapors by the monitoring device is not rendered inoperative by the ground water, rainfall, soil moisture, or other known interferences so that a release could go undetected for more than thirty days;

(D) The level of background contamination in the excavation zone will not interfere with the method used to detect releases from the tank;

(E) The vapor monitors are designed and operated to detect any significant increase in concentration above background of the regulated substance stored in the tank system, a component or components of that substance, or a tracer compound placed in the tank system;

(F) In the tank system excavation zone, the site is assessed with written documentation to ensure compliance with the requirements in subparagraphs (5)(A) through (D) and to establish the number and positioning of monitoring wells that will detect releases within the excavation zone from any portion of the

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tank that routinely contains product; and

(G) Monitoring wells are clearly marked and secured to avoid unauthorized access and tampering.

(6) Ground water monitoring. Testing or monitoring for liquids on the ground water must meet the following requirements:

(A) The regulated substance stored is immiscible in water and has a specific gravity of less than one;

(B) Ground water is never more than twenty feet from the ground surface and the hydraulic conductivity of the soil(s) between the UST or tank system and the monitoring wells or devices is not less than 0.01 cm/sec (e.g., the soil should consist of gravel, coarse to medium sands, coarse silts or other permeable materials);

(C) The slotted portion of the monitoring well casing must be designed to prevent migration of natural soils or filter pack into the well and to allow entry of regulated substance on the water table into the well under both high and low ground water conditions;

(D) Monitoring wells shall be sealed from the ground surface to the top of the filter-pack;

(E) Monitoring wells or devices intercept the excavation zone or are as close to it as is technically feasible;

(F) The continuous monitoring devices or manual methods used can detect the presence of at least one-eighth of one inch of free product on top of the ground water in the monitoring wells;

(G) Within and immediately below the tank system excavation zone, the site is assessed with written documentation to ensure compliance with the requirements in subparagraphs (6)(A) through (E) and to establish the number and positioning

of monitoring wells or devices that will detect releases from any portion of the tank that routinely contains product; and

(H) Monitoring wells are clearly marked and secured to avoid unauthorized access and tampering.

(7) Interstitial monitoring. Interstitial monitoring between the tank system and a secondary barrier immediately around or beneath it may be used, but only if the monitoring system is designed, constructed and installed to detect a leak from any portion of the tank that routinely contains product and also meets one of the following requirements:

(A) For double-walled tank systems, the sampling or testing method can detect a release through the inner wall in any portion of the tank that routinely contains product.

NOTE: The provisions outlined in the Steel Tank Institute's "Standard for Dual Wall Underground Steel Storage Tanks" may be helpful for aspects of the design and construction of underground steel double-walled tanks.

(B) For tanks with an internally fitted liner, an automated device can detect a release between the inner wall of the tank and the liner, and the liner is compatible with the substance stored.

(8) Other methods. Any other type of release detection method, or combination of methods, can be used if:

(A) It can detect a 0.2 gallon per hour leak rate or a release of one hundred fifty gallons within a month with a probability of detection of 0.95 and a probability of false alarm of 0.05;

(B) The owners and operators demonstrate to the department that the method can

detect a release as effectively as any of the methods allowed in paragraphs (3) through (7), and the department approves the method. In comparing methods, the department shall consider the size of release that the method can detect and the frequency and reliability with which it can be detected. If the method is approved, owners and operators must comply with any conditions imposed by the department on its use to ensure the protection of human health and the environment; or

(C) For hazardous substance tanks, the owners and operators:

(i) Provide information to the department on effective corrective action technologies, health risks, and chemical and physical properties of the stored substance, and the characteristics of the UST site; and

(ii) Obtain approval from the department to use the alternate release detection method. [Eff] (Auth: HRS §§342L-3, 342L-33) (Imp: 40 C.F.R. §280.43)

§11-281-53 Methods of release detection for piping. Each method of release detection for piping used to meet the requirements of section 11-281-51(e) must be conducted in accordance with the following:

(1) Automatic line leak detectors. Methods which alert the operator to the presence of a leak by restricting or shutting off the flow of regulated substances through piping may be used only if they detect leaks of three gallons per hour at ten pounds per square inch line pressure within one hour. A test every twelve months of the operation of the leak detector must be conducted in accordance with the manufacturer's requirements.

(2) Line tightness testing. A periodic test of piping may be conducted only if it can detect a 0.1 gallon per hour leak rate at one and one-half times the operating pressure.

(3) Applicable tank methods. Any of the methods in sections 11-281-52(5) through (8) may be used if they are designed to detect a release from any portion of the underground piping that routinely contains regulated substances. [Eff] (Auth: HRS §§342L-3, 342L-33) (Imp: 40 C.F.R. §280.44)

§11-281-54 Release detection recordkeeping. (a) All owners and operators of USTs or tank systems must keep and maintain records in accordance with section 11-281-45 demonstrating compliance with all applicable requirements of this subchapter.

(b) These records must be kept at least one year, unless otherwise specified, and shall include but is not limited to the following:

(1) All written performance claims pertaining to any release detection system used, and the manner in which these claims have been justified or tested by the equipment manufacturer or installer, must be kept and maintained for the lifetime of the equipment;

(2) All results of any sampling, testing, or monitoring;

(3) Written documentation of the last twelve months of all calibration, maintenance (including testing required by section 11-281-51(a)(2)), and repair of release detection equipment permanently located on-site. Any schedules of required calibration and maintenance provided by the release detection equipment manufacturer must be retained for the lifetime of the equipment;

(4) All records of the last twelve months of release detection, the most recent tank and line tightness tests, and test results of the automatic line leak detectors, except tank and line tightness test records must be maintained until the next test. These

records shall include all of the testing data, not just the pass or fail determination;

(5) Operating manuals for all currently installed leak detection equipment for the remaining operating life of the UST or tank system; and

(6) Documentation of the site assessment, as required by sections 11-281-52(5)(F) and (6)(G), for three years after change-in-service or permanent closure of the UST or tank system. [Eff] (Auth: HRS §§342L-3, 342L-33) (Imp: 40 C.F.R. §280.45)

§§11-281-55 to 11-281-60 (Reserved)

SUBCHAPTER 6

RELEASE REPORTING, INVESTIGATION, AND CONFIRMATION

§11-281-61 Reporting of suspected releases. Owners and operators of USTs or tank systems must notify the department within twenty-four hours, and follow the procedures in section 11-281-63, for any of the following conditions:

(1) The discovery by any person of evidence of regulated substances which may have been released at the UST or tank system site or in the surrounding area (such as the presence of free product or vapors in soils, basements, sewer and utility lines, and nearby surface water);

(2) Unusual UST or tank system operating conditions observed or experienced by owners and operators (such as the erratic behavior of product dispensing equipment, the sudden loss of product from the UST or tank system, or an unexplained presence of water in the tank), unless a component of the UST or tank system is found to be defective but not leaking, and is immediately repaired or replaced; or

(3) Monitoring results from a release detection method required under section 11-281-51(e) indicate a release may have occurred unless:

(A) The monitoring device is found to be defective, and is immediately repaired, recalibrated, or replaced, and additional monitoring results do not confirm the initial result; or

(B) In the case of inventory control monthly reconciliation, two consecutive months of data do not confirm the initial result. [Eff] (Auth: HRS §§342L-3, 342L-34) (Imp: 40 C.F.R. §280.50)

§11-281-62 Investigation of off-site impacts. When required by the department, owners and operators of USTs or tank systems must follow the procedures in section 11-281-63 to determine if the UST or tank system is the source of off-site impacts. These impacts include the discovery of regulated substances (such as the presence of free product or vapors in soils, basements, sewer and utility lines, and nearby surface and drinking waters) that have been observed by the department or brought to the department's attention by any person. [Eff] (Auth: HRS §§342L-3, 342L-34) (Imp: 40 C.F.R. §280.51)

§11-281-63 Release investigation and confirmation steps. (a) Unless release response action is initiated in accordance with subchapter 7, owners and operators must immediately investigate and confirm all suspected releases of regulated substances that require reporting under section 11-281-61 within seven days following the discovery of the suspected release, unless a written request for extension of time is granted by the director.

(b) Investigations and confirmations required in subsection (a) must use the following steps:

(1) System test. Owners and operators must conduct tests (according to the requirements for tightness testing in sections 11-281-

52(3) and 11-281-53(2)) to determine whether a leak exists in that portion of the UST that routinely contains product, or the attached delivery piping, or both.

(A) Owners and operators must repair, replace, or upgrade the UST or tank system, and begin release response action in accordance with subchapter 7 if the test results for the UST system, UST, or delivery piping indicate that a leak exists.

(B) Further investigation is not required if the test results for the UST system, UST, and delivery piping do not indicate that a leak exists and if the discovery of environmental contamination subject to the reporting requirements of section 11-281-61(1) is not the basis for suspecting a release.

(C) Owners and operators must conduct a site assessment as described in paragraph (b)(2) if the test results for the UST system, UST, and delivery piping do not indicate that a leak exists but the discovery of environmental contamination subject to the reporting requirements of section 11-281-61(1) is the basis for suspecting a release.

(2) Site assessment. Owners and operators must measure for the presence of a release where contamination is most likely to be present at the UST or tank system site. In selecting sample types, sample locations, and measurement methods, owners and operators must consider the nature of the stored substance, the type of initial alarm or cause for suspicion, the types of backfill and surrounding soil, the depth and flow of ground water, and other factors as appropriate for identifying the presence and source of a release.

(A) If the test results for the excavation zone, or the UST or tank system site, indicate that a release has occurred,

owners and operators must begin release response action in accordance with subchapter 7;

(B) If the test results for the excavation zone, or the UST or tank system site, do not indicate that a release has occurred, further investigation is not required.

(c) If it is determined that a release has not occurred, owners and operators must report the results of the investigation in writing to the department within thirty days following discovery of the suspected release. The report shall include, but not be limited to, results of the tests pursuant to subsection (b) as well as performance claims pursuant to section 11-281-51(a)(3). [Eff] (Auth: HRS §§342L-3, 342L-34) (Imp: 40 C.F.R. §280.52)

§11-281-64 Reporting and cleanup of spills and overfills. (a) Owners and operators of USTs or tank systems must contain and immediately clean up all spills and overfills in a manner which is protective of human health and the environment as set forth in section 11-281-78.

(b) Owners and operators must notify the department within twenty-four hours and begin release response action in accordance with subchapter 7 in the following cases:

(1) Spill or overfill of petroleum that results in a release to the environment that exceeds twenty-five gallons or that causes a sheen on nearby surface waters; and

(2) Spill or overfill of a hazardous substance that results in a release to the environment that equals or exceeds its reportable quantity as determined in compliance with section 11-451-6 (determination of reportable quantities).

(c) If the owners and operators cannot, within twenty-four hours, contain and complete the cleanup of a spill or overfill of petroleum that is less than twenty-five gallons, or a spill or overfill of a hazardous substance that is less than the reportable

quantity, then the owners and operators must immediately notify the department of the incident and continue cleaning up the spill or overfill. Owners and operators must also complete and submit to the department a written report of the actions taken in response to the spill or overfill within ninety days of the spill or overfill. [Eff] (Auth: HRS §§342L-3, 342L-34) (Imp: 40 C.F.R. §280.53)

§§11-281-65 to 11-281-70 (Reserved)

SUBCHAPTER 7

RELEASE RESPONSE ACTION

§11-281-71 General. (a) Owners and operators of USTs or tank systems must comply with the requirements of this subchapter in responding to releases of regulated substances from USTs or tank systems.

(b) For purposes of complying with this subchapter, the date of confirmation of a release shall be as follows:

(1) For releases confirmed on or after the effective date of these rules, the date of confirmation shall be the date the release is confirmed in accordance with section 11-281-63.

(2) For releases confirmed before the effective date of these rules, the date of confirmation shall be the effective date of the State rules. [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: 40 C.F.R. §280.60)

§11-281-72 Immediate response actions. (a) Upon confirmation of a release in accordance with section 11-281-63, or after a release from the UST or tank system is identified in any other manner, owners and operators must perform the following immediate response actions within twenty-four hours following the confirmation:

(1) Report the release to the department (e.g., by telephone or fax);

(2) Identify and mitigate any safety hazards (such as fire, explosion, and vapor hazards) posed by the release of the regulated substance; and

(3) Take necessary actions to prevent any further release of the regulated substance into the environment, including removal of as much of the regulated substance from the UST or tank system as possible; and

(4) Take necessary action to minimize the spread of contamination.

(b) Within seven days of confirmation, owners and operators must submit to the department a written notice of confirmation. The notice shall include, but not be limited to, the following information: source of the release, method of discovery and confirmation, estimated quantity of substance released, type of substance released, immediate hazards, release impact, migration pathways, and actions taken. [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: 40 C.F.R. §280.61)

§11-281-73 Posting of signs. (a) If the department determines that posting of signs is appropriate, owners and operators shall post signs around the perimeter of the site informing passersby of the potential hazards. In this instance, "site" means an area where contamination poses an immediate health risk or an area where contaminated media is exposed to the surface.

(b) Signs shall be placed at each entrance to the site and at other locations in sufficient numbers to be seen from any approach to the site.

(c) Signs shall be legible and readable from a distance of at least twenty-five feet. The sign legend shall read, "Caution - Petroleum/Hazardous Substance Contamination - Unauthorized Personnel Keep Out". Other sign legends may be used if the legend on the sign indicates that only authorized personnel are allowed to enter the site and that entry onto the site may be dangerous. A contact person and telephone

number shall be listed on the sign.

(d) The sign may be removed upon determination by the department that no further release response action is necessary or that posting of signs is no longer appropriate. [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: HRS §342L-35)

§11-281-74 Initial abatement measures and site assessment. (a) After a release has been confirmed, owners and operators must perform the following release abatement and control measures:

(1) Continue to remove as much of the regulated substance from the UST or tank system as is necessary to prevent further release to the environment;

(2) Visually inspect the area around the UST or tank system for evidence of any aboveground releases or exposed below ground releases and continue to take necessary actions to minimize the spread of contamination and to prevent further migration of the released substance into surrounding soils, air, surface water, and ground water;

(3) Continue to monitor and mitigate any safety hazards (such as fire, explosion, and vapors) posed by the release that have migrated from the UST or tank system excavation zone and entered into subsurface structures (such as sewers or basements);

(4) Remedy hazards (such as dust and vapors and the potential for leachate generation) posed by contaminated soils and debris that are excavated or exposed as a result of release confirmation activities undertaken pursuant to subchapter 6 or release response actions undertaken pursuant to this subchapter;

(5) Investigate to determine the possible presence of free product, and begin free product removal in accordance with section 11-281-76;

(6) Remove or remediate contaminated soil at the site to the extent necessary to prevent the spread of free product;

(7) Conduct an assessment of the release by measuring for the presence of a release where contamination is most likely to be present at the UST or tank system site, unless the presence and source of the release have been confirmed in accordance with the site assessment required by section 11-281-63(b)(2) or the site assessment required for change-in-service or permanent UST or tank system closures in section 11-281-83. In selecting sample types, sample locations, and measurement methods, owners and operators must consider the nature of the stored substance, the types of backfill and surrounding soil, depth and flow of ground water, and other factors as appropriate for identifying the presence and source of a release; and

(8) If any of the remedies in this section include treatment or disposal of contaminated soils, owners or operators must comply with all applicable local, state and federal requirements.

(b) Initial site assessment and abatement shall be completed within ninety days of confirmation of a release or sooner if directed by the department. [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: 40 C.F.R. §280.62)

§11-281-75 Initial site characterization. (a) While carrying out release response actions under this subchapter, owners and operators must concurrently assemble necessary information about the characteristics of the site and the nature of the release in order to adequately assess the impact or potential impact the release has on human health and the environment.

(b) The information assembled pursuant to subsection (a) must include, but is not limited to, the following:

(1) Data on the nature and estimated quantity of release;

(2) Data from available sources or site

investigations or both concerning the following factors: surrounding populations, water quality, use and approximate locations of wells potentially affected by the release, subsurface soil conditions, locations of subsurface sewers, climatological data, and land use;

(3) Results of the site assessment required under section 11-281-74(a)(7);

(4) Results of the free product investigations required under section 11-281-74(a)(5) to be used by the owners and operators to determine whether free product must be recovered under section 11-281-76; and

(5) Any other information, as appropriate, which may relate to the impact of the release on human health and the environment.

(c) Initial site characterization shall be completed within ninety days of confirmation of a release or sooner as determined by the department. [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: 40 C.F.R. §280.63)

§11-281-76 Free product removal. (a) At sites where investigations indicate the presence of free product, owners and operators must remove free product to the maximum extent practicable, as determined by the department, while continuing, as necessary, actions initiated under sections 11-281-62 and 11-281-63, or preparing for actions required under sections 11-281-71 through 11-281-78. In meeting the requirement of this section, owners and operators must:

(1) Conduct free product removal in a manner that minimizes the spread of contamination into previously uncontaminated zones by using recovery and disposal techniques appropriate to the hydrogeologic conditions at the site, and that properly treats, discharges or disposes of recovery byproducts in compliance with applicable local, state, and federal regulations;

(2) Use abatement of free product migration as a minimum objective for the design of the free

product removal system;

(3) Handle any flammable products in a safe and competent manner to prevent fires or explosions; and

(4) Prepare and submit to the department, included in the first quarter progress report required pursuant to section 11-281-80.1(a), information that provides at least the following:

(A) The name of the person(s) responsible for implementing the free product removal measures;

(B) The estimated quantity, type, and thickness of free product observed or measured in wells, boreholes, and excavations;

(C) The type of free product recovery system used;

(D) Whether any discharge will take place on-site or off-site during the recovery operation and where this discharge will be located;

(E) The type of treatment applied to, and the effluent quality expected from, any discharge;

(F) The steps that have been or are being taken to remove free product including steps to obtain any necessary permits for any discharges;

(G) The disposition of the recovered free product; and

(H) Schedule for completion of free product removal.

(b) Owners and operators shall initiate free product removal as soon as practicable but no later than ninety days following confirmation of a release or sooner if directed by the department. [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: 40 C.F.R. §280.281)

§11-281-77 Investigation of soil and ground water contamination. (a) For releases confirmed in accordance with section 11-281-63, owners and operators

must determine the extent and location of the soil contaminated by the release and the presence and concentrations of dissolved product contamination in the ground water and must conduct investigations of the release, the release site, and the surrounding area possibly affected by the release.

(b) Owners and operators must submit information collected under this section with the quarterly reports required pursuant to sections 11-281-80.1(a) and (b). [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: 40 C.F.R. §280.65)

§11-281-78 Site cleanup criteria. (a) For releases confirmed in accordance with section 11-281-63, owners and operators must remediate soil, water, and materials contaminated by releases from USTs or tank systems in a manner which is protective of human health and the environment and achieves cleanup as described in subsection (b).

(b) Owners and operators must remediate contaminated soil and water at the site to residual levels which meet one of the following criteria:

(1) Default tier 1 action levels as presented in Table 1-1a (Tier 1 Action Levels for Soil and Groundwater: Rainfall ≤ 200cm/yr), section 11-281-80.1 and in Table 1-1b (Tier 1 Action Levels for Soil and Groundwater: Rainfall > 200cm/yr), section 11-281-80.1; or

(2) Site-specific action levels as approved by the department. Site-specific action levels must take into account the following factors:

(A) For systemic toxicants, acceptable levels shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety;

(B) For known or suspected carcinogens, acceptable levels are generally concentration levels that represent an excess upper bound lifetime cancer risk

to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. The 10^{-6} excess risk level shall be used as the point of departure for determining acceptable levels for alternatives when chemical specific state or federal requirements are not available or are not sufficiently protective because of the presence of multiple contaminants at the site or multiple pathways of exposure;

(C) Impacts to ecological receptors; and

(D) Other applicable requirements, if available;

NOTE: Owners and operators should consult with the department on how the standards in section 11-281-78(b) can be met. Owners and operators should also consult the department for forms to be used that will be helpful in expediting the department's review of the owners' and operators' reports.

(c) The department may require the owners and operators to modify cleanup activities being undertaken at a site if the department determines that the activities are not being carried out in accordance with this subchapter, or are not achieving cleanup levels which are protective of human health and the environment. The department may impose modifications to cleanup activities by written notice to the owners and operators, and the owners and operators must implement necessary changes to the cleanup activities in response to the department's notice by a time schedule established by the department.

(d) A schedule for completion of site cleanup shall be included in the fourth quarter report required pursuant to section 11-281-80.1(b). [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: HRS §342L-35)

§11-281-78.1 Notification of confirmed releases. (a) Within ninety days following confirmation of

a release pursuant to section 11-281-63, the owner and operator shall notify those members of the public directly affected by a release and the proposed response to the release. Members of the public directly affected by the release shall include:

(1) Persons who own, hold a lease for, or have easements at, any property on which the regulated substance released from the UST was discovered; and

(2) Other persons as identified by the director.

(b) The owner and operator shall send a letter to all members of the public directly affected by the release. Model language for the letter shall be provided by the department and shall include at least the following information:

(1) Name and address of the UST or UST system;

(2) Statement that a release of regulated substance has been confirmed at the UST or UST system;

(3) Name of a contact person at the department; and

(4) Reference to an attached factsheet pursuant to subsection (c).

(c) The letter to the members of the public directly affected by the release shall include a factsheet which contains the following information:

(1) Name and address of the UST or UST system;

(2) Name and address of the owner and operator of the UST or UST system;

(3) Date of the confirmed release;

(4) Nature and extent of the confirmed release;

(5) Summary of measures taken to assess the release and extent of contamination; and

(6) Summary of the proposed response to the release.

The factsheet shall be updated on a quarterly basis and sent to all members of the public directly affected by the release. If additional members of the public directly affected by the release are identified in the course of release response actions, then the owner and operator shall provide those persons with all previous and future letters and factsheets.

(d) The owner and operator shall include in the quarterly report required pursuant to section 11-281-

80.1 the following information:

(1) Copy of the letter pursuant to subsection (b);

(2) List of the members of the public directly affected by the release and to whom the letter was sent; and

(3) Copies of the factsheet and amended factsheets pursuant to subsection (c). [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: HRS §342L-35)

§11-281-79 Corrective action plan. (a) The department may require that the owner and operator submit a written corrective action plan for responding to a release, if one or more of the following minimum threshold criteria is met:

(1) Actual or probable release to ground water which is a drinking water supply;

(2) Actual or probable release to surface water which is a drinking water supply;

(3) Actual or probable release to air that poses a threat to public health;

(4) Actual or probable release to and extensive contamination of soil that poses a direct contact hazard due to uncontrolled access;

(5) Actual or probable existence of uncontrolled regulated substances that pose a direct contact hazard due to uncontrolled access;

(6) Actual or probable adverse impact to natural resources;

(7) Actual or probable imminent danger of fire or explosion; or

(8) A determination by the director that a release poses a substantial endangerment to public health or welfare, the environment, or natural resources.

(b) Such plans must be submitted to the department within thirty days of the department's request unless an extension of time is granted by the department.

(c) Owners and operators must make necessary modifications to the corrective action plan when directed to do so by the department.

(d) Corrective action plans which are required to be submitted to the department shall be subject to the review and discretionary approval of the department in accordance with the procedures set forth in this section.

NOTE: Forms such as those in the TGH may be helpful in fulfilling the requirements of this section.

(e) The department will approve written corrective action plans only after owners and operators demonstrate to the satisfaction of the department that implementation of the plan will be safe and will adequately protect human health and the environment in accordance with section 11-281-78. In making this determination, the department will consider the following factors:

(1) The physical and chemical characteristics of the regulated substance, including its toxicity, persistence, and potential for migration;
(2) The hydrogeologic characteristics of the facility and the surrounding area;
(3) The proximity, quality, and current and future uses of nearby surface water and ground water;
(4) The potential effects of residual contamination on nearby surface water and ground water;
(5) An exposure assessment; and
(6) Any other information assembled in compliance with this subchapter.

(f) The public participation procedures set forth in section 11-281-80 apply to all corrective action plans submitted under this section.

(g) Upon approval of a corrective action plan, owners and operators must implement the plan, including any modifications to the plan made by the department.

(h) Owners and operators must monitor, evaluate, and report quarterly to the department the results of implementing the corrective action plan pursuant to this section and section 11-281-80.1.

(i) Owners and operators who have been requested by the department to submit a corrective action plan

may, in the interest of minimizing environmental contamination and promoting effective and timely cleanups, begin cleanup of contaminated soils, water, and materials before the plan is approved by the department provided that they:

(1) Notify the department of their intention to begin cleanup;
(2) Ensure that cleanup measures undertaken are consistent with the cleanup actions required pursuant to section 11-281-78;
(3) Comply with any conditions imposed by the department, including halting cleanup or mitigating adverse consequences from cleanup activities; and
(4) Incorporate self-initiated cleanup measures in the corrective action plan. (Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: 40 C.F.R. §280.66)

§11-281-80 Public participation for corrective action plans. (a) The department shall conduct public participation activities as outlined in subsections (e) through (j) where:

(1) A corrective action plan required pursuant to section 11-281-79(a) has been submitted and the department has made a tentative decision concerning the proposed plan; or
(2) Implementation of any previously approved corrective action plan has not achieved the cleanup levels established in the plan and termination of the plan is under consideration by the department.

(b) Costs for all public participation activities described in subsections (e) through (j) shall be borne by the owner and operator of the UST or UST system, including the costs of making copies of materials to the public under subsection (h).

(c) The department will provide notice to the public of the release and the applicable response by means designed to reach those members of the public directly affected by the release and the cleanup actions planned.

(d) Members of the public directly affected by

the release shall include the following:

(1) Those individuals defined in sections 11-281-78.1(a); and

(2) The general public.

(e) Notice to those individuals defined in paragraph (d)(1) shall be in the form of a letter from the department and shall include at least the following information:

(1) Name and address of the UST or UST system;

(2) Name and address of the owner and operator of the UST or UST system;

(3) Summary of the release information and the proposed or previously approved corrective action plan;

(4) The department's tentative decision concerning the proposed corrective action plan or concerning the termination of the previously approved corrective action plan;

(5) Announcement that an informational meeting will be held in accordance with subsection (i);

(6) Request for comments on the corrective action plan and the department's tentative decision; and

(7) Availability of information on the release and the department's tentative decision.

(f) Notice to those individuals defined in paragraph (d)(2) shall be in the form of a notice in a local newspaper and shall include at least the same information as in subsection (e).

(g) Comments shall be received by the department no later than thirty days after the notice provided in subsections (e) and (f) or after the end of the public meeting, if held, pursuant to subsection (i), whichever occurs later.

(h) Information on the release, the proposed corrective action plan, and the department's tentative decision on the plan shall be made available to the public for inspection upon request.

(i) Before approving a corrective action plan, the department may conduct a public meeting to provide information and receive comments on the proposed plan. A meeting will be held if there is sufficient public interest. Public interest shall be indicated by written request to the department.

(j) At the director's discretion, a notice of final decision may be issued. [Eff] (Auth: HRS §§342L-3, 342L-35) (Imp: 40 C.F.R. §280.67)

§11-281-80.1 Reporting and recordkeeping. (a) No later than ninety days following the confirmation of a release in accordance with section 11-281-63, owners and operators must submit to the department a written report of:

(1) All release response actions taken pursuant to this subchapter during the first ninety-day period (first quarter); and

(2) A plan for future release response actions to be taken.

(b) Beginning one hundred eighty days following confirmation of a release, owners and operators must submit written quarterly progress reports to the department describing:

(1) All response actions taken pursuant to this subchapter after the last reported date;

(2) A plan for future release response actions to be taken; and

(3) Information required pursuant to section 11-281-78.1.

(c) A quarterly progress report is not required if:

(1) Response actions have met the requirements of section 11-281-78; and

(2) A final quarterly report has been submitted.

NOTE: The report contents and format in the TGM may be helpful in complying with this section. [Eff] (Auth. HRS §§342L-3, 342L-35) (Imp: HRS §342L-35)

TABLE 1-1a.Tier 1 Action Levels for Soil and Groundwater: Rainfall < 200cm/year (6/99)

Contaminant	RAINFALL ≤200CM/YEAR			
	DRINKING WATER SOURCE THREATENED		DRINKING WATER SOURCE NOT THREATENED	
	Groundwater (mg/l)	Soil (mg/kg):	Groundwater (mg/l)	Soil (mg/kg):
Benzene	0.005	0.05	1.7	1.7
Toluene	1.0	16	2.1	34
Ethylbenzene	(0.14)	0.50	0.14	0.50
Xylene	10	23	[10]	23
Benzo(a)pyrene	0.0002	1.0de	[0.0002]	1.0de
Acenaphthene	(0.32)	18sat	0.32	18sat
Fluoranthene	(0.013)	11sat	0.013	11sat
Naphthalene	0.24	41sat	0.77	41sat
PCE	0.005	0.29	0.145	5.0de
1,1 DCE	0.046	0.47de	3.9	0.47de
Vinyl Chloride	0.002	0.18de	[0.002]	0.18de
TCE	0.005	0.01	0.70	1.5
1,1,1 TCA	0.20	0.10	8.0	3.0
PCBs (all)	0.0005	1de	0.002	1de
Lead (total)	(0.0056)	400de	0.0056.	400de
Cadmium (total)	0.005	38de	0.009	38de
TPH-residual fuels	NS	5,000	NS	5,000
TPH-middle distillates	NS	5,000	NS	5,000
TPH-gasolines	NS	2,000	NS	2,000

TABLE 1-1b.Tier 1 Action Levels for Soil and Groundwater: Rainfall > 200cm/year (6/99)

Contaminant	RAINFALL >200CM/YEAR			
	DRINKING WATER SOURCE THREATENED		DRINKING WATER SOURCE NOT THREATENED	
	Groundwater (mg/l)	Soil (mg/kg):	Groundwater (mg/l)	Soil (mg/kg):
Benzene	0.005	0.05	1.7	0.68
Toluene	1.0	2.8	2.1	5.5
Ethylbenzene	(0.14)	0.13	0.14	0.13
Xylene	10	8	[10]	8
Benzo(a)pyrene	0.0002	1.0de	[0.0002]	1.0de
Acenaphthene	(0.32)	18sat	0.32	18sat
Fluoranthene	(0.013)	11sat	0.013	11sat
Naphthalene	0.24	41sat	0.77	41sat
PCE	0.005	0.04	0.145	1.1
1,1 DCE	0.046	0.47de	3.9	0.47de
Vinyl Chloride	0.002	0.18de	[0.002]	0.18de
TCE	0.005	0.004	0.70	0.56
1,1,1 TCA	0.20	0.06	8.0	1.9
PCBs (all)	0.0005	1de	0.002	1de
Lead (total)	(0.0056)	400de	0.0056	400de
Cadmium (total)	0.005	38de	0.009	38de
TPH-residual fuels	NS	5,000	NS	5,000
TPH-middle distillates	NS	5,000	NS	5,000
TPH-gasolines	NS	2,000	NS	2,000

TABLE 1-1 (cont.). Tier 1 Action Levels for soil and groundwater: Notes

ANNOTATIONS:

unmarked criteria: groundwater-protection concerns dominate
de: direct-exposure concerns dominate
sat: saturation concentration, groundwater-protection concerns dominate
(): Same as surface water; surface water standard more stringent than drinkingwater standard.
[]: Same as drinking water; surface water standards not set.
NS: no standard, no drinking water or surface water criteria set.
PCE: tetrachloroethylene, DCE: dichloroethylene, TCE: trichloroethylene, TCA: trichloroethane, PCBs: polychlorinated biphenyls, TPH: total petroleum hydrocarbons

NOTES:

1. Determination of groundwater utility should be determined based on the DOH policy *Determination of Groundwater Utility at Leaking Underground Storage Tank Sites (September 13, 1995)*. (HIDOH, 1995b)
2. TPH criteria as presented in *Reporting, Remediation, and Management of Petroleum-Contaminated Soil (December, 1995)*. (HIDOH, 1995d). Gasolines: characterized by a predominance of alkyl benzenes and straight-chain, branched, and cyclo- alkanes and alkenes with carbon ranges of C6 to C12. Middles distillates (e.g., kerosene, diesel fuel, home heating fuel, jet fuel, etc.): characterized by a predominance of straight-chain alkanes and polynuclear aromatic hydrocarbons with carbon ranges of C12 to C24. Residual fuels: characterized by long chain alkanes (carbon range >C24) and less predominant aromatics that include phenathrenes, benzopyranes, and other poly-nuclear aromatic hydrocarbons.
3. The facility should contact DOH for further guidance when laboratory practical quantification limits exceed the recommended groundwater criteria.
4. Lowermost limit on soil action levels for benzene leachate concerns set at 0.05mg/kg based on field experience rather than adhering to SESOIL results. (See Chapter 1 of the TGM.)
5. Soil action levels set for leachate-impact concerns (SALs not annotated with "sat" or "da") assume depth to groundwater is two meters or less and assume no dilution of leachate in groundwater (i.e., Dilution Attenuation Factor (DAF) = 1. Not applicable to TPH criteria. See Chapter 2 and Table 1 in Appendix F of the TGM.).
6. Refer to Tier 2 discussion (Chapter 2 of the TGM) for guidance on adjustment of Tier 1 leachate-impact SALs with respect to depth to groundwater from the base of the impacted soil and site-specific DAFs.

GROUNDWATER-IMPACT MODEL (refer to the TGM)

Climate data: Standard rainfall models: 'Ahuimanu Loop station data adjusted to 200cm annual rainfall.

High rainfall models: Honomū Mauka station data adjusted to 400cm annual rainfall.

Geologic model: Sand or very permeable saprolite/soil overlying fractured, porous basalt.

DIRECT-EXPOSURE MODEL (refer to the TGM)

Assumes long-term residential exposure to impacted soil through inhalation, ingestion, and dermal absorption.

SUBCHAPTER 8

CLOSURE AND CHANGE-IN-SERVICE

§11-281-81 Temporary closure. (a) An UST or tank system is considered temporarily closed if owners and operators do not deposit regulated substance into the UST or tank system or dispense regulated substance from the UST or tank system during a time period of twelve months or less except as provided for in subsection (e).

(b) When an UST or tank system is temporarily closed, owners and operators must continue operation and maintenance of any corrosion protection system in accordance with section 11-281-42, and any release detection method in accordance with subchapter 5. However, release detection is not required as long as the UST or tank system is empty. The UST or tank system is empty when all materials have been removed using practices commonly recognized by the industry so that no more than 2.5 centimeters (one inch) of residue, or residue that is no more than 0.3 percent by weight of the total capacity of the UST or tank system, remains in the UST or tank system.

(c) Owners and operators must comply with subchapters 6 and 7 if a release is suspected or confirmed.

(d) When an UST or tank system is temporarily closed for three months or more, owners and operators must also comply with the following requirements:

(1) Leave vent lines open and functioning; and

(2) Cap and secure all other lines, pumps, manways, and ancillary equipment.

(e) When an UST or tank system is temporarily closed for more than twelve months, owners and operators must permanently close the UST or tank system if it does not meet the performance standards in sections 11-281-11 through 11-281-18 or the upgrading requirements in section 11-281-18, except that the spill and overfill equipment requirements do not have to be met. However, after December 22, 1998, an UST or tank system filled by transfers of more than twenty-five gallons at one time, must meet spill and overfill prevention equipment requirements and owners and

operators who fail to meet such requirements must permanently close the UST or tank system. Permanent closure must be conducted in accordance with sections 11-281-82 through 11-281-85, unless the department grants an extension of the twelve month temporary closure period. Owners and operators must complete a site assessment in accordance with section 11-281-83 before such an extension can be requested. [Eff] (Auth: HRS §§342L-3, 342L-37) (Imp: 40 C.F.R. §280.70)

§11-281-82 Permanent closure and change-in-service. (a) In permanently closing or changing the service of an UST or tank system, owners and operators must comply with the requirements of this section.

(b) At least thirty days before beginning either permanent closure or a change-in-service of an UST or tank system, owners and operators must notify the department in writing of their intent to permanently close or make the change-in-service, unless such action is in response to a confirmed release.

NOTE: A form such as that in the TGM may be helpful in fulfilling the notification requirements of subsection (b).

(c) At least seven days before a permanent closure or change-in-service action, owners or operators must notify the department of the exact date(s) that the activity will occur.

(d) To permanently close an UST or tank system, owners and operators must:

(1) Empty the UST and tank system by removing all liquid contents and accumulated sludges from the UST and tank system;

(2) Remove the UST or tank system from the ground, or leave the UST or tank system in place and fill the UST or tank system with an inert solid material in accordance with local agency requirements; and

(3) Conduct a site assessment of the area beneath and around the UST or tank system in accordance with section 11-281-83.

(e) Continued use of an UST or tank system to store a non-regulated substance is considered a change-in-service. Before a change-in-service, owners and operators must:

(1) Empty the UST and tank system by removing all liquid contents and accumulated sludges from the UST and tank system; and

(2) Conduct a site assessment of the area beneath and around the UST or tank system in accordance with section 11-281-83.

NOTE: The following cleaning and closure procedures may be helpful in complying with this section:

A. American Petroleum Institute Recommended Practice 1604, "Removal and Disposal of Used Underground Petroleum Storage Tanks";

B. American Petroleum Institute Publication 2015, "Cleaning Petroleum Storage Tanks";

C. American Petroleum Institute Recommended Practice 1631, "Interior Lining of Underground Storage Tanks," may be used as guidance for compliance with this section; and

D. The National Institute for Occupational Safety and Health "Criteria for a Recommended Standard * * * Working in Confined Space" may be used as guidance for conducting safe closure procedures at some hazardous substance tanks. [Eff] (Auth: HRS §§342L-3, 342L-37) (Imp: 40 C.F.R. §280.71)

§11-281-83 Site assessment. (a) Owners and operators must perform a site assessment in permanently closing or changing the service of an UST or tank system.

(b) Before permanent closure or a change-in-service is completed, owners and operators must measure for the presence of a release of regulated substance where contamination is most likely to be present at the UST or tank system site.

(c) In selecting sample types, sample locations,

and measurement methods, owners and operators must consider the method of closure, the nature of the stored substance, the types of backfill and surrounding soil, the depth and flow of ground water, and other factors appropriate for identifying the presence of a release.

(d) If a release of regulated substance is discovered in carrying out the requirements of this section, or by any other means, owners and operators must respond to the release in accordance with the requirements of subchapter 7. [Eff] (Auth: HRS §§342L-3, 342L-37) (Imp: 40 C.F.R. §280.72)

§11-281-84 Previously-closed underground storage tanks or tank systems. (a) Owners and operators of USTs or tank systems which have been removed before December 22, 1988, or were left in-place but have not been in operation on or after December 22, 1988, must comply with the requirements of this subchapter, and subchapter 7, if contaminated soil, contaminated ground water, or free product as a vapor or liquid is discovered by any means in or around the location or former location of the UST or tank system.

(b) Upon discovery of contamination, owners and operators must comply with the suspected release response requirements of subchapter 6. [Eff] (Auth: HRS §§342L-3, 342L-37) (Imp: 40 C.F.R. §280.73)

§11-281-85 Closure records. (a) Owners and operators permanently closing or changing the service of an UST or tank system must submit to the department a revised written notification form pursuant to section 11-281-21 or submit a written notice pursuant to section 11-281-29(b), whichever is appropriate.

(b) Owners and operators must keep and maintain records in accordance with section 11-281-45(c)(5). These records must be capable of demonstrating compliance with the requirements of this subchapter.

(c) Records of compliance with permanent closure or change-in-service requirements, including the

results of the site assessment required in section 11-281-83, must be kept and maintained for at least three years after completion of permanent closure or change-in-service. These results must be kept and maintained in one of the following ways:

(1) By owners and operators who permanently closed or changed the service of the UST or tank system;

(2) By current owners and operators of the UST or tank system site; or

(3) By submitting these records to the department if they cannot be maintained at the facility or site. [Eff] (Auth: HRS §§342L-3, 342L-37) (Imp: 40 C.F.R. §280.74)

§§11-281-86 to 11-281-90 (Reserved)

SUBCHAPTER 9

FINANCIAL RESPONSIBILITY

§11-281-91 Applicability. (a) This subchapter applies to all owners and operators of petroleum USTs or tank systems except as otherwise provided in this section.

(b) (Reserved)

(c) State and federal government entities whose debts and liabilities are the debts and liabilities of the United States, the State of Hawaii, or any other state, are exempt from the requirements of this subchapter.

(d) The requirements of this subchapter do not apply to owners and operators of any UST or tank system described in section 11-281-01(b) or (c).

(e) If owners and operators of a petroleum UST or tank system are separate persons, only one person is required to demonstrate financial responsibility; however, both parties are liable in the event of noncompliance. [Eff] (Auth: HRS §§342L-3, 342L-36) (Imp: 40 C.F.R. §280.90)

APPENDIX II–APPLICATION FOR AN UNDERGROUND STORAGE TANK PERMIT Form No. II (6/99)

Solid and Hazardous Waste Branch, 919 Ala Moana Blvd., Room 212, Honolulu, Hawaii 96814

TYPE OF PERMIT APPLICATION (Check all that apply)

___ Installation and operation ($150) ___ Modification ($100 except for temporary & permanent closure)

STATE USE ONLY

Facility ID Number _____ Permit # _____

Date Received _____ Permit Fee _____

Date Entered into Computer _____ Date Paid _____

Receipt # _____

Comments:

Please type or print in ink all items except "signature" in sections XIV and XV. For tanks not requiring a permit submit Notification for Underground Storage Tanks (Form # I).

I. LOCATION OF TANKS(S)

Facility Name or Company Site identifiers, as applicable | Contact Person at Location

Location Address (P.O. Box not acceptable | Location Phone # (w/ area code) | Fax # (w/ area code)

City | State | Zip Code | Island | Tax Map Key #

II. CONTACT PERSON IN CHARGE OF TANK(S)

Name | Job Title | Address

Phone # (with area code) | Fax # (with area code)

III. OWNER OF TANK(S) (If same as Section I, check here ___)

Owner Name (Corporation, Individual, Public Agency, or Other Entity)

Mailing Address

City | State | Zip Code | Phone # (w/ area code) | Fax # (w/ area code)

IV. OPERATOR OF TANK(S) (If same as Section I, check here ___)

Operator Name (Corporation, Individual, Public Agency, or Other Entity)

Mailing Address

City | State | Zip Code | Phone # (w/ area code) | Fax # (w/ area code)

V. CONTRACTOR

Company Name | Contact Person

Mailing Address | Phone # (w/ area code) | Fax # (w/ area code)

City | State | Zip Code

VI. TYPE OF OWNER

___ Federal Government–Military ___ Federal Government–Non-Military ___ State Government

___ Local Government ___ Marketer ___ Non-Marketer

VII. TYPE OF FACILITY (Select the appropriate facility description)

___ Airline ___ Auto Dealership ___ Baseyard ___ Car Rental ___ Cleaner/Laundromat ___ Communication Sites
___ Contractor ___ Farm ___ Fire Station ___ Gas Station ___ Golf Course ___ Hospital ___ Petroleum Distributor
___ Police Station ___ Residential ___ Resort/Hotel ___ School ___ Service Centers/Auto Repair/Maintenance
___ Trucking/Transporter ___ Utilities ___ Wastewater Treatment Plants ___ Wholesaler/Retailer
___ Other (Explain) _____

VIII. FINANCIAL RESPONSIBILITY (Check all that apply)

___ Self Insurance ___ Commercial Insurance ___ Risk Retention Group ___ Guarantee ___ Surety Bond ___ Letter of Credit ___ Trust Fund ___ Exempt: State or Federal Agency ___Other Method Allowed (Specify)

_____

IX. DESCRIPTION OF TANK(S) (Complete for each at this location)

Tank Number	Tank No.__	Tank No.__	Tank No.__	Tank No.__	Tank No.__
1. Status of Tank (Mark only one)					
A. Currently in Use					
B. Temporarily Out of Use (Also complete Section X)					
C. Permanently Out of Use (Also complete Section X)					
D. Installed prior to _____ but not yet brought into use.					
E. To be installed					
2. Proposed Date of Activity (Installation, Modification, Closure, etc.) (mo./day/year)					
3. Estimated Total Capacity (gallons)					
4. Substance Stored					
A. Gasoline					
B. Diesel					
C. Gasohol					
D. Kerosene					
E. Used Oil					
F. JP-4					
G. Non-Petroleum Hazardous Substance (CERCLA name and/or CAS #)					
H. Mixture of Substances, Please specify					
I. Other, Please specify					
5. Substance Compatible with Tank and Piping (Y/N)					
6. Tank (Mark all that apply)					
A. Primary Containment Material					
i. Fiberglass reinforced plastic (FRP)					
ii. Steel					

iii. Other, Please specify					
B. Secondary Containment Material					
i. Double walled					
a. FRP					
b. Steel					
c. Other, Please specify					
ii. Other secondary containment					
a. FRP					
b. Other, Please specify					
C. Corrosion Protection (except FRP tanks)					
i. Fiberglass coated steel					
ii. Double walled steel					
iii. Impressed current system					
iv. Sacrificial anode system					
v. Corrosion expert determination					
vi. Other, Please specify					
7. Piping (Mark all that apply)					
A. Primary Containment Material					
i. Rigid fiberglass					
ii. Flex piping					
iii. Other					
B. Type of Secondary Containment					
i. Lined trench					
ii. Rigid double walled piping					
iii. Flex double walled piping					
iv. Other					
C. Corrosion Protection (except FRP piping)					
i. Fiberglass coated steel					
ii. Impressed current system					
iii. Sacrificial anode system					
iv. Corrosion expert determination					
v. Other, Please specify					
8. Method of Product Dispensing					
A. Suction					
B. Safe Suction					

C. Pressure										
D. Not Applicable										
9. Spill and Overfill Prevention										
A. Overfill device installed										
i. Automatic shutoff device										
ii. Overfill alarm										
iii. Ball float valve										
B. Spill device installed										
10. Release Detection (Mark all that apply)	TANK	PIPE	TANK	PIPE	TANK	PIPE	TANK	PIPE	TANK	PIPE
A. Manual tank gauging		NA		NA		NA		NA		NA
B. Tank tightness testing		NA		NA		NA		NA		NA
C. Inventory control		NA		NA		NA		NA		NA
D. Automatic tank gauging		NA		NA		NA		NA		NA
E. Vapor monitoring										
F. Groundwater monitoring										
G. Interstitial monitoring										
H. Statistical inventory reconciliation										
I. Automatic line leak detectors	NA		NA		NA		NA		NA	
J. Line tightness testing	NA		NA		NA		NA		NA	
K. Other method approved by the department. Please specify										
11. Tank or Pipe Repaired (Y/N)										
A. Date										
B. Description of repair										

X. TANK(S) OUT OF USE OR CHANGE IN SERVICE

Tank Number	Tank No. __	Tank No. __	Tank No. __	Tank No. __	Tank No. __
1. Closing of Tank A. Estimated date last used (mo./day/year)					
B. Estimated date tank closed (mo./day/year)					
C. Tank was removed from ground					
D. Tank was closed in ground					
E. Tank filled with inert material Describe					
F. Change in service					

2. Site Assessment Completed (Y/N)					
3. Evidence of a Leak Detected (Y/N)					

XI. FACILITY DRAWING

Include a drawing showing the general layout of the facility. This drawing should be no larger than 11 by 17 inches and preferably to scale. This drawing should show the following:

A. The property boundaries of the facility;
B. Identification of streets, roads and nearby bodies of water;
C. Identification of nearby facilities;
D. Tax Map Key (TMK) Numbers;
E. Location of buildings at the facility;
F. The approximate dimensions of the property boundaries and major buildings;
G. Location of all USTs (identified by number consistent with the tank numbers in Sections IX - X), dispenser pumps, and associated pipings; and
H. Indication of North/South direction.

XII. LOCATION MAP

Include a map showing the location of the facility with respect to nearby landmarks. The map should indicate roads and landmarks to a level of detail such that the site would be easily located.

XIII. NEW OR UPGRADED TANKS

Tank Number	Tank No. __	Tank No. __	Tank No. __	Tank No. __	Tank No. __
1. Tank A. Manufacturer/Model					
B. Underwriter Laboratory (UL) #					
C. Leak Detection Permanently Installed Equipment. Manufacturer/Model					
2. Piping A. Primary containment i. Manufacturer/Model					
ii. Diameter in inches					
iii. UL #					
B. Secondary containment i. Manufacturer/Model					
ii. Diameter in inches					
iii. UL #					
C. Leak Detection Permanently Installed Equipment. Manufacturer/Model					
D. Dispenser drip pan. Make/Model					
3. Tank Pump. Manufacturer/Model					
4. Risers A. Spill containment bucket i. Manufacturer/Model					
ii. Capacity in gallons					

B. Overfill device i. Mechanical: Make/model					
ii. Electronic. Make/model					

XIV. OPERATOR'S CERTIFICATION (Read and sign after completing all sections)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete.

Name of operator or operator's authorized representative (Print or Type) Official Title

Signature Date Signed

Status of Signatory (Mark as appropriate)–

1. Corporation: ___ principal executive officer
   ___ duly authorized representative
2. Partnership: ___ general partner
3. Sole proprietorship: ___ proprietor
4. Government entity: ___ principal executive officer
   ___ ranking elected official
   ___ duly authorized employee

XV. OWNER'S CERTIFICATION (Read and sign after completing all sections)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete.

Name of owner or owner's authorized representative (Print or Type) Official Title

Signature Date Signed

Status of Signatory (Mark as appropriate)–

1. Corporation: ___ principal executive officer
   ___ duly authorized representative
2. Partnership: ___ general partner
3. Sole proprietorship: ___ proprietor
4. Government entity: ___ principal executive officer
   ___ ranking elected official
   ___ duly authorized employee

APPENDIX III

CERTIFICATION OF UNDERGROUND STORAGE TANK INSTALLATION Form No. III (6/99)

Facility Name ID # Permit No.

Part I. CERTIFICATION OF COMPLIANCE FOR NEW AND MODIFIED TANKS (Complete for each at this location)

Tank Number	Tank No. __	Tank No. __	Tank No. __	Tank No. __	Tank No. __
1. Installation					
A. Installation certified by tank and piping manufacturers					
B. Installation inspected by a registered engineer					
C. Installation inspected and approved by the department					
D. Manufacturer's installation checklists have been completed and documented					
E. Another method allowed by the department. Please specify					

Part II. INSTALLER'S CERTIFICATION

I certify the information concerning installation that is provided in section I is true to the best of my belief and knowledge.

Installer Name Signature Date

Position Company

Part III. OPERATOR'S AND OWNER'S CERTIFICATION FOLLOWING INSTALLATION

Were any changes made to the original installation plans? _____ No _____ Yes - Complete and Submit Part IV

I have received the manufacturer's operations manual, the certification of performance on all permanently installed leak detection equipment (if applicable), and other documentation regarding the equipment that has been installed.
Y/N (Operator) _____ OR Y/N (Owner) _____

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete.

Operator's Name Operator's Signature

Owner's Name Owner's Signature

Part IV. CHANGES TO ORIGINAL INSTALLATION PLANS (Complete this Part only if changes were made to the original installation plans)

FINANCIAL RESPONSIBILITY (Check all that apply)
___ Self Insurance ___ Commercial Insurance ___ Risk Retention Group ___ Guarantee ___ Surety Bond ___
Letter of Credit ___ Trust Fund ___ Exempt: State or Federal Agency ___ Other Method Allowed (Specify)

DESCRIPTION OF TANK(S) (Complete for each at this location)

Tank Number	Tank No.__	Tank No.__	Tank No.__	Tank No.__	Tank No.__
1. Status of Tank (Mark only one)					
A. Currently in Use					
B. Temporarily Out of Use (Also complete Section X)					
C. Permanently Out of Use (Also complete Section X)					
D. Installed prior to _____ but not yet brought into use					
E. To be installed					
2. Proposed Date of Activity (Installation, Modification, Closure, etc.) (mo./day/year)					
3. Estimated Total Capacity (gallons)					
4. Substance Stored					
A. Gasoline					
B. Diesel					
C. Gasohol					
D. Kerosene					
E. Used Oil					
F. JP-4					
G. Non-Petroleum Hazardous Substance (CERCLA name and/or CAS #)					
H. Mixture of Substances, Please specify					
I. Other, Please specify					
5. Substance Compatible with Tank and Piping (Y/N)					
6. Tank (Mark all that apply)					
A. Primary Containment Material					
i. Fiberglass reinforced plastic (FRP)					
ii. Steel					
iii. Other, Please specify					
B. Secondary Containment Material					

i. Double walled					
a. FRP					
b. Steel					
c. Other, Please specify					
ii. Other secondary containment					
a. FRP					
b. Other, Please specify					
C. Corrosion Protection (except FRP tanks)					
i. Fiberglass coated steel					
ii. Double walled steel					
iii. Impressed current system					
iv. Sacrificial anode system					
v. Corrosion expert determination					
vi. Other, Please specify					
7. Piping (Mark all that apply)					
A. Primary Containment Material					
i. Rigid fiberglass					
ii. Flex piping					
iii. Other					
B. Type of Secondary Containment					
i. Lined trench					
ii. Rigid double walled piping					
iii. Flex double walled piping					
iv. Other					
C. Corrosion Protection (except FRP piping)					
i. Fiberglass coated steel					
ii. Impressed current system					
iii. Sacrificial anode system					
iv. Corrosion expert determination					
v. Other, Please specify					
8. Method of Product Dispensing					
A. Suction					
B. Safe Suction					
C. Pressure					
D. Not Applicable					

9. Spill and Overfill Prevention										
A. Overfill device installed										
i. Automatic shutoff device										
ii. Overfill alarm										
iii. Ball float valve										
B. Spill device installed										
10. Release Detection (Mark all that apply)	TANK	PIPE	TANK	PIPE	TANK	PIPE	TANK	PIPE	TANK	PIPE
A. Manual tank gauging		NA		NA		NA		NA		NA
B. Tank tightness testing		NA		NA		NA		NA		NA
C. Inventory control		NA		NA		NA		NA		NA
D. Automatic tank gauging		NA		NA		NA		NA		NA
E. Vapor monitoring										
F. Groundwater monitoring										
G. Interstitial monitoring										
H. Statistical inventory reconciliation										
I. Automatic line leak detectors	NA		NA		NA		NA		NA	
J. Line tightness testing	NA		NA		NA		NA		NA	
K. Other method approved by the department. Please specify										
11. Tank or Pipe Repaired (Y/N)										
A. Date										
B. Description of repair										

FACILITY DRAWING

Include a drawing showing the general layout of the facility. This drawing should be no larger than 11 by 17 inches and preferably to scale. This drawing should show the following:

A. The property boundaries of the facility;
B. Identification of streets, roads and nearby bodies of water;
C. Identification of nearby facilities;
D. Tax Map Key (TMK) Numbers;
E. Location of buildings at the facility;
F. The approximate dimensions of the property boundaries and major buildings;
G. Location of all USTs (identified by number consistent with the tank numbers in Sections IX - X), dispenser pumps, and associated pipings; and
H. Indication of North/South direction.

NEW OR UPGRADED TANKS

Tank Number	Tank No. __	Tank No. __	Tank No. __	Tank No. __	Tank No. __
1. Tank A. Manufacturer/Model					
B. Underwriter Laboratory (UL) #					

C. Leak Detection Permanently Installed Equipment. Manufacturer/Model					
2. Piping A. Primary containment i. Manufacturer/Model					
ii. Diameter in Inches					
iii. UL #					
B. Secondary containment i. Manufacturer/Model					
ii. Diameter in Inches					
iii. UL.#					
C. Leak Detection Permanently Installed Equipment. Manufacturer/Model					
D. Dispenser drip pan. Make/Model					
3. Tank Pump. Manufacturer/Model					
4. Risers A. Spill containment bucket i. Manufacturer/Model					
ii. Capacity in gallons					
B. Overfill device i. Mechanical. Make/model					
ii. Electronic. Make/model					

Appendix B

Portions of CFR Title 40, Part 112
(related to Spill Prevention Control and Countermeasures Plans)

OF THE INTERIOR, SECRETARY OF TRANSPORTATION, AND ADMINISTRATOR OF THE ENVIRONMENTAL PROTECTION AGENCY
APPENDIX C TO PART 112—SUBSTANTIAL HARM CRITERIA
APPENDIX D TO PART 112—DETERMINATION OF A WORST CASE DISCHARGE PLANNING VOLUME
APPENDIX E TO PART 112—DETERMINATION AND EVALUATION OF REQUIRED RESPONSE RESOURCES FOR FACILITY RESPONSE PLANS
APPENDIX F TO PART 112—FACILITY-SPECIFIC RESPONSE PLAN

AUTHORITY: 33 U.S.C. 1251 *et seq.*; 33 U.S.C. 2720; E.O. 12777 (October 18, 1991), 3 CFR, 1991 Comp., p. 351.

SOURCE: 38 FR 34165, Dec. 11, 1973, unless otherwise noted.

EDITORIAL NOTE: Nomenclature changes to part 112 appear at 65 FR 40798, June 30, 2000.

§ 112.1 General applicability.

(a) This part establishes procedures, methods and equipment and other requirements for equipment to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable waters of the United States or adjoining shorelines.

(b) Except as provided in paragraph (d) of this section, this part applies to owners or operators of non-transportation-related onshore and offshore facilities engaged in drilling, producing, gathering, storing, processing, refining, transferring, distributing or consuming oil and oil products, and which, due to their location, could reasonably be expected to discharge oil in harmful quantities, as defined in part 110 of this chapter, into or upon the navigable waters of the United States or adjoining shorelines.

(c) As provided in section 313 (86 Stat. 875) departments, agencies, and instrumentalities of the Federal government are subject to these regulations to the same extent as any person, except for the provisions of § 112.6.

(d) This part does not apply to:

(1) Facilities, equipment or operations which are not subject to the jurisdiction of the Environmental Protection Agency, as follows:

(i) Onshore and offshore facilities, which, due to their location, could not reasonably be expected to discharge oil into or upon the navigable waters of the United States or adjoining shorelines. This determination shall be based solely upon a consideration of the geographical, locational aspects of the facility (such as proximity to navigable waters or adjoining shorelines, land contour, drainage, etc.) and shall exclude consideration of manmade features such as dikes, equipment or other structures which may serve to restrain, hinder, contain, or otherwise prevent a discharge of oil from reaching navigable waters of the United States or adjoining shorelines; and

(ii) Equipment or operations of vessels or transportation-related onshore and offshore facilities which are subject to authority and control of the Department of Transportation, as defined in the Memorandum of Understanding between the Secretary of Transportation and the Administrator of the Environmental Protection Agency, dated November 24, 1971, 36 FR 24000.

(2) Those facilities which, although otherwise subject to the jurisdiction of the Environmental Protection Agency, meet both of the following requirements:

(i) The underground buried storage capacity of the facility is 42,000 gallons or less of oil, and

(ii) The storage capacity, which is not buried, of the facility is 1,320 gallons or less of oil, provided no single container has a capacity in excess of 660 gallons.

(e) This part provides for the preparation and implementation of Spill Prevention Control and Countermeasure Plans prepared in accordance with § 112.7, designed to complement existing laws, regulations, rules, standards, policies and procedures pertaining to safety standards, fire prevention and pollution prevention rules, so as to form a comprehensive balanced Federal/State spill prevention program to minimize the potential for oil discharges. Compliance with this part does not in any way relieve the owner or operator of an onshore or an offshore facility from compliance with other Federal, State or local laws.

[38 FR 34165, Dec. 11, 1973, as amended at 41 FR 12657, Mar. 26, 1976]

§ 112.2 Definitions.

For the purposes of this part:

Adverse weather means the weather conditions that make it difficult for response equipment and personnel to cleanup or remove spilled oil, and that will be considered when identifying response systems and equipment in a response plan for the applicable operating environment. Factors to consider include significant wave height as specified in Appendix E to this part, as appropriate, ice conditions, temperatures, weather-related visibility, and currents within the area in which the systems or equipment are intended to function.

Animal fat means a non-petroleum oil, fat, or grease of animal, fish, or marine mammal origin.

Complex means a facility possessing a combination of transportation-related and non-transportation-related components that is subject to the jurisdiction of more than one Federal agency under section 311(j) of the Clean Water Act.

Contract or other approved means: (1) A written contractual agreement with an oil spill removal organization(s) that identifies and ensures the availability of the necessary personnel and equipment within appropriate response times; and/or

(2) A written certification by the owner or operator that the necessary personnel and equipment resources, owned or operated by the facility owner or operator, are available to respond to a discharge within appropriate response times; and/or

(3) Active membership in a local or regional oil spill removal organization(s) that has identified and ensures adequate access through such membership to necessary personnel and equipment to respond to a discharge within appropriate response times in the specified geographic areas; and/or

(4) Other specific arrangements approved by the Regional Administrator upon request of the owner or operator.

Discharge includes but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying or dumping. For purposes of this part, the term *discharge* shall not include any discharge of oil which is authorized by a permit issued pursuant to section 13 of the River and Harbor Act of 1899 (30 Stat. 1121, 33 U.S.C. 407), or sections 402 or 405 of the FWPCA Amendments of 1972 (86 Stat. 816 *et seq.*, 33 U.S.C. 1251 *et seq.*).

Fish and wildlife and sensitive environments means areas that may be identified by either their legal designation or by evaluations of Area Committees (for planning) or members of the Federal On-Scene Coordinator's spill response structure (during responses). These areas may include wetlands, National and State parks, critical habitats for endangered/threatened species, wilderness and natural resource areas, marine sanctuaries and estuarine reserves, conservation areas, preserves, wildlife areas, wildlife refuges, wild and scenic rivers, recreational areas, national forests, Federal and State lands that are research national areas, heritage program areas, land trust areas, and historical and archeological sites and parks. These areas may also include unique habitats such as: aquaculture sites and agricultural surface water intakes, bird nesting areas, critical biological resource areas, designated migratory routes, and designated seasonal habitats.

Injury means a measurable adverse change, either long- or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil, or exposure to a product of reactions resulting from a discharge of oil.

Maximum extent practicable means the limitations used to determine oil spill planning resources and response times for on-water recovery, shoreline protection, and cleanup for worst case discharges from onshore non- transportation-related facilities in adverse weather. It considers the planned capability to respond to a worst case discharge in adverse weather, as contained in a response plan that meets the requirements in § 112.20 or in a specific plan approved by the Regional Administrator.

The term *navigable waters* of the United States means *navigable waters* as defined in section 502(7) of the FWPCA, and includes:

(1) All navigable waters of the United States, as defined in judicial decisions prior to passage of the 1972 Amendments to the FWPCA (Pub. L. 92–500), and tributaries of such waters;

(2) Interstate waters;
(3) Intrastate lakes, rivers, and streams which are utilized by interstate travelers for recreational or other purposes; and
(4) Intrastate lakes, rivers, and streams from which fish or shellfish are taken and sold in interstate commerce.

Navigable waters do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

Non-petroleum oil means oil of any kind that is not petroleum-based, including but not limited to: Fats, oils, and greases of animal, fish, or marine mammal origin; and vegetable oils, including oils from seeds, nuts, fruits, and kernels.

Offshore facility means any facility of any kind located in, on, or under any of the navigable waters of the United States, which is not a transportation-related facility.

Oil means oil of any kind or in any form, including, but not limited to petroleum, fuel oil, sludge, oil refuse and oil mixed with wastes other than dredged spoil.

Oil Spill Removal Organization means an entity that provides oil spill response resources, and includes any for-profit or not-for-profit contractor, cooperative, or in-house response resources that have been established in a geographic area to provide required response resources.

Onshore facility means any facility of any kind located in, on, or under any land within the United States, other than submerged lands, which is not a transportation-related facility.

Owner or operator means any person owning or operating an onshore facility or an offshore facility, and in the case of any abandoned offshore facility, the person who owned or operated such facility immediately prior to such abandonment.

Person includes an individual, firm, corporation, association, and a partnership.

Petroleum oil means petroleum in any form, including but not limited to crude oil, fuel oil, mineral oil, sludge, oil refuse, and refined products.

Regional Administrator, means the Regional Administrator of the Environmental Protection Agency, or his designee, in and for the Region in which the facility is located.

Spill event means a discharge of oil into or upon the navigable waters of the United States or adjoining shorelines in harmful quantities, as defined at 40 CFR part 110.

Transportation-related and *non-transportation-related* as applied to an onshore or offshore facility, are defined in the Memorandum of Understanding between the Secretary of Transportation and the Administrator of the Environmental Protection Agency, dated November 24, 1971, 36 FR 24080.

United States means the States, the District of Columbia, the Commonwealth of Puerto Rico, the Canal Zone, Guam, American Samoa, the Virgin Islands, and the Trust Territory of the Pacific Islands.

Vegetable oil means a non-petroleum oil or fat of vegetable origin, including but not limited to oils and fats derived from plant seeds, nuts, fruits, and kernels.

Vessel means every description of watercraft or other artificial contrivance used, or capable of being used as a means of transportation on water, other than a public vessel.

Worst case discharge for an onshore non-transportation-related facility means the largest foreseeable discharge in adverse weather conditions as determined using the worksheets in Appendix D to this part.

[38 FR 34165, Dec. 11, 1973, as amended at 58 FR 45039, Aug. 25, 1993; 59 FR 34097, July 1, 1994; 65 FR 40798, June 30, 2000]

EFFECTIVE DATE NOTE: At 65 FR 40798, June 30, 2000, §112.2 was amended by adding definitions for "Animal fat", "Non-petroleum oil", "Petroleum oil", and "Vegetable oil" in alphabetical order, effective July 31, 2000.

§112.3 Requirements for preparation and implementation of Spill Prevention Control and Countermeasure Plans.

(a) Owners or operators of onshore and offshore facilities in operation on or before the effective date of this part that have discharged or, due to their location, could reasonably be expected to discharge oil in harmful quantities, as defined in 40 CFR part 110, into or upon the navigable waters of the United States or adjoining shorelines, shall prepare a Spill Prevention Control and Countermeasure Plan (hereinafter "SPCC Plan"), in writing and in accordance with §112.7. Except as provided for in paragraph (f) of this section, such SPCC Plan shall be prepared within six months after the effective date of this part and shall be fully implemented as soon as possible, but not later than one year after the effective date of this part.

(b) Owners or operators of onshore and offshore facilities that become operational after the effective date of this part, and that have discharged or could reasonably be expected to discharge oil in harmful quantities, as defined in 40 CFR part 110, into or upon the navigable waters of the United States or adjoining shorelines, shall prepare an SPCC Plan in accordance with §112.7. Except as provided for in paragraph (f) of this section, such SPCC Plan shall be prepared within six months after the date such facility begins operations and shall be fully implemented as soon as possible, but not later than one year after such facility begins operations.

(c) Owners or operators of onshore and offshore mobile or portable facilities, such as onshore drilling or workover rigs, barge mounted offshore drilling or workover rigs, and portable fueling facilities shall prepare and implement an SPCC Plan as required by paragraphs (a), (b) and (d) of this section. The owners or operators of such facility need not prepare a new SPCC Plan each time the facility is moved to a new site. The SPCC Plan may be a general plan, prepared in accordance with §112.7, using good engineering practice. When the mobile or portable facility is moved, it must be located and installed using the spill prevention practices outlined in the SPCC Plan for the facility. No mobile or portable facility subject to this regulation shall operate unless the SPCC Plan has been implemented. The SPCC Plan shall only apply while the facility is in a fixed (non-transportation) operating mode.

(d) No SPCC Plan shall be effective to satisfy the requirements of this part unless it has been reviewed by a Registered Professional Engineer and certified to by such Professional Engineer. By means of this certification the engineer, having examined the facility and being familiar with the provisions of this part, shall attest that the SPCC Plan has been prepared in accordance with good engineering practices. Such certification shall in no way relieve the owner or operator of an onshore or offshore facility of his duty to prepare and fully implement such Plan in accordance with §112.7, as required by paragraphs (a), (b) and (c) of this section.

(e) Owners or operators of a facility for which an SPCC Plan is required pursuant to paragraph (a), (b) or (c) of this section shall maintain a complete copy of the Plan at such facility if the facility is normally attended at least 8 hours per day, or at the nearest field office if the facility is not so attended, and shall make such Plan available to the Regional Administrator for on-site review during normal working hours.

(f) *Extensions of time.* (1) The Regional Administrator may authorize an extension of time for the preparation and full implementation of an SPCC Plan beyond the time permitted for the preparation and implementation of an SPCC Plan pursuant to paragraph (a), (b) or (c) of this section where he finds that the owner or operator of a facility subject to paragraphs (a), (b) or (c) of this section cannot fully comply with the requirements of this part as a result of either nonavailability of qualified personnel, or delays in construction or equipment delivery beyond the control and without the fault of such owner or operator or their respective agents or employees.

(2) Any owner or operator seeking an extension of time pursuant to paragraph (f)(1) of this section may submit a letter of request to the Regional Administrator. Such letter shall include:

(i) A complete copy of the SPCC Plan, if completed;

(ii) A full explanation of the cause for any such delay and the specific aspects of the SPCC Plan affected by the delay;

(iii) A full discussion of actions being taken or contemplated to minimize or mitigate such delay;

(iv) A proposed time schedule for the implementation of any corrective actions being taken or contemplated, including interim dates for completion of tests or studies, installation and operation of any necessary equipment or other preventive measures.

In addition, such owner or operator may present additional oral or written statements in support of his letter of request.

(3) The submission of a letter of request for extension of time pursuant to paragraph (f)(2) of this section shall in no way relieve the owner or operator from his obligation to comply with the requirements of §112.3 (a), (b) or (c). Where an extension of time is authorized by the Regional Administrator for particular equipment or other specific aspects of the SPCC Plan, such extension shall in no way affect the owner's or operator's obligation to comply with the requirements of §112.3 (a), (b) or (c) with respect to other equipment or other specific aspects of the SPCC Plan for which an extension of time has not been expressly authorized.

[38 FR 34165, Dec. 11, 1973, as amended at 41 FR 12657, Mar. 26, 1976]

§112.4 Amendment of SPCC Plans by Regional Administrator.

(a) Notwithstanding compliance with §112.3, whenever a facility subject to §112.3 (a), (b) or (c) has: Discharged more than 1,000 U.S. gallons of oil into or upon the navigable waters of the United States or adjoining shorelines in a single spill event, or discharged oil in harmful quantities, as defined in 40 CFR part 110, into or upon the navigable waters of the United States or adjoining shorelines in two spill events, reportable under section 311(b)(5) of the FWPCA, occurring within any twelve month period, the owner or operator of such facility shall submit to the Regional Administrator, within 60 days from the time such facility becomes subject to this section, the following:

(1) Name of the facility;

(2) Name(s) of the owner or operator of the facility;

(3) Location of the facility;

(4) Date and year of initial facility operation;

(5) Maximum storage or handling capacity of the facility and normal daily throughput;

(6) Description of the facility, including maps, flow diagrams, and topographical maps;

(7) A complete copy of the SPCC Plan with any amendments;

(8) The cause(s) of such spill, including a failure analysis of system or subsystem in which the failure occurred;

(9) The corrective actions and/or countermeasures taken, including an adequate description of equipment repairs and/or replacements;

(10) Additional preventive measures taken or contemplated to minimize the possibility of recurrence;

(11) Such other information as the Regional Administrator may reasonably require pertinent to the Plan or spill event.

(b) Section 112.4 shall not apply until the expiration of the time permitted for the preparation and implementation of an SPCC Plan pursuant to §112.3 (a), (b), (c) and (f).

(c) A complete copy of all information provided to the Regional Administrator pursuant to paragraph (a) of this section shall be sent at the same time to the State agency in charge of water pollution control activities in and for the State in which the facility is located. Upon receipt of such information such State agency may conduct a review and make recommendations to the Regional Administrator as to further procedures, methods, equipment and other requirements for equipment necessary to prevent and to contain discharges of oil from such facility.

(d) After review of the SPCC Plan for a facility subject to paragraph (a) of this section, together with all other information submitted by the owner or operator of such facility, and by the State agency under paragraph (c) of this section, the Regional Administrator may require the owner or operator of such facility to amend the SPCC Plan if he finds that the Plan does not meet the requirements of this part or that the amendment of the Plan is necessary to prevent and to contain discharges of oil from such facility.

(e) When the Regional Administrator proposes to require an amendment to the SPCC Plan, he shall notify the facility operator by certified mail addressed to, or by personal delivery to, the facility owner or operator, that he proposes to require an amendment to the Plan, and shall specify the terms of such amendment. If the facility owner or operator is a corporation, a copy of such notice shall also be mailed to the registered agent, if any, of such corporation in the State where such facility is located. Within 30 days from receipt of such notice, the facility owner or operator may submit written information, views, and arguments on the amendment. After considering all relevant material presented, the Regional Administrator shall notify the facility owner or operator of any amendment required or shall rescind the notice. The amendment required by the Regional Administrator shall become part of the Plan 30 days after such notice, unless the Regional Administrator, for good cause, shall specify another effective date. The owner or operator of the facility shall implement the amendment of the Plan as soon as possible, but not later than six months after the amendment becomes part of the Plan, unless the Regional Administrator specifies another date.

(f) An owner or operator may appeal a decision made by the Regional Administrator requiring an amendment to an SPCC Plan. The appeal shall be made to the Administrator of the United States Environmental Protection Agency and must be made in writing within 30 days of receipt of the notice from the Regional Administrator requiring the amendment. A complete copy of the appeal must be sent to the Regional Administrator at the time the appeal is made. The appeal shall contain a clear and concise statement of the issues and points of fact in the case. It may also contain additional information from the owner or operator, or from any other person. The Administrator or his designee may request additional information from the owner or operator, or from any other person. The Administrator or his designee shall render a decision within 60 days of receiving the appeal and shall notify the owner or operator of his decision.

[38 FR 34165, Dec. 11, 1973, as amended at 41 FR 12658, Mar. 26, 1976]

§112.5 Amendment of Spill Prevention Control and Countermeasure Plans by owners or operators.

(a) Owners or operators of facilities subject to §112.3 (a), (b) or (c) shall amend the SPCC Plan for such facility in accordance with §112.7 whenever there is a change in facility design, construction, operation or maintenance which materially affects the facility's potential for the discharge of oil into or upon the navigable waters of the United States or adjoining shore lines. Such amendments shall be fully implemented as soon as possible, but not later than six months after such change occurs.

(b) Notwithstanding compliance with paragraph (a) of this section, owners and operators of facilities subject to §112.3 (a), (b) or (c) shall complete a review and evaluation of the SPCC Plan at least once every three years from the date such facility becomes subject to this part. As a result of this review and evaluation, the owner or operator shall amend the SPCC Plan within six months of the review to include more effective prevention and control technology if: (1) Such technology will significantly reduce the likelihood of a spill event from the facility, and (2) if such technology has been field-proven at the time of the review.

(c) No amendment to an SPCC Plan shall be effective to satisfy the requirements of this section unless it has been certified by a Professional Engineer in accordance with §112.3(d).

§112.7 Guidelines for the preparation and implementation of a Spill Prevention Control and Countermeasure Plan.

The SPCC Plan shall be a carefully thought-out plan, prepared in accordance with good engineering practices, and which has the full approval of management at a level with authority to commit the necessary resources. If the plan calls for additional facilities or procedures, methods, or equipment not yet fully operational, these items

should be discussed in separate paragraphs, and the details of installation and operational start-up should be explained separately. The complete SPCC Plan shall follow the sequence outlined below, and include a discussion of the facility's conformance with the appropriate guidelines listed:

(a) A facility which has experienced one or more spill events within twelve months prior to the effective date of this part should include a written description of each such spill, corrective action taken and plans for preventing recurrence.

(b) Where experience indicates a reasonable potential for equipment failure (such as tank overflow, rupture, or leakage), the plan should include a prediction of the direction, rate of flow, and total quantity of oil which could be discharged from the facility as a result of each major type of failure.

(c) Appropriate containment and/or diversionary structures or equipment to prevent discharged oil from reaching a navigable water course should be provided. One of the following preventive systems or its equivalent should be used as a minimum:

(1) Onshore facilities:

(i) Dikes, berms or retaining walls sufficiently impervious to contain spilled oil;

(ii) Curbing;

(iii) Culverting, gutters or other drainage systems;

(iv) Weirs, booms or other barriers;

(v) Spill diversion ponds;

(vi) Retention ponds;

(vii) Sorbent materials.

(2) Offshore facilities:

(i) Curbing, drip pans;

(ii) Sumps and collection systems.

(d) When it is determined that the installation of structures or equipment listed in §112.7(c) to prevent discharged oil from reaching the navigable waters is not practicable from any onshore or offshore facility, the owner or operator should clearly demonstrate such impracticability and provide the following:

(1) A strong oil spill contingency plan following the provision of 40 CFR part 109.

(2) A written commitment of manpower, equipment and materials required to expeditiously control and remove any harmful quantity of oil discharged.

(e) In addition to the minimal prevention standards listed under §112.7(c), sections of the Plan should include a complete discussion of conformance with the following applicable guidelines, other effective spill prevention and containment procedures (or, if more stringent, with State rules, regulations and guidelines):

(1) *Facility drainage (onshore); (excluding production facilities).* (i) Drainage from diked storage areas should be restrained by valves or other positive means to prevent a spill or other excessive leakage of oil into the drainage system or inplant effluent treatment system, except where plan systems are designed to handle such leakage. Diked areas may be emptied by pumps or ejectors; however, these should be manually activated and the condition of the accumulation should be examined before starting to be sure no oil will be discharged into the water.

(ii) Flapper-type drain valves should not be used to drain diked areas. Valves used for the drainage of diked areas should, as far as practical, be of manual, open-and-closed design. When plant drainage drains directly into water courses and not into wastewater treatment plants, retained storm water should be inspected as provided in paragraphs (e)(2)(iii) (B), (C) and (D) of this section before drainage.

(iii) Plant drainage systems from undiked areas should, if possible, flow into ponds, lagoons or catchment basins, designed to retain oil or return it to the facility. Catchment basins should not be located in areas subject to periodic flooding.

(iv) If plant drainage is not engineered as above, the final discharge of all in-plant ditches should be equipped with a diversion system that could, in the event of an uncontrolled spill, return the oil to the plant.

(v) Where drainage waters are treated in more than one treatment unit, natural hydraulic flow should be used. If pump transfer is needed, two "lift" pumps should be provided, and at least one of the pumps should be permanently installed when such treatment is continuous. In any event, whatever

techniques are used facility drainage systems should be adequately engineered to prevent oil from reaching navigable waters in the event of equipment failure or human error at the facility.

(2) *Bulk storage tanks (onshore); (excluding production facilities).* (i) No tank should be used for the storage of oil unless its material and construction are compatible with the material stored and conditions of storage such as pressure and temperature, etc.

(ii) All bulk storage tank installations should be constructed so that a secondary means of containment is provided for the entire contents of the largest single tank plus sufficient freeboard to allow for precipitation. Diked areas should be sufficiently impervious to contain spilled oil. Dikes, containment curbs, and pits are commonly employed for this purpose, but they may not always be appropriate. An alternative system could consist of a complete drainage trench enclosure arranged so that a spill could terminate and be safely confined in an inplant catchment basin or holding pond.

(iii) Drainage of rainwater from the diked area into a storm drain or an effluent discharge that empties into an open water course, lake, or pond, and bypassing the in-plant treatment system may be acceptable if:

(A) The bypass valve is normally sealed closed.

(B) Inspection of the run-off rain water ensures compliance with applicable water quality standards and will not cause a harmful discharge as defined in 40 CFR part 110.

(C) The bypass valve is opened, and resealed following drainage under responsible supervision.

(D) Adequate records are kept of such events.

(iv) Buried metallic storage tanks represent a potential for undetected spills. A new buried installation should be protected from corrosion by coatings, cathodic protection or other effective methods compatible with local soil conditions. Such buried tanks should at least be subjected to regular pressure testing.

(v) Partially buried metallic tanks for the storage of oil should be avoided, unless the buried section of the shell is adequately coated, since partial burial in damp earth can cause rapid corrosion of metallic surfaces, especially at the earth/air interface.

(vi) Aboveground tanks should be subject to periodic integrity testing, taking into account tank design (floating roof, etc.) and using such techniques as hydrostatic testing, visual inspection or a system of non-destructive shell thickness testing. Comparison records should be kept where appropriate, and tank supports and foundations should be included in these inspections. In addition, the outside of the tank should frequently be observed by operating personnel for signs of deterioration, leaks which might cause a spill, or accumulation of oil inside diked areas.

(vii) To control leakage through defective internal heating coils, the following factors should be considered and applied, as appropriate.

(A) The steam return or exhaust lines from internal heating coils which discharge into an open water course should be monitored for contamination, or passed through a settling tank, skimmer, or other separation or retention system.

(B) The feasibility of installing an external heating system should also be considered.

(viii) New and old tank installations should, as far as practical, be fail-safe engineered or updated into a fail-safe engineered installation to avoid spills. Consideration should be given to providing one or more of the following devices:

(A) High liquid level alarms with an audible or visual signal at a constantly manned operation or surveillance station; in smaller plants an audible air vent may suffice.

(B) Considering size and complexity of the facility, high liquid level pump cutoff devices set to stop flow at a predetermined tank content level.

(C) Direct audible or code signal communication between the tank gauger and the pumping station.

(D) A fast response system for determining the liquid level of each bulk storage tank such as digital computers, telepulse, or direct vision gauges or their equivalent.

(E) Liquid level sensing devices should be regularly tested to insure proper operation.

(ix) Plant effluents which are discharged into navigable waters should have disposal facilities observed frequently enough to detect possible system upsets that could cause an oil spill event.

(x) Visible oil leaks which result in a loss of oil from tank seams, gaskets, rivets and bolts sufficiently large to cause the accumulation of oil in diked areas should be promptly corrected.

(xi) Mobile or portable oil storage tanks (onshore) should be positioned or located so as to prevent spilled oil from reaching navigable waters. A secondary means of containment, such as dikes or catchment basins, should be furnished for the largest single compartment or tank. These facilities should be located where they will not be subject to periodic flooding or washout.

(3) *Facility transfer operations, pumping, and in-plant process (onshore); (excluding production facilities).* (i) Buried piping installations should have a protective wrapping and coating and should be cathodically protected if soil conditions warrant. If a section of buried line is exposed for any reason, it should be carefully examined for deterioration. If corrosion damage is found, additional examination and corrective action should be taken as indicated by the magnitude of the damage. An alternative would be the more frequent use of exposed pipe corridors or galleries.

(ii) When a pipeline is not in service, or in standby service for an extended time the terminal connection at the transfer point should be capped or blank-flanged, and marked as to origin.

(iii) Pipe supports should be properly designed to minimize abrasion and corrosion and allow for expansion and contraction.

(iv) All aboveground valves and pipelines should be subjected to regular examinations by operating personnel at which time the general condition of items, such as flange joints, expansion joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces should be assessed. In addition, periodic pressure testing may be warranted for piping in areas where facility drainage is such that a failure might lead to a spill event.

(v) Vehicular traffic granted entry into the facility should be warned verbally or by appropriate signs to be sure that the vehicle, because of its size, will not endanger above ground piping.

(4) *Facility tank car and tank truck loading/unloading rack (onshore).* (i) Tank car and tank truck loading/unloading procedures should meet the minimum requirements and regulation established by the Department of Transportation.

(ii) Where rack area drainage does not flow into a catchment basin or treatment facility designed to handle spills, a quick drainage system should be used for tank truck loading and unloading areas. The containment system should be designed to hold at least maximum capacity of any single compartment of a tank car or tank truck loaded or unloaded in the plant.

(iii) An interlocked warning light or physical barrier system, or warning signs, should be provided in loading/unloading areas to prevent vehicular departure before complete disconnect of flexible or fixed transfer lines.

(iv) Prior to filling and departure of any tank car or tank truck, the lowermost drain and all outlets of such vehicles should be closely examined for leakage, and if necessary, tightened, adjusted, or replaced to prevent liquid leakage while in transit.

(5) *Oil production facilities (onshore)*—(i) *Definition.* An onshore production facility may include all wells, flowlines, separation equipment, storage facilities, gathering lines, and auxiliary non-transportation-related equipment and facilities in a single geographical oil or gas field operated by a single operator.

(ii) *Oil production facility (onshore) drainage.* (A) At tank batteries and central treating stations where an accidental discharge of oil would have a reasonable possibility of reaching navigable waters, the dikes or equivalent required under §112.7(c)(1) should have drains closed and sealed at all times except when rainwater is being drained. Prior to drainage, the diked area should be inspected as provided in paragraphs (e)(2)(iii) (B), (C), and (D) of this section. Accumulated oil on the

rainwater should be picked up and returned to storage or disposed of in accordance with approved methods.

(B) Field drainage ditches, road ditches, and oil traps, sumps or skimmers, if such exist, should be inspected at regularly scheduled intervals for accumulation of oil that may have escaped from small leaks. Any such accumulations should be removed.

(iii) *Oil production facility (onshore) bulk storage tanks.* (A) No tank should be used for the storage of oil unless its material and construction are compatible with the material stored and the conditions of storage.

(B) All tank battery and central treating plant installations should be provided with a secondary means of containment for the entire contents of the largest single tank if feasible, or alternate systems such as those outlined in §112.7(c)(1). Drainage from undiked areas should be safely confined in a catchment basin or holding pond.

(C) All tanks containing oil should be visually examined by a competent person for condition and need for maintenance on a scheduled periodic basis. Such examination should include the foundation and supports of tanks that are above the surface of the ground.

(D) New and old tank battery installations should, as far as practical, be fail-safe engineered or updated into a fail-safe engineered installation to prevent spills. Consideration should be given to one or more of the following:

(*1*) Adequate tank capacity to assure that a tank will not overfill should a pumper/gauger be delayed in making his regular rounds.

(*2*) Overflow equalizing lines between tanks so that a full tank can overflow to an adjacent tank.

(*3*) Adequate vacuum protection to prevent tank collapse during a pipeline run.

(*4*) High level sensors to generate and transmit an alarm signal to the computer where facilities are a part of a computer production control system.

(iv) *Facility transfer operations, oil production facility (onshore).* (A) All above ground valves and pipelines should be examined periodically on a scheduled basis for general condition of items such as flange joints, valve glands and bodies, drip pans, pipeline supports, pumping well polish rod stuffing boxes, bleeder and gauge valves.

(B) Salt water (oil field brine) disposal facilities should be examined often, particularly following a sudden change in atmospheric temperature to detect possible system upsets that could cause an oil discharge.

(C) Production facilities should have a program of flowline maintenance to prevent spills from this source. The program should include periodic examinations, corrosion protection, flowline replacement, and adequate records, as appropriate, for the individual facility.

(6) *Oil drilling and workover facilities (onshore).* (i) Mobile drilling or workover equipment should be positioned or located so as to prevent spilled oil from reaching navigable waters.

(ii) Depending on the location, catchment basins or diversion structures may be necessary to intercept and contain spills of fuel, crude oil, or oily drilling fluids.

(iii) Before drilling below any casing string or during workover operations, a blowout prevention (BOP) assembly and well control system should be installed that is capable of controlling any well head pressure that is expected to be encountered while that BOP assembly is on the well. Casing and BOP installations should be in accordance with State regulatory agency requirements.

(7) *Oil drilling, production, or workover facilities (offshore).* (i) Definition: "An oil drilling, production or workover facility (offshore)" may include all drilling or workover equipment, wells, flowlines, gathering lines, platforms, and auxiliary nontransportation-related equipment and facilities in a single geographical oil or gas field operated by a single operator.

(ii) Oil drainage collection equipment should be used to prevent and control small oil spillage around pumps, glands, valves, flanges, expansion joints, hoses, drain lines, separators, treaters, tanks, and allied equipment. Drains on the facility should be controlled and directed toward a central collection sump or equivalent collection system sufficient to prevent discharges of oil into the navigable waters of the United States. Where drains and

sumps are not practicable oil contained in collection equipment should be removed as often as necessary to prevent overflow.

(iii) For facilities employing a sump system, sump and drains should be adequately sized and a spare pump or equivalent method should be available to remove liquid from the sump and assure that oil does not escape. A regular scheduled preventive maintenance inspection and testing program should be employed to assure reliable operation of the liquid removal system and pump start-up device. Redundant automatic sump pumps and control devices may be required on some installations.

(iv) In areas where separators and treaters are equipped with dump valves whose predominant mode of failure is in the closed position and pollution risk is high, the facility should be specially equipped to prevent the escape of oil. This could be accomplished by extending the flare line to a diked area if the separator is near shore, equipping it with a high liquid level sensor that will automatically shut-in wells producing to the separator, parallel redundant dump valves, or other feasible alternatives to prevent oil discharges.

(v) Atmospheric storage or surge tanks should be equipped with high liquid level sensing devices or other acceptable alternatives to prevent oil discharges.

(vi) Pressure tanks should be equipped with high and low pressure sensing devices to activate an alarm and/or control the flow or other acceptable alternatives to prevent oil discharges.

(vii) Tanks should be equipped with suitable corrosion protection.

(viii) A written procedure for inspecting and testing pollution prevention equipment and systems should be prepared and maintained at the facility. Such procedures should be included as part of the SPCC Plan.

(ix) Testing and inspection of the pollution prevention equipment and systems at the facility should be conducted by the owner or operator on a scheduled periodic basis commensurate with the complexity, conditions and circumstances of the facility or other appropriate regulations.

(x) Surface and subsurface well shut-in valves and devices in use at the facility should be sufficiently described to determine method of activation or control, e.g., pressure differential, change in fluid or flow conditions, combination of pressure and flow, manual or remote control mechanisms. Detailed records for each well, while not necessarily part of the plan should be kept by the owner or operator.

(xi) Before drilling below any casing string, and during workover operations a blowout preventer (BOP) assembly and well control system should be installed that is capable of controlling any well-head pressure that is expected to be encountered while that BOP assembly is on the well. Casing and BOP installations should be in accordance with State regulatory agency requirements.

(xii) Extraordinary well control measures should be provided should emergency conditions, including fire, loss of control and other abnormal conditions, occur. The degree of control system redundancy should vary with hazard exposure and probable consequences of failure. It is recommended that surface shut-in systems have redundant or "fail close" valving. Subsurface safety valves may not be needed in producing wells that will not flow but should be installed as required by applicable State regulations.

(xiii) In order that there will be no misunderstanding of joint and separate duties and obligations to perform work in a safe and pollution free manner, written instructions should be prepared by the owner or operator for contractors and subcontractors to follow whenever contract activities include servicing a well or systems appurtenant to a well or pressure vessel. Such instructions and procedures should be maintained at the offshore production facility. Under certain circumstances and conditions such contractor activities may require the presence at the facility of an authorized representative of the owner or operator who would intervene when necessary to prevent a spill event.

(xiv) All manifolds (headers) should be equipped with check valves on individual flowlines.

(xv) If the shut-in well pressure is greater than the working pressure of the flowline and manifold valves up to and including the header valves associated with that individual flowline, the flowline should be equipped with a high pressure sensing device and shut-in valve at the wellhead unless provided with a pressure relief system to prevent over pressuring.

(xvi) All pipelines appurtenant to the facility should be protected from corrosion. Methods used, such as protective coatings or cathodic protection, should be discussed.

(xvii) Sub-marine pipelines appurtenant to the facility should be adequately protected against environmental stresses and other activities such as fishing operations.

(xviii) Sub-marine pipelines appurtenant to the facility should be in good operating condition at all times and inspected on a scheduled periodic basis for failures. Such inspections should be documented and maintained at the facility.

(8) *Inspections and records.* Inspections required by this part should be in accordance with written procedures developed for the facility by the owner or operator. These written procedures and a record of the inspections, signed by the appropriate supervisor or inspector, should be made part of the SPCC Plan and maintained for a period of three years.

(9) *Security (excluding oil production facilities).* (i) All plants handling, processing, and storing oil should be fully fenced, and entrance gates should be locked and/or guarded when the plant is not in production or is unattended.

(ii) The master flow and drain valves and any other valves that will permit direct outward flow of the tank's content to the surface should be securely locked in the closed position when in non-operating or non-standby status.

(iii) The starter control on all oil pumps should be locked in the "off" position or located at a site accessible only to authorized personnel when the pumps are in a non-operating or non-standby status.

(iv) The loading/unloading connections of oil pipelines should be securely capped or blank-flanged when not in service or standby service for an extended time. This security practice should also apply to pipelines that are emptied of liquid content either by draining or by inert gas pressure.

(v) Facility lighting should be commensurate with the type and location of the facility. Consideration should be given to: (A) Discovery of spills occurring during hours of darkness, both by operating personnel, if present, and by non-operating personnel (the general public, local police, etc.) and (B) prevention of spills occurring through acts of vandalism.

(10) *Personnel, training and spill prevention procedures.* (i) Owners or operators are responsible for properly instructing their personnel in the operation and maintenance of equipment to prevent the discharges of oil and applicable pollution control laws, rules and regulations.

(ii) Each applicable facility should have a designated person who is accountable for oil spill prevention and who reports to line management.

(iii) Owners or operators should schedule and conduct spill prevention briefings for their operating personnel at intervals frequent enough to assure adequate understanding of the SPCC Plan for that facility. Such briefings should highlight and describe known spill events or failures, malfunctioning components, and recently developed precautionary measures.

§ 112.20 Facility response plans.

(a) The owner or operator of any non-transportation-related onshore facility that, because of its location, could reasonably be expected to cause substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines shall prepare and submit a facility response plan to the Regional Administrator, according to the following provisions:

(1) For the owner or operator of a facility in operation on or before February 18, 1993 who is required to prepare and submit a response plan under 33 U.S.C. 1321(j)(5), the Oil Pollution Act of 1990 (Pub. L. 101–380, 33 U.S.C. 2701 *et seq.*) requires the submission of a response plan that satisfies the requirements of 33 U.S.C. 1321(j)(5) no later than February 18, 1993.

(i) The owner or operator of an existing facility that was in operation on or before February 18, 1993 who submitted a response plan by February 18, 1993 shall revise the response plan to satisfy the requirements of this section and resubmit the response plan or updated portions of the response plan to the Regional Administrator by February 18, 1995.

(ii) The owner or operator of an existing facility in operation on or before February 18, 1993 who failed to submit a response plan by February 18, 1993 shall prepare and submit a response plan that satisfies the requirements of this section to the Regional Administrator before August 30, 1994.

(2) The owner or operator of a facility in operation on or after August 30, 1994 that satisfies the criteria in paragraph (f)(1) of this section or that is notified by the Regional Administrator pursuant to paragraph (b) of this section shall prepare and submit a facility response plan that satisfies the requirements of this section to the Regional Administrator.

(i) For a facility that commenced operations after February 18, 1993 but prior to August 30, 1994, and is required to prepare and submit a response plan based on the criteria in paragraph (f)(1) of this section, the owner or operator shall submit the response plan or updated portions of the response plan, along with a completed version of the response plan cover sheet contained in Appendix F to this part, to the Regional Administrator prior to August 30, 1994.

(ii) For a newly constructed facility that commences operation after August 30, 1994, and is required to prepare and submit a response plan based on the criteria in paragraph (f)(1) of this section, the owner or operator shall submit the response plan, along with a completed version of the response plan cover sheet contained in Appendix F to this part, to the Regional Administrator prior to the start of operations (adjustments to the response plan to reflect changes that occur at the facility during the start-up phase of operations must be submitted to the Regional Administrator after an operational trial period of 60 days).

(iii) For a facility required to prepare and submit a response plan after August 30, 1994, as a result of a planned change in design, construction, operation, or maintenance that renders the facility subject to the criteria in paragraph (f)(1) of this section, the owner or operator shall submit the response plan, along with a completed version of the response plan cover sheet contained in Appendix F to this part, to the Regional Administrator before the portion of the facility undergoing change commences operations (adjustments to the response plan to reflect changes that occur at the facility during the start-up phase of operations must be submitted to the Regional Administrator after an operational trial period of 60 days).

(iv) For a facility required to prepare and submit a response plan after August 30, 1994, as a result of an unplanned event or change in facility characteristics that renders the facility subject to the criteria in paragraph (f)(1) of this section, the owner or operator shall submit the response plan, along with a completed version of the response plan cover sheet contained in Appendix F to this part, to the Regional Administrator within six months of the unplanned event or change.

(3) In the event the owner or operator of a facility that is required to prepare and submit a response plan uses an alternative formula that is comparable to one contained in Appendix C to this part to evaluate the criterion in paragraph (f)(1)(ii)(B) or (f)(1)(ii)(C) of this section, the owner or operator shall attach documentation to the response plan cover sheet contained in Appendix F to this part that demonstrates the reliability and analytical soundness of the alternative formula.

(4) *Preparation and submission of response plans—Animal fat and vegetable oil facilities.* The owner or operator of any non-transportation-related facility that handles, stores, or transports animal fats and vegetable oils must prepare and submit a facility response plan as follows:

(i) *Facilities with approved plans.* The owner or operator of a facility with a

facility response plan that has been approved under paragraph (c) of this section by July 31, 2000 need not prepare or submit a revised plan except as otherwise required by paragraphs (b), (c), or (d) of this section.

(ii) *Facilities with plans that have been submitted to the Regional Administrator.* Except for facilities with approved plans as provided in paragraph (a)(4)(i) of this section, the owner or operator of a facility that has submitted a response plan to the Regional Administrator prior to July 31, 2000 must review the plan to determine if it meets or exceeds the applicable provisions of this part. An owner or operator need not prepare or submit a new plan if the existing plan meets or exceeds the applicable provisions of this part. If the plan does not meet or exceed the applicable provisions of this part, the owner or operator must prepare and submit a new plan by September 28, 2000.

(iii) *Newly regulated facilities.* The owner or operator of a newly constructed facility that commences operation after July 31, 2000 must prepare and submit a plan to the Regional Administrator in accordance with paragraph (a)(2)(ii) of this section. The plan must meet or exceed the applicable provisions of this part. The owner or operator of an existing facility that must prepare and submit a plan after July 31, 2000 as a result of a planned or unplanned change in facility characteristics that causes the facility to become regulated under paragraph (f)(1) of this section, must prepare and submit a plan to the Regional Administrator in accordance with paragraphs (a)(2)(iii) or (iv) of this section, as appropriate. The plan must meet or exceed the applicable provisions of this part.

(iv) *Facilities amending existing plans.* The owner or operator of a facility submitting an amended plan in accordance with paragraph (d) of this section after July 31, 2000, including plans that had been previously approved, must also review the plan to determine if it meets or exceeds the applicable provisions of this part. If the plan does not meet or exceed the applicable provisions of this part, the owner or operator must revise and resubmit revised portions of an amended plan to the Regional Administrator in accordance with paragraph (d) of this section, as appropriate. The plan must meet or exceed the applicable provisions of this part.

(b)(1) The Regional Administrator may at any time require the owner or operator of any non-transportation-related onshore facility to prepare and submit a facility response plan under this section after considering the factors in paragraph (f)(2) of this section. If such a determination is made, the Regional Administrator shall notify the facility owner or operator in writing and shall provide a basis for the determination. If the Regional Administrator notifies the owner or operator in writing of the requirement to prepare and submit a response plan under this section, the owner or operator of the facility shall submit the response plan to the Regional Administrator within six months of receipt of such written notification.

(2) The Regional Administrator shall review plans submitted by such facilities to determine whether the facility could, because of its location, reasonably be expected to cause significant and substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines.

(c) The Regional Administrator shall determine whether a facility could, because of its location, reasonably be expected to cause significant and substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines, based on the factors in paragraph (f)(3) of this section. If such a determination is made, the Regional Administrator shall notify the owner or operator of the facility in writing and:

(1) Promptly review the facility response plan;

(2) Require amendments to any response plan that does not meet the requirements of this section;

(3) Approve any response plan that meets the requirements of this section; and

(4) Review each response plan periodically thereafter on a schedule established by the Regional Administrator provided that the period between plan reviews does not exceed five years.

(d)(1) The owner or operator of a facility for which a response plan is required under this part shall revise and resubmit revised portions of the response plan within 60 days of each facility change that materially may affect the response to a worst case discharge, including:

(i) A change in the facility's configuration that materially alters the information included in the response plan;

(ii) A change in the type of oil handled, stored, or transferred that materially alters the required response resources;

(iii) A material change in capabilities of the oil spill removal organization(s) that provide equipment and personnel to respond to discharges of oil described in paragraph (h)(5) of this section;

(iv) A material change in the facility's spill prevention and response equipment or emergency response procedures; and

(v) Any other changes that materially affect the implementation of the response plan.

(2) Except as provided in paragraph (d)(1) of this section, amendments to personnel and telephone number lists included in the response plan and a change in the oil spill removal organization(s) that does not result in a material change in support capabilities do not require approval by the Regional Administrator. Facility owners or operators shall provide a copy of such changes to the Regional Administrator as the revisions occur.

(3) The owner or operator of a facility that submits changes to a response plan as provided in paragraph (d)(1) or (d)(2) of this section shall provide the EPA-issued facility identification number (where one has been assigned) with the changes.

(4) The Regional Administrator shall review for approval changes to a response plan submitted pursuant to paragraph (d)(1) of this section for a facility determined pursuant to paragraph (f)(3) of this section to have the potential to cause significant and substantial harm to the environment.

(e) If the owner or operator of a facility determines pursuant to paragraph (a)(2) of this section that the facility could not, because of its location, reasonably be expected to cause substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines, the owner or operator shall complete and maintain at the facility the certification form contained in Appendix C to this part and, in the event an alternative formula that is comparable to one contained in Appendix C to this part is used to evaluate the criterion in paragraph (f)(1)(ii)(B) or (f)(1)(ii)(C) of this section, the owner or operator shall attach documentation to the certification form that demonstrates the reliability and analytical soundness of the comparable formula and shall notify the Regional Administrator in writing that an alternative formula was used.

(f)(1) A facility could, because of its location, reasonably be expected to cause substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines pursuant to paragraph (a)(2) of this section, if it meets any of the following criteria applied in accordance with the flowchart contained in Attachment C-I to Appendix C to this part:

(i) The facility transfers oil over water to or from vessels and has a total oil storage capacity greater than or equal to 42,000 gallons; or

(ii) The facility's total oil storage capacity is greater than or equal to 1 million gallons, and one of the following is true:

(A) The facility does not have secondary containment for each aboveground storage area sufficiently large to contain the capacity of the largest aboveground oil storage tank within each storage area plus sufficient freeboard to allow for precipitation;

(B) The facility is located at a distance (as calculated using the appropriate formula in Appendix C to this part or a comparable formula) such that a discharge from the facility could cause injury to fish and wildlife and sensitive environments. For further description of fish and wildlife and sensitive environments, see Appendices I, II, and III of the "Guidance for Facility and Vessel Response Plans: Fish and Wildlife and Sensitive Environments" (see Appendix E to this part, section 13, for availability) and the applicable Area Contingency Plan prepared pursuant to section 311(j)(4) of the Clean Water Act;

(C) The facility is located at a distance (as calculated using the appropriate formula in Appendix C to this part or a comparable formula) such that a discharge from the facility would shut down a public drinking water intake; or

(D) The facility has had a reportable oil discharge in an amount greater than or equal to 10,000 gallons within the last 5 years.

(2)(i) To determine whether a facility could, because of its location, reasonably be expected to cause substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines pursuant to paragraph (b) of this section, the Regional Administrator shall consider the following:

(A) Type of transfer operation;

(B) Oil storage capacity;

(C) Lack of secondary containment;

(D) Proximity to fish and wildlife and sensitive environments and other areas determined by the Regional Administrator to possess ecological value;

(E) Proximity to drinking water intakes;

(F) Spill history; and

(G) Other site-specific characteristics and environmental factors that the Regional Administrator determines to be relevant to protecting the environment from harm by discharges of oil into or on navigable waters or adjoining shorelines.

(ii) Any person, including a member of the public or any representative from a Federal, State, or local agency who believes that a facility subject to this section could, because of its location, reasonably be expected to cause substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines may petition the Regional Administrator to determine whether the facility meets the criteria in paragraph (f)(2)(i) of this section. Such petition shall include a discussion of how the factors in paragraph (f)(2)(i) of this section apply to the facility in question. The RA shall consider such petitions and respond in an appropriate amount of time.

(3) To determine whether a facility could, because of its location, reasonably be expected to cause significant and substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines, the Regional Administrator may consider the factors in paragraph (f)(2) of this section as well as the following:

(i) Frequency of past discharges;

(ii) Proximity to navigable waters;

(iii) Age of oil storage tanks; and

(iv) Other facility-specific and Region-specific information, including local impacts on public health.

(g)(1) All facility response plans shall be consistent with the requirements of the National Oil and Hazardous Substance Pollution Contingency Plan (40 CFR part 300) and applicable Area Contingency Plans prepared pursuant to section 311(j)(4) of the Clean Water Act. The facility response plan should be coordinated with the local emergency response plan developed by the local emergency planning committee under section 303 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. 11001 et seq.). Upon request, the owner or operator should provide a copy of the facility response plan to the local emergency planning committee or State emergency response commission.

(2) The owner or operator shall review relevant portions of the National Oil and Hazardous Substances Pollution Contingency Plan and applicable Area Contingency Plan annually and, if necessary, revise the facility response plan to ensure consistency with these plans.

(3) The owner or operator shall review and update the facility response plan periodically to reflect changes at the facility.

(h) A response plan shall follow the format of the model facility-specific response plan included in Appendix F to this part, unless an equivalent response plan has been prepared to meet State or other Federal requirements. A response plan that does not follow the specified format in Appendix F to this part shall have an emergency response action plan as specified in paragraphs

(h)(1) of this section and be supplemented with a cross-reference section to identify the location of the elements listed in paragraphs (h)(2) through (h)(10) of this section. To meet the requirements of this part, a response plan shall address the following elements, as further described in Appendix F to this part:

(1) *Emergency response action plan.* The response plan shall include an emergency response action plan in the format specified in paragraphs (h)(1)(i) through (viii) of this section that is maintained in the front of the response plan, or as a separate document accompanying the response plan, and that includes the following information:

(i) The identity and telephone number of a qualified individual having full authority, including contracting authority, to implement removal actions;

(ii) The identity of individuals or organizations to be contacted in the event of a discharge so that immediate communications between the qualified individual identified in paragraph (h)(1) of this section and the appropriate Federal officials and the persons providing response personnel and equipment can be ensured;

(iii) A description of information to pass to response personnel in the event of a reportable discharge;

(iv) A description of the facility's response equipment and its location;

(v) A description of response personnel capabilities, including the duties of persons at the facility during a response action and their response times and qualifications;

(vi) Plans for evacuation of the facility and a reference to community evacuation plans, as appropriate;

(vii) A description of immediate measures to secure the source of the discharge, and to provide adequate containment and drainage of discharged oil; and

(viii) A diagram of the facility.

(2) *Facility information.* The response plan shall identify and discuss the location and type of the facility, the identity and tenure of the present owner and operator, and the identity of the qualified individual identified in paragraph (h)(1) of this section.

(3) *Information about emergency response.* The response plan shall include:

(i) The identity of private personnel and equipment necessary to remove to the maximum extent practicable a worst case discharge and other discharges of oil described in paragraph (h)(5) of this section, and to mitigate or prevent a substantial threat of a worst case discharge (To identify response resources to meet the facility response plan requirements of this section, owners or operators shall follow Appendix E to this part or, where not appropriate, shall clearly demonstrate in the response plan why use of Appendix E of this part is not appropriate at the facility and make comparable arrangements for response resources);

(ii) Evidence of contracts or other approved means for ensuring the availability of such personnel and equipment;

(iii) The identity and the telephone number of individuals or organizations to be contacted in the event of a discharge so that immediate communications between the qualified individual identified in paragraph (h)(1) of this section and the appropriate Federal official and the persons providing response personnel and equipment can be ensured;

(iv) A description of information to pass to response personnel in the event of a reportable discharge;

(v) A description of response personnel capabilities, including the duties of persons at the facility during a response action and their response times and qualifications;

(vi) A description of the facility's response equipment, the location of the equipment, and equipment testing;

(vii) Plans for evacuation of the facility and a reference to community evacuation plans, as appropriate;

(viii) A diagram of evacuation routes; and

(ix) A description of the duties of the qualified individual identified in paragraph (h)(1) of this section, that include:

(A) Activate internal alarms and hazard communication systems to notify all facility personnel;

(B) Notify all response personnel, as needed;

(C) Identify the character, exact source, amount, and extent of the release, as well as the other items needed for notification;

(D) Notify and provide necessary information to the appropriate Federal, State, and local authorities with designated response roles, including the National Response Center, State Emergency Response Commission, and Local Emergency Planning Committee;

(E) Assess the interaction of the discharged substance with water and/or other substances stored at the facility and notify response personnel at the scene of that assessment;

(F) Assess the possible hazards to human health and the environment due to the release. This assessment must consider both the direct and indirect effects of the release (i.e., the effects of any toxic, irritating, or asphyxiating gases that may be generated, or the effects of any hazardous surface water runoffs from water or chemical agents used to control fire and heat-induced explosion);

(G) Assess and implement prompt removal actions to contain and remove the substance released;

(H) Coordinate rescue and response actions as previously arranged with all response personnel;

(I) Use authority to immediately access company funding to initiate cleanup activities; and

(J) Direct cleanup activities until properly relieved of this responsibility.

(4) *Hazard evaluation.* The response plan shall discuss the facility's known or reasonably identifiable history of discharges reportable under 40 CFR part 110 for the entire life of the facility and shall identify areas within the facility where discharges could occur and what the potential effects of the discharges would be on the affected environment. To assess the range of areas potentially affected, owners or operators shall, where appropriate, consider the distance calculated in paragraph (f)(1)(ii) of this section to determine whether a facility could, because of its location, reasonably be expected to cause substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines.

(5) *Response planning levels.* The response plan shall include discussion of specific planning scenarios for:

(i) A worst case discharge, as calculated using the appropriate worksheet in Appendix D to this part. In cases where the Regional Administrator determines that the worst case discharge volume calculated by the facility is not appropriate, the Regional Administrator may specify the worst case discharge amount to be used for response planning at the facility. For complexes, the worst case planning quantity shall be the larger of the amounts calculated for each component of the facility;

(ii) A discharge of 2,100 gallons or less, provided that this amount is less than the worst case discharge amount. For complexes, this planning quantity shall be the larger of the amounts calculated for each component of the facility; and

(iii) A discharge greater than 2,100 gallons and less than or equal to 36,000 gallons or 10 percent of the capacity of the largest tank at the facility, whichever is less, provided that this amount is less than the worst case discharge amount. For complexes, this planning quantity shall be the larger of the amounts calculated for each component of the facility.

(6) *Discharge detection systems.* The response plan shall describe the procedures and equipment used to detect discharges.

(7) *Plan implementation.* The response plan shall describe:

(i) Response actions to be carried out by facility personnel or contracted personnel under the response plan to ensure the safety of the facility and to mitigate or prevent discharges described in paragraph (h)(5) of this section or the substantial threat of such discharges;

(ii) A description of the equipment to be used for each scenario;

(iii) Plans to dispose of contaminated cleanup materials; and

(iv) Measures to provide adequate containment and drainage of discharged oil.

(8) *Self-inspection, drills/exercises, and response training.* The response plan shall include:

(i) A checklist and record of inspections for tanks, secondary containment, and response equipment;

(ii) A description of the drill/exercise program to be carried out under the response plan as described in § 112.21;

(iii) A description of the training program to be carried out under the response plan as described in § 112.21; and

(iv) Logs of discharge prevention meetings, training sessions, and drills/exercises. These logs may be maintained as an annex to the response plan.

(9) *Diagrams.* The response plan shall include site plan and drainage plan diagrams.

(10) *Security systems.* The response plan shall include a description of facility security systems.

(11) *Response plan cover sheet.* The response plan shall include a completed response plan cover sheet provided in Section 2.0 of Appendix F to this part.

(i)(1) In the event the owner or operator of a facility does not agree with the Regional Administrator's determination that the facility could, because of its location, reasonably be expected to cause substantial harm or significant and substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines, or that amendments to the facility response plan are necessary prior to approval, such as changes to the worst case discharge planning volume, the owner or operator may submit a request for reconsideration to the Regional Administrator and provide additional information and data in writing to support the request. The request and accompanying information must be submitted to the Regional Administrator within 60 days of receipt of notice of the Regional Administrator's original decision. The Regional Administrator shall consider the request and render a decision as rapidly as practicable.

(2) In the event the owner or operator of a facility believes a change in the facility's classification status is warranted because of an unplanned event or change in the facility's characteristics (i.e., substantial harm or significant and substantial harm), the owner or operator may submit a request for reconsideration to the Regional Administrator and provide additional information and data in writing to support the request. The Regional Administrator shall consider the request and render a decision as rapidly as practicable.

(3) After a request for reconsideration under paragraph (i)(1) or (i)(2) of this section has been denied by the Regional Administrator, an owner or operator may appeal a determination made by the Regional Administrator. The appeal shall be made to the EPA Administrator and shall be made in writing within 60 days of receipt of the decision from the Regional Administrator that the request for reconsideration was denied. A complete copy of the appeal must be sent to the Regional Administrator at the time the appeal is made. The appeal shall contain a clear and concise statement of the issues and points of fact in the case. It also may contain additional information from the owner or operator, or from any other person. The EPA Administrator may request additional information from the owner or operator, or from any other person. The EPA Administrator shall render a decision as rapidly as practicable and shall notify the owner or operator of the decision.

[59 FR 34098, July 1, 1994, as amended at 65 FR 40798, June 30, 2000]

EFFECTIVE DATE NOTE: At 65 FR 40798, June 30, 2000, § 112.20 was amended by adding paragraph (a)(4); by revising the phrase "section 10" to read "section 13" in the second sentence of paragraph (f)(1)(ii)(B); by revising the word "spills" to read "discharges" in paragraph (f)(3)(i); and by revising the words "spill" and "spilled" to read "discharge" and "discharged", respectively, wherever they appear in paragraph (h), effective July 31, 2000.

§ 112.21 Facility response training and drills/exercises.

(a) The owner or operator of any facility required to prepare a facility response plan under § 112.20 shall develop and implement a facility response training program and a drill/exercise program that satisfy the requirements of this section. The owner or operator shall describe the programs in the response plan as provided in § 112.20(h)(8).

(b) The facility owner or operator shall develop a facility response training program to train those personnel

Appendix C

Portions of HAR §11-23 (Underground Injection Control)

State Application for Underground Injection Control Permit

DEPARTMENT OF HEALTH

HAWAII ADMINISTRATIVE RULES

TITLE 11

CHAPTER 23

UNDERGROUND INJECTION CONTROL

§11-23-01Purpose

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§11-23-03 Definitions

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§11-23-23 Severability

Chapter §11-23-01

§11-23-01 Purpose. The purpose of this chapter is to establish a state underground injection control (UIC) program in order to protect the quality of the state's underground sources of drinking water (USDW) from pollution by subsurface disposal of fluids. Toward this end, conditions are specified to govern the location, construction and operation of injection wells so that injected fluids do not migrate and pollute USDW.. This chapter establishes minimum standards and counties are not precluded from establishing more stringent standards. [Eff. 7/6/84; am and comp] (Auth: HRS §340E-2) (Imp: HRS §340E-2, 40 CFR §144.1)

§11-23-02 Scope.

This chapter covers any injection well as herein defined in this chapter. Excluded from this chapter are:

(1) Individual wastewater systems (IWS) serving single family residential households which generate a volume of domestic sewage less than one thousand gallons per day (gpd);

(2) Non-residential waste disposal systems which receive solely sanitary wastes from buildings that generate less than one thousand gpd of wastewater;

(3) Test borings used for geotechnical and/or hydrologic investigations, provided that those borings are plugged with impermeable material upon completion of the investigation; and

(4) Wells which are used for ground stabilization by the injection of a grout or by vertical relief of excess soil pore pressures. [Eff. 7/6/84; am and comp] (Auth: HRS §340E-2) (Imp: HRS §340E-2, 40 CFR §§144.1(e), 146.1 and 146.5)

§11-23-03 Definitions. As used in this chapter:

"Abandon" means to permanently discontinue usage; temporary or intermittent cessation of operation does not constitute abandonment. An abandoned well need not necessarily be a sealed well.

"Aquifer" means a geological formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well, tunnel or spring.

"Artesian" means a hydrologic condition whereby groundwater is confined, under pressure greater than atmospheric, by overlying, relatively impermeable strata. Because of hydrostatic pressure, the piezometric surface of an artesian aquifer rises above the bottom of the (upper) confining bed.

"Building" means a structure, permanent or temporary, built, erected and framed of component structural parts designed for the housing, shelter, workplace, enclosure or support of persons, animals or property of any kind.

"Caprock" means a geological formation or formations composed of terrigenous or marine sediments deposited over a formation or formations of volcanic origin. Caprock is substantially less permeable than volcanic formations, and is considered a "confining material".

"Confining materials or zone" means a geological formation or part of a formation capable of preventing or severely retarding fluid movement between different geological formations; used interchangeably

sensitivity of drinking water sources.

[Eff. 7/6/84; am and comp] (Auth: HRS §340E-2) (Imp: HRS §340E-2, 40 CFR §§144.7 and 146.4)

§11-23-06 Classification of injection wells.

(a) The department shall classify existing and proposed injection wells in accordance with the five classes of wells described in this section. Wells in classes I through IV are prohibited and are defined as follows:

(1) Class I. Wells which inject fluids beneath the lowermost formation containing, within one quarter mile of the well bore, an underground source of drinking water and which are used by:

(A) Generators of hazardous waste or owners or operators of hazardous waste management facilities; and

(B) Disposers of industrial and municipal waste fluids.

(2) Class II. Wells which inject fluids:

(A) Which are brought to the surface in connection with conventional oil or natural gas production and may be commingled with waste waters from gas plants which are an integral part of production operations, unless those waters are classified as a hazardous waste at the time of injection;

(B) For enhanced recovery of oil or natural gas; and

(C) For storage of hydrocarbons which are liquid at standard temperature and pressure.

(3) Class III. Wells which inject for extraction of minerals including:

(A) Mining of sulfur by the Frasch process;

(B) In-situ production of uranium or other metals, using unconventional techniques to mine ore bodies; and

(C) Solution mining of salts or potash.

(4) Class IV. Wells used by generators of hazardous waste or of radioactive waste, by owners or operators of hazardous waste management facilities, or by owners or operators of radioactive waste disposal sites to dispose of hazardous waste or radioactive waste into any geohydrologic formation or a formation, which, within one-quarter of a mile of the well, contains an underground source of drinking water (USDW), even if exempted.

(b) Without exception, only class V wells shall be permissible and are defined as follows:

(1) Subclass A. Injection wells which inject fluids into an underground source of drinking water. Subclass A wells include:

(A) Sewage injection wells; and

(B) Industrial disposal wells other than those classified under subclasses AB or B.

(2) Subclass AB. Injection wells which inject only into exempted aquifers. Subclass AB wells include:

(A) Sewage injection wells; and

(B) Industrial disposal wells, other than those classified under subclass B, such as brine disposal wells used in a desalinization process.

(3) Subclass B. Injection wells which inject non-polluting fluids into any geohydrologic formation, including underground sources of drinking water. Subclass B wells include:

(A) Air conditioning return flow wells used to return the water used for heating or cooling in a heat pump;

(B) Cooling water return flow wells used to inject water previously used for cooling;

(C) Recharge wells used to replenish, augment, or store water in an aquifer;

(D) Salt water intrusion barrier wells, used to prevent the intrusion of salt water into fresh water, if they inject water of equal or lesser chloride concentration as that portion of the aquifer into which injected;

(E) Wells used in aquaculture, if the water in the receiving formation has, either:

(i) An equal or greater chloride concentration as that of the injected fluid; or

(ii) A total dissolved solids concentration in excess of five thousand mg/L.

(F) Injection wells used in an experimental technology, which is one that has not been proven feasible under the conditions in which it is being tested; and

(G) All wells not included in subclasses A, AB, C, D, or E of class V or in classes I through IV.

(4) Subclass C. Injection wells which inject surface fluids, i.e., storm runoff, into any geohydrologic formation.

(5) Subclass D. Injection wells which inject overflows, or relief flows, from potable water systems into any geohydrologic formation.

(6) Subclass E.

(A) Injection wells associated with the development and recovery of geothermal energy, provided that the geothermal effluent will be injected at a depth that will not be detrimental to underground sources of drinking water. If injection is to occur below the basal water table, the receiving formation water shall be tested and injection allowed if the receiving water has, either:

(i) An equal or greater chloride concentration as that of the injected fluid; or

(ii) A total dissolved solids concentration in excess of five thousand mg/l; or

(iii) An equivalent or lesser water quality than the injected fluid.

(B) Subclass E injection wells include:

(i) Brine injection wells for the disposal of excess water from the steam-flashing process;

(ii) Condensate injection wells for the disposal of condensate from electric generators; and

(iii) Gas injection wells for the disposal of non-condensible gases entrained in an aqueous solution.

[Eff. 7/6/84; am and comp] (Auth: HRS §340E-2) (Imp: HRS §340E-2, 40 CFR §§144.6 and 146.5)

§11-23-07 Prohibition.

(a) Without exception, any injection well not defined by class V in section 11-23-06 shall not be permitted to be constructed, operated or to exist in the State. Class V injection wells shall be permitted to be constructed, modified and operated to the extent provided by, and subject to, the requirements of this chapter.

(b) No new subclass A well shall be constructed or operated in an underground source of drinking water after July 6, 1984.

(c) No injection well owner or operator shall construct, operate, maintain, or close its injection well unless authorized by this chapter, a permit, or an order to do so.

(d) No injection well owner or operator shall violate any term of any written authorization, including those relating to inspection, monitoring, recordkeeping, and reporting. [Eff. 7/6/84; am and comp] (Auth: HRS §340E-2) (Imp: HRS §340E-2, 40 CFR §§144.11, 144.12, 144.24 and 146.52)

§11-23-08 Construction conditions.

(a) No injection well shall be constructed unless, prior to the start of any construction:

(1) Application is made for a UIC permit and all application procedures set forth in sections 11-23-12 through 11-23-15 are completed;

(2) It is shown that the proposed injection well will comply with this chapter; and

(3) The department, upon satisfaction of the requirements set forth in paragraphs (1) and (2), approves the start of construction.

(b) Approval of the start of the construction of any injection well shall not be construed as approval for the operation of that injection well. Further, the approval of the start of construction does not guarantee the approval to operate upon completion of the injection well. Permits shall be issued only in accordance with this chapter and it is the duty of the applicant to insure compliance with the law and this chapter. [Eff. 7/6/84 ; am and comp] (Auth: HRS §340E-2) (Imp: HRS §340E-2)

§11-23-09 Siting and pre-construction requirements.

(a) Any new injection well, other than subclass D injection wells, shall be sited beyond an area which extends at least one-quarter mile from any part of a drinking water source. This includes not only the surface expression of the water supply well, tunnel or spring, but also all portions of the subsurface collection system which may extend laterally, either at right or inclined angles to the ground surface. The area of protection shall be delineated by a reasonably smooth curve drawn to connect the points extending one-quarter mile beyond the most extensive portions of the drinking water source and its collection system.

(b) Where the surface expression of an existing drinking water source drawing from an artesian aquifer is located in an exempted caprock aquifer, a new injection well, other than a subclass D injection well, shall be located, in addition to subsection (a) of this section, outside an area measuring one-half mile wide, which is bisected by a line running hydrologically upgradient from the surface expression of the drinking water source to the UIC boundary line. This condition also applies to any future drinking water source which may be sited in an exempted aquifer.

(c) For a proposed injection well which is sited mauka of the UIC boundary line, in addition to meeting the minimum distance requirement in subsection (a) of this section, the department shall require the applicant to submit water quality data representative of local conditions as part of the application.

Where water quality data is lacking or insufficient to determine the areal water quality, the department may require the applicant to collect representative water samples from the injection well during construction. The samples shall be collected and analyzed, in accordance with standards and methods established in chapter 11-20, entitled "Rules Relating To Potable Water Systems". The parameters for which values shall be identified are, at least, the following:

(1) Chloride concentration,

(2) Total dissolved solids (TDS), and

(3) Coliform - Total; if found, then fecal and streptococcus determinations.

(d) The variety of injection wells and their uses dictate a variety of construction designs consistent with those uses, and precludes specific construction standards for each type of injection well outlined in this chapter. However, an injection well shall be designed for its intended use, in accordance with good engineering practices as recommended by the Honolulu Board of Water Supply's "Water System Standards", dated March, 1977.

(e) Vertical migration resulting in undesirable mixing of fluids from aquifers of substantially different water quality (due to improper well construction or use of an injection well) shall be prevented by preserving the integrity of the confining zone or zones by grouting or some other method acceptable to the department.

(f) If a large void, such as a lava tube or solution cavity, is encountered during drilling, where the drill rod drops more than three feet, measures shall be taken to prevent unacceptable migration of the injected fluids. The owner shall either verify that the void does not slope inland or construct the well in such a manner that wastes are not injected directly into the void. For the first option, a test boring which verifies the void's inclination inland of the wellsite shall be drilled. For the second option, the section of the well casing which passes through the void shall be without openings. Either the perforated casing shall be replaced with solid casing, or the holes in the casing shall be sealed by grouting or in some other manner approved by the department. The owner shall notify the department to arrange discussion and approval of any corrective actions. Scheduling of the procedures shall be arranged so that the departmental staff may observe the remedial operations. The final responsibility for remedial design, implementation and performance shall rest with the consulting engineer.

(g) Departmental staff shall have the right to enter property during normal working hours, without advance notification, for the purpose of observing injection well construction methods and progress. [Eff. 7/6/84; am and comp] (Auth: HRS §340E-2) (Imp: HRS §§340E-2 and 340E-9, 40 CFR §§144.12, 144.51 and 146.6)

§11-23-10 Provision for artesian aquifer protection.

(a) Where an injection well is located in a caprock formation which overlies volcanic USDW under artesian pressure, the following conditions shall be applied:

(1) A buffer zone of at least fifty feet of the confining materials (caprock) or other impermeable substance, shall remain between the bottom of the injection well and the top of the volcanic aquifer, and

(2) Injection pressure, as measured at the feed elevation or well head, shall remain below the hydrostatic pressure of the volcanic aquifer (the artesian head) or two p.s.i., whichever is greater.

(b) The locations of artesian aquifer areas are described generally. The major areas, which have an extensive caprock formation, include:

(1) The southern coastal plains of Oahu, from Kahe Pt. (West Beach) to Wailea Pt. (Lanikai);

(2) The windward (eastern) coastal plains of Oahu, from Makalii Pt. (Punaluu) to Waialee;

UNDERGROUND INJECTION CONTROL (UIC)
Department of Health
State of Hawaii

General Application For A UIC Permit To Operate
(Reference: Chapter 23 of Title 11, Hawaii Administrative Rules, Titled Underground Injection Control)

$100.00 Filing Fee Required
(Revised July 1999)

Submit application and attachments to:

Safe Drinking Water Branch
Environmental Management Division
Department of Health
919 Ala Moana Blvd., Room 308
Honolulu, Hawaii 96814

For Office Use:

File No. _____

Facility Name: _____

Facility Description: _____

Facility Location:

a. Street Address _____

Town _____ District _____

Island _____ State _____ Zip Code _____

b. Attach island map showing the general location of the facility.

c. Attach TMK map highlighting the property and showing the location of injection well(s).

Tax Map Key No. _____

d. Attach Site Plan.

e. Attach USGS topographic map (scale 1:24,000) showing the location of the property, the injection well(s), and drinkng water sources within 1/4 mile of the facility.

f. Coordinates: Latitude _____° _____' _____" N Longitude _____° _____' _____" W

Owner of the facility: _____

_____

_____

_____

Operator of the facility: _____

(Repeat the entry even _____

if same as item No. 4) _____

_____

Legal contact or official contact person for the facility (Note: person the correspondence will be addressed to; contractors and managing agents are not applicable.):

Full Name _____

Position _____

Company _____

Permanent Address _____

_____

_____

Telephone Number _____ FAX Number _____

Check appropriate box.

☐ Fee Simple property. Owner: _____

_____

☐ Leasehold property. Owner (Lessor): _____

_____

If the facility is on leasehold property, attach a written acknowledgement and consent of this application from the fee simple owner (lessor) of the property.

Consultant servicing this application:

Contact person _____

Position _____

Company Name _____

Address _____

_____

Telephone Number _____ FAX Number _____

Injection System:

a. Number of injection wells _____

b. Source of injected fluid (check appropriate box):

☐ Rainfall Runoff Water ☐ Aquaculture ☐ Filter Backwash

☐ Private WWTP ☐ Industrial ☐ Pond, Pool or Tank Drainage

☐ Municipal WWTP ☐ Geothermal ☐ Potable Water

☐ Other: _____

_____

_____

_____

c. Describe the connection of the wastewater source(s) to the injection well system and the connection between each injection well within the system.

d. Describe in detail the wastestream process and chemical composition of the injectant. (Attach appropriate schematic flow diagrams showing how the wastestream is generated. If the wastestream is generated from various sources, list the percent contribution from each source.)

Note: Regarding rainfall runoff drainage injection wells, provide drainage calculations as an attachment to this application.

). Proposed Injection: Manner, Quantity, Rate, Duration, and Pressure. Answer all that apply for the injection well system. Provide more information for clarity, if needed. If individual injection wells within the injection well system differ in use, complete a separate column for each use. Make additional copies of this table if more than two uses need to be described.

Injection Well(s) No.		
Injection Manner: continuous, intermittent, batch, seasonal, or other (please specify).		
Average Injection Quantity in gallons per day (gpd): representative average over a calendar week.		
Maximum Injection Quantity in gallons per day (gpd): representative maximum for one day.		
Injection Rate: fixed or variable.		
Average Injection Rate in gallons per minute (gpm): representative average over 24 hours.		
Maximum Injection Rate in gallons per minute (gpm): representative maximum for one day.		
Average Injection Duration in hours per day: representative average over a calendar week.		
Maximum Injection Duration in hours per day: representative maximum for one day.		
Injection Pressure: gravity fed or pump fed.		
Wellhead: open to atmosphere (vented), or closed to atmosphere (unvented).		
Wellhead terminus elevation in feet above (+) or below (-) ground surface.		
If pump fed and unvented, average injection pressure in pounds per square inch (psig) at the wellhead: representative average over time of use.		
If pump fed and unvented, maximum injection pressure in pounds per square inch (psig) at the wellhead: representative maximum for one day.		

11. Complete the attached "Diagram For Injection Well Dimensions"; OR, provide a detailed cross-sectional drawing of the injection well. Complete the following table.

Injection Well No.			
Latitude:			
Longitude:			
Elevations: Ground Surface Bottom of Well			
Total Depth of Well Below Ground Surface			
Diameter of Boring			
Well Cellar: *Lateral Dimensions* Depth Material			
Solid Casing: Diameter Stick Up Total Length Material			
Perforated Casing: Diameter Perforation Stick Up Total Length Material			
Open Hole: Diameter Total Length			
Annular Backfill: Capping Solid Casing Separation Perforated Casing Open Hole			
Approximate Depth of Groundwater			

2. Drilling contractor and proposed injection well construction method:

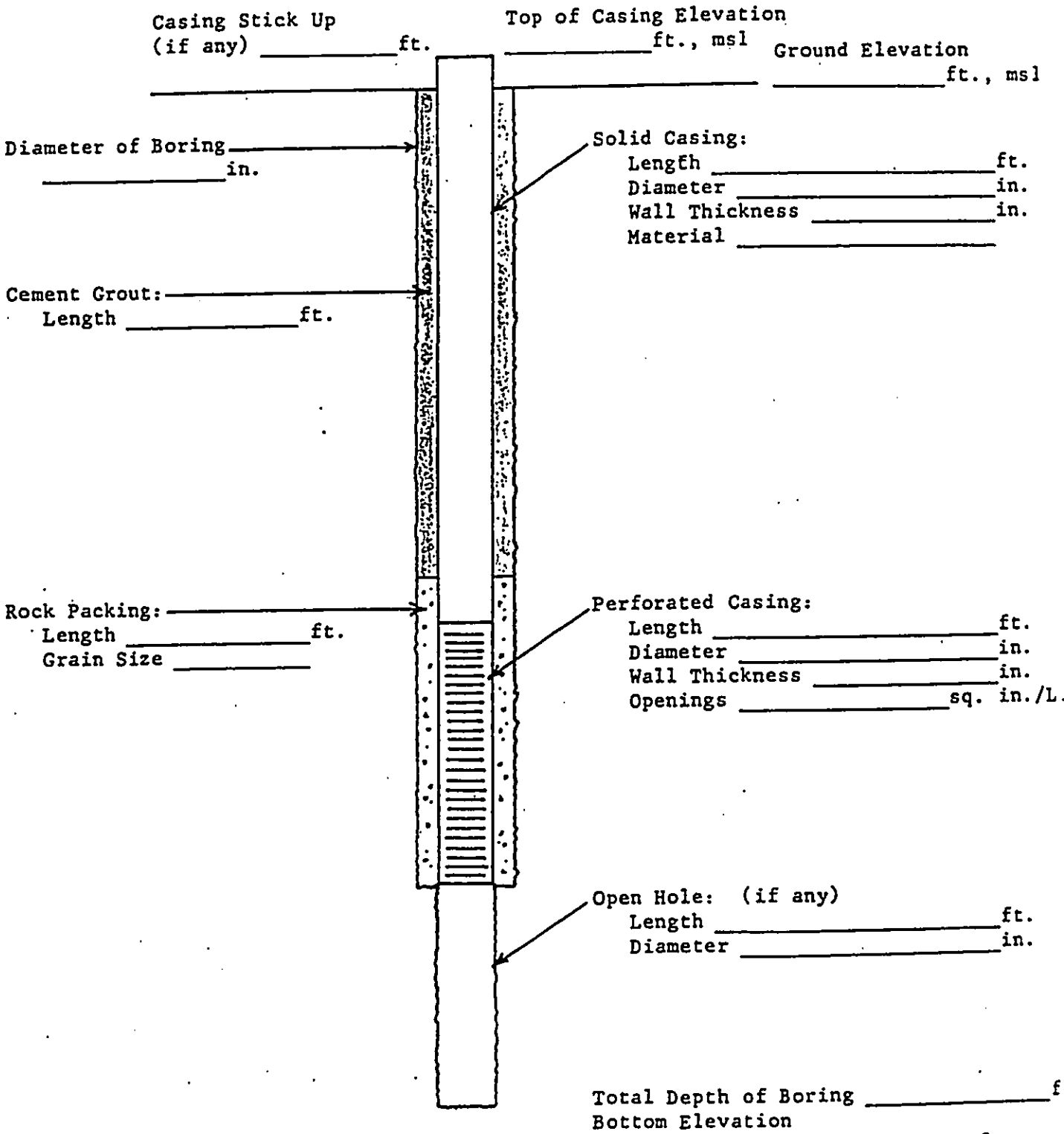
3. Describe proposed injection test.

4. Water Quality: Provide the following information.

- Source of potable water serving the facility. _____
- Source(s) of nonpotable water serving the facility. _____
- Available groundwater quality from within the boundaries of the project. (Sampling and analyses may be required during the construction of the injection well.)

[Office use: _____]

DIAGRAM FOR INJECTION WELL DIMENSIONS



SIGNATORY AND CERTIFICATION STATEMENT
FOR UNDERGROUND INJECTION CONTROL (UIC) SUBMITTALS
(submitted Statement shall bear an original signature and date -
photocopy signatures are unsatisfactory.)

I certify that:

(for a municipal, state, federal, or other public agency)
I am a principal executive officer or ranking elected official; or

In the case of Federal agencies, I am the chief executive officer of the agency, or I am the senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

(for a partnership or sole proprietorship)
I am a general partner (partnership) or a proprietor (sole proprietorship).

(for a corporation)
I am President, Vice President, Secretary or Treasurer of the corporation and in charge of a principal business function, or I perform similar policy or decision making functions for the corporation; or,

I am the manager of one or more manufacturing, production or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), and authority to sign documents has been assigned or delegated to me in accordance with corporate procedures.

****

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Description of Document
Application

Type of Organization (please circle):
1. sole proprietorship 2. partnership 3. corporation
4. municipal 5. state, federal or other public agency

Signature _____

Name (Print) _____

Title _____

Date _____

Company Name _____

Address _____

Phone Number ( )_____ FAX Number ( )_____

UNDERGROUND INJECTION CONTROL (UIC)
INSTRUCTIONS FOR COMPLETING THE
GENERAL APPLICATION FOR A UIC PERMIT TO OPERATE
(JULY 1999)

Attached are instructions to assist in completing the general application. The listed instructions correspond to the numbered items in the application. The general application is used for a new injection well, or to modify an injection well in use or to revise an existing UIC permit condition.

Do not use the general application to file for permit renewal, change of owner/operator, or existing injection well registration. Instead, obtain the appropriate application for these actions.

All items must be accurately and completely answered. An inaccurate or incomplete application is not acceptable. If an item does not apply, please enter "Not Applicable" to show that the item was given consideration.

The services of a professional consultant are typically necessary to complete and service the application throughout the permitting process. Professional services enhance efficient processing.

The general application to construct a new injection well must be submitted under the signature of a geologist or professional engineer. The general application to modify an injection well, or to revise an existing UIC permit condition, need not have this requirement; however, the services of a qualified environmental consultant, such as an engineer or geologist, to complete and service the application are recommended. Such services will generally result in efficient application processing.

The general application should be submitted six months before the anticipated date of injection well construction. Six months accommodate evaluation, corrections, public notice, and inspection. An approval to construct and test the injection well is issued by departmental letter after the application is satisfactorily processed.

Construction of an injection well is followed by injection testing. Injection test results, geologic logs, and other information as requested must be submitted collectively as a final engineering/geologist report. A UIC permit to operate the injection well is issued after the final report is satisfactorily completed. (The UIC permit is a document of approximately 23 pages and contains monitoring and reporting requirements and permit conditions.)

If the project site is located mauka (inland) of the UIC line, submit two complete copies of the general application. The second copy will be used for public notification.

A filing fee of $100.00 payable to the State of Hawai'i is required to initiate the application. Governmental agencies are exempt from the filing fee.

Questions about the general application can be directed to either Jaime Rimando, Norris Uchara, or Chauncey Hew at the Safe Drinking Water Branch. Please call 808-586-4258 (Honolulu) or call toll free: Kaua'i 274-3141 ext. 64258; Maui 984-2400, ext. 64258; Big Island 974-4000 ext. 64258; Molokai and Lana'i 1-800-468-4644, ext. 64258.

1. Provide the full facility name or project name. This name will appear on all correspondence, official files and the permit.

2. Provide a comprehensive description of the facility. For a subdivision, the description should include the total project area, total number of lots, range of lot sizes, type of subdivision and zoning, number of roadways, and areas of rainfall runoff.

3a. Enter a street <u>number</u> and <u>name</u>. If no number is available at the time, then give street boundaries and approximate dimensions of the subject parcel, and location of the parcel relative to street boundaries.

3b. Provide a map of the entire island with the project location highlighted. A simple map will suffice such as the type found in textbooks that show an entire island on one page, and can be photocopied on an 8-1/2" x 11" sheet.

3c. Provide a copy of the TMK <u>map</u> showing TMK numbers and the exact location of the injection well(s) and well numbers. Highlight the injection wells.

Provide Division, Zone, Section, Plat and Parcel numbers.

3d. Provide a site plan of the facility showing the injection well(s) with pertinent details.

3e. Provide a copy of the 1:24,000 scale USGS map: this is the 7-1/2 minute quadrangle map. The entire quadrangle map is not necessary, but give a portion large enough to identify the surrounding areas and surrounding pertinent features. Plot on the map other wells, especially drinking water wells or sources, within a 1/4 mile radius of the facility. Recommendation: plot the nearest drinking water well(s) even if it is more than 1/4 mile away. Remember, one of the primary concerns of UIC is the location of drinking water wells in proximity to an injection well.

Maps showing drinking water wells are located at:

a)	Safe Drinking Water Branch	State agency, Oahu;
b)	Department of Land & Natural Resources (DLNR), Commission on Water Resource Management	State agency, Oahu;
c)	Department of Water Supply	County agency.

The extent of current information may vary between agencies.

3f. Provide the latitude and longitude of the injection well(s) as plotted on your 7-1/2 minute quadrangle map. For a system of injection wells, state a latitude and longitude of a representative point which is central to all wells.

Injection wells situated far apart from one another may require separate permits instead of a single permit.

List coordinates to the nearest 2 seconds. Remember, every second changes your map distance by about 95 feet in longitude, 100 feet in latitude.

4. Provide the name and address of the person, company, or corporation that owns the injection well.

5. Provide the name and address of the business operator of the injection well. (The operator is often the owner of the injection well. The operator is not a service-provider contractor.)

6. Provide the name, position, company, address and telephone number of the person legally responsible for the injection facility. All UIC correspondence will be made to this person. (Courtesy copies of correspondence will be sent to the consultant who is processing the application.)

7. Check the appropriate box to describe the facility's interest in the land on which the facility is built. Fee simple refers to direct ownership. Leasehold refers to a lease agreement between the facility and the fee simple owner of the property.

8. Provide the requested information about the consultant who is servicing the application.

9., 10. & 11.
Provide the requested information. Please call the UIC program if questions arise.

12. Provide the name of the drilling contractor and a description of the method and drill equipment. Typical drilling methods are rotary, percussion, washing, or excavating.

13. Provide a description of the injection test. The data obtained from this test is used by the applicant to complete the engineer/geologist report for a UIC permit. The duration for injection testing is a minimum 12 hours. Shorter durations needs departmental approval.

14. Provide data as indicated.

Signatory and Certification Statement: This statement must bear the original signature and identity of the applicant. Typically this signature corresponds to the person described in item No. 6.

Remarks:

Multiple rainfall runoff drainage injection wells should be presented in table form as suggested below. Specific details may be shown by attachment diagram.

	Depth	Diameter	Grd. Elev.	Bottom Elev.	Proposed Discharge	...Etc.
Well #1					-	
Well #2						
Well #3						
.						
.						
.						

Appendix D

EPA's Fact Sheet for Generators and Transporters of Hazardous Waste

EPA Form 8700-12 "Notification of Regulated Waste Activity"

Portions of HAR 262 Hazardous Waste Management;
Standards Applicable to Generators of Hazardous Waste

Portions of HAR 263 Hazardous Waste Management;
Standards Applicable to Transporters of Hazardous Waste

Text-Only Version

HOME

Frequently Asked Questions
Reduce Reuse and Recycle
Generate and Transport
Treat Store and Dispose
Clean Up

Concerned Citizens
Students and Teachers

OSW

EPA Regions States & Tribes

Laws, Regulations & Policies
Environmental Justice
Software and Databases

EPA United States Environmental Protection Agency **Office of Solid Waste**

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Generate and Transport Waste

- What Are Hazardous Waste Generators and Transporters?
- Are All Hazardous Waste Generators Regulated the Same Way?
- What Are the Requirements for Hazardous Waste Generators?
- What Are the Requirements for Hazardous Waste Transporters?
- The Hazardous Waste Manifest
- Facts and Figures for Nonhazardous and Hazardous Waste Generators and Transporters
- Other Documents Related to Hazardous Waste Generators and Transporters
- Municipal Solid (Nonhazardous) Waste Generation and Transport Information

What Are Hazardous Waste Generators and Transporters?

Generators are individuals that produce hazardous waste, usually as a result of an industrial process. Transporters are individuals or entities that move hazardous waste from the generator off-site to a facility that can recycle, treat, store, or dispose of the waste. For the regulations about identifying hazardous waste, see 40 CFR 261 [Adobe Acrobat PDF File].

Hazardous waste may be transported to another location to be treated, stored or disposed, or may be managed at the place of generation. When waste is to be transported off-site, the generator prepares a shipping document called a manifest. This tracking form must accompany the waste to its final destination, and is used to track the waste from "cradle-to-grave." For additional information see The Hazardous Waste Manifest.

Regulatory definitions for generators and transporters can be found at 40 CFR 260.10 [Adobe Acrobat PDF File].

Are All Hazardous Waste Generators Regulated in the Same Way?

No, hazardous waste generators are divided into three categories, based on the amount of waste produced, and are subject to different levels of regulation. The three types of hazardous generators are: (Please note that the following provides only brief generator definitions. For more detailed information, refer to the links under each generator type.)

1. **Conditionally exempt small quantity generators (CESQGs):** generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month. For more information about CESQGs, see the CESQG Rule page.
2. **Small quantity generators (SQGs):** generate between 100 kg and 1,000 kg of hazardous waste per month. For more information on SQGs, see Understanding the Hazardous Waste Regulations, a Handbook for Small Businesses.
3. **Large quantity generators (LQGs):** generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month. For more information on LQG requirements, see Hazardous Waste Requirements for Large Quantity Generators

What Are the Requirements for Hazardous Waste Generators?

- Requirements for CESQGs (Conditionally Exempt Small Quantity Generators) includes: (see also 40 CFR 261.5 [Adobe Acrobat PDF File]).
  - CESQGs must identify all the hazardous waste they generate
  - CESQGs must not accumulate more than 1000 kg of hazardous waste at any time
  - CESQGs must ensure that their hazardous waste is delivered to someone who is authorized to manage their waste.
- Requirements for SQGs (Small Quantity Generators) and LQGs (Large Quantity Generators) include: (see also 40 CFR 262 [Adobe Acrobat PDF File]).
  - Obtaining an EPA identification number (contact state environmental office for number)
  - Handling wastes properly before shipment (packaging, labeling, marking, placarding, accumulation time, etc.)
  - Complying with the manifest system
  - Recordkeeping and reporting requirements
- Some states may have additional requirements for generators. You should contact your state environmental office if you are not familiar with the requirements that may apply to you.

What Are the Requirements for Hazardous Waste Transporters?

Requirements for transporters include: (see also 40 CFR 263 [Adobe Acrobat PDF File]).

- Obtaining an EPA identification number
- Complying with the manifest system
- Responding appropriately to hazardous waste discharges
- Complying with both the RCRA requirements (40 CFR Part 263) & DOT regulations (49 CFR Part 171-179) EXIT EPA

Some states may have additional requirements for generators. You should contact your state environmental office if you are not familiar with the requirements that may apply to you.

The Hazardous Waste Manifest

The Uniform Hazardous Waste Manifest (the manifest) is a form used to track the movement of hazardous waste from the point of generation to the point of ultimate disposition ("cradle to grave"). (For information regarding the manifest requirements, see 40 CFR part 262, subpart B [Adobe Acrobat PDF File]).
RCRA manifests include information such as:

- name and address of the generator, transporter, and the destination facility
- U.S. DOT description of the waste being transported and any associated hazards
- waste quantity
- name and phone number of a contact in case of an emergency
- other information required either by EPA or the state

Visit the "Manifest Automation Pilot" subpage to further explain the manifest system.

Facts & Figures for Nonhazardous and Hazardous Waste Generators and Transporters>
(from the Municipal Solid Waste Characterization Report, 1996 Edition, and the 1995 RCRA Biennial Report)

- In 1996 a total of 209.7 million tons of MSW was generated. This reflects a decrease of nearly 2 million tons from 1995, when MSW generation was 211.5 million tons. Of the MSW generated, 57.3 million tons (27.3 percent) were recovered by recycling or composting, 36.1 million tons (17.2 percent) were combusted at high tempratures, and 116.3 million tons (55.5 percent) were landfilled.
- The per capita generation rate in 1996 was 4.3 pounds per person per day, compared to 4.4 pounds per person per day in 1995.
- The per capita discard rate (after recovery for recycling, including composting) was 3.2 pounds per person per day in 1996, down from 3.3 pounds per person per day in 1995.
- Recycling (including composting) recovered 27 percent (57 million tons) of MSW in 1996, up from 26 percent (55 million tons) in 1995.
- There were nearly 9,000 curbside recycling programs in the United States in 1996, as well as more than 10,000 drop-off centers for recyclables. About 360 materials recovery facilities helped process the recyclables collected. More than 3,000 yard trimmings composting programs were reported.
- Recovery of paper and paperboard reached 41 percent (33 million tons) in 1996, accounting for more than half of the total MSW recovered. In addition, nearly 11 million tons of yard trimmings were recovered for composting in 1996, accounting for the second largest fraction of total recovery. The percentage of yard trimmings composted (38 percent) has more than doubled since 1992.
- Landfills managed 55 percent of MSW generated (116 million tons), down from 57 percent in 1995. Combustion facilities managed 17 percent (36 million tons) of total MSW generated, about the same as in 1995.
- In 1995, 20,873 LQGs produced 214 million tons of hazardous waste regulated by RCRA. This is a decrease of 3,489 LQGs and a decrease of 44 million tons of waste compared to 1993. The five (5) States whose LQGs generated the largest amount of hazardous waste were Texas (69 million tons), Tennessee (39 million tons), Louisiana (17 million tons), Michigan (13 million tons), and Illinois - (13 million tons). Together, the LQGs in these States accounted for 70% of the national total waste generated.
- In 1995, wastewater generation accounted for 95% of the national generation total, while in 1993, wastewater generation accounted for 92% percent of the national generation total.
- Overall, total hazardous waste generation decreased from 258 million tons in 1993 to 214 million tons in 1995. Wastewater generation decreased from 237 million tons in 1993 to 202 million tons in 1995, and non-wastewater generation decreased from 22 million tons in 1993 to over 11 million tons in 1995.

Other Documents Related to Hazardous Waste Generators and Transporters

- Understanding the Hazardous Waste Rules: A Handbook for Small Business
- RCRIS RCRA Regulated Handlers
- BRS Biennial RCRA Hazardous Waste Report (1993)
- 1995 RCRA Biennial Report
- Control of Transfrontier Movements of Wastes destined for Recovery Operations, OECD Council Decision Implementation Final Rule (October 12, 1996)

Municipal Solid (Nonhazardous) Waste Generation and Transport Information

- Municipal Solid Waste Factbook - Reference manual about household waste management practices.
- Municipal Solid Waste Characterization Report, 1996 Edition
- Municipal Solid Waste Characterization Report, 1995 Edition
- Decision Makers Guide to Solid Waste Management
- Flow Control and Municipal Solid Waste - a review of the legal provisions that allow state and local governments to designate the places where municipal solid waste is taken for processing.
- Pay As You Throw: Unit Pricing - residents pay for household waste directly based on the amount of waste they generate.
- Full Cost Accounting for Municipal Solid Waste - a primer for managing the economics of solid waste.

Get Acrobat Reader • Some of the documents provided by EPA are in an Adobe Acrobat PDF (Portable Document Format) file. They can be viewed, and printed, with the use of an Adobe Acrobat Reader. The Adobe Acrobat's Reader is available, free, for Unix,

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0028 Expires 12/31/02
GSA No. 0246-EPA-OT

Please refer to Section V. Line-by-Line Instructions for Completing EPA Form 8700-12 before completing this form. The information requested here is required by law (Section 3010 of the *Resource Conservation and Recovery Act*).

Notification of Regulated Waste Activity

EPA United States Environmental Protection Agency

Date Received (For Official Use Only)

I. Installation's EPA ID Number *(Mark 'X' in the appropriate box)*

☐ A. Initial Notification ☐ B. Subsequent Notification *(Complete item C)*

C. Installation's EPA ID Number

II. Name of Installation *(Include company and specific site name)*

III. Location of Installation *(Physical address not P.O. Box or Route Number)*

Street

Street *(Continued)*

City or Town | State | Zip Code

County Code | County Name

IV. Installation Mailing Address *(See instructions)*

Street or P.O. Box

City or Town | State | Zip Code

V. Installation Contact *(Person to be contacted regarding waste activities at site)*

Name *(Last)* | *(First)*

Job Title | Phone Number *(Area Code and Number)*

VI. Installation Contact Address *(See instructions)*

A. Contact Address Location ☐ Mailing ☐ | B. Street or P.O. Box

City or Town | State | Zip Code

VII. Ownership *(See instructions)*

A. Name of Installation's Legal Owner

Street, P.O. Box, or Route Number

City or Town | State | Zip Code

Phone Number *(Area Code and Number)* | B. Land Type | C. Owner Type | D. Change of Owner Indicator (Yes ☐ No ☐) | Date Changed (Month, Day, Year)

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GSA No. 0246-EPA-OT

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VIII. Type of Regulated Waste Activity *(Mark 'X' in the appropriate boxes. Refer to Instructions)*

A. Hazardous Waste Activities

1. Generator (See Instructions)
   - ☐ a. Greater than 1000kg/mo (2,200 lbs.)
   - ☐ b. 100 to 1000 kg/mo (220-2,200 lbs.)
   - ☐ c. Less than 100 kg/mo (220 lbs)
2. Transporter (Indicate Mode in boxes 1-5 below)
   - ☐ a. For own waste only
   - ☐ b. For commercial purposes

Mode of Transportation
- ☐ 1. Air
- ☐ 2. Rail
- ☐ 3. Highway
- ☐ 4. Water
- ☐ *5. Other - specify*

3. ☐ Treater, Storer, Disposer (at installation) Note: A permit is required for this activity, see instructions.
4. Exempt Boiler and/or Industrial Furnace
   - ☐ a. Smelting, Melting, and Refining Furnace Exemption
   - ☐ b. Small Quantity On-Site Burner Exemption
5. ☐ Underground Injection Control

B. Universal Waste Activity

☐ Large Quantity Handler of Universal Waste

C. Used Oil Management Activities

1. Used Oil Transporter/Transfer Facility - Indicate Type(s) of Activity(ies)
   - ☐ a. Transporter
   - ☐ b. Transfer Facility
2. Used Oil Processor/Re-refiner - Indicate Type(s) of Activity(ies)
   - ☐ a. Processor
   - ☐ b. Re-refiner
3. ☐ Off-Specification Used Oil Burner
4. Used Oil Fuel Marketer
   - ☐ a. Marketer Who Directs Shipment of Off-Specification Used Oil to Used Oil Burner
   - ☐ b. Marketer Who First Claims the Used Oil Meets the Specifications

IX. Description of Hazardous Wastes *(Use additional sheets if necessary)*

A. Listed Hazardous Wastes. *(See 40 CFR 261.31 - 33; See instructions if you need to list more than 12 waste codes.)*

1	2	3	4	5	6
7	8	9	10	11	12

B. Characteristics of Nonlisted Hazardous Wastes. *(Mark 'X' in the boxes corresponding to the characteristics of nonlisted hazardous wastes your installation handles. See 40 CFR Parts 261.20 - 261.24; See instructions if you need to list more than 4 toxicity characteristic waste codes.)*

1. Ignitable (D001)	2. Corrosive (D002)	3. Reactive (D003)	4. Toxicity Characteristic	(List specific EPA hazardous waste number(s) for the Toxicity Characteristic contaminant(s)) 1	2	3	4

C. Other Wastes. *(State-regulated or other wastes requiring a handler to have an I.D. number; See instructions.)*

1	2	3	4	5	6

X. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature	Name and Official Title *(Type or print)*	Date Signed

XI. Comments

Note: Mail completed form to the appropriate EPA Regional or State Office. *(See Section IV of the booklet for addresses.)*

Please print or type with ELITE type (12 characters per inch) in the unshaded areas only

Form Approved, OMB No. 2050-0028 Expires 12/31/02
GSA No. 0245-EPA-OT

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IX. Description of Hazardous Wastes *(Continued; Additional Sheet)*

A. Listed Hazardous Wastes. *(See 40 CFR 261.31 - 33; Use this page only if you need to list more than 12 waste codes.)*

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

B. Toxicity Characteristic Hazardous Wastes. *(See 40 CFR 261.24; Use this page only if you need to list more than 4 waste codes.)*

5	6	7	8	9	10
11	12	13	14	15	16
17	18	19	20	21	22

United States Environmental Protection Agency | Office of Solid Waste (5301) Washington, DC 20460 | December 1999

Solid Waste

EPA Notification of Regulated Waste Activity

United States Environmental Protection Agency Washington, D.C. 20460

Notification of Regulated Waste Activity Forms and Instructions

This booklet is designed to help you determine if you are subject to requirements under the *Resource Conservation and Recovery Act* (RCRA) for notifying the U.S. Environmental Protection Agency (EPA) of your regulated waste activities. Regulated wastes are hazardous wastes as defined by 40 CFR Part 261, universal wastes as defined by 40 CFR Part 273, and used oil as defined by 40 CFR Part 279. The instructions contained in this booklet will assist you in obtaining an EPA Identification Number by completing and submitting EPA Form 8700-12 for initial notifications, or in revising your EPA Form 8700-12 if you are required to submit a subsequent notification. RCRA is a Federal law. If you are regulated but do not comply with the RCRA notification requirements, you may be subject to civil penalties.

Large Quantity Handlers of Universal Waste and Used Oil Handlers have the option of submitting either EPA Form 8700-12 or a letter to notify EPA of their regulated waste activities, including both initial and subsequent notifications. As noted above, the instructions in this booklet refer only to completing and submitting EPA Form 8700-12 (also referred to as the notification form). However, the circumstances under which these handlers must notify EPA of their regulated waste activities, the data they must provide, and the procedures they must follow, as described in this booklet, apply to submitting both EPA Form 8700-12 and a letter.

Note: *Although this booklet contains information and instructions for completing a Notification of Regulated Waste Activity, it should not be considered a substitute for the regulations in Title 40 of the Code of Federal Regulations (40 CFR). Rather, this booklet serves as a supplement to the regulations and provides additional information not contained in 40 CFR. As*

a handler of regulated wastes, you are responsible for learning and complying with all the requirements that apply to you and your regulated waste activities.

In addition, remember that this booklet and the regulations in 40 CFR address only the Federal hazardous waste program. Many States may have notification requirements that differ from the Federal requirements; those States may use EPA Form 8700-12 or they may use a similar State form that requires information not requested in the EPA form. Again, it is your responsibility to make sure that you have completed and submitted all forms required under the Federal or your State program.

We know that the regulations can be confusing. We are not providing reprints of the 40 CFR regulations with this booklet. However, copies of the federal regulations are readily available from several sources (see below). In addition, in Section IV of these instructions, we have listed the addresses and phone numbers of the contacts in each State who can answer your questions and help you understand the Federal and State requirements that apply to you (see Table 1). In addition, Table 2 in Section IV contains the addresses and phone numbers of contacts in each of the EPA Regional offices.

In addition to those contacts, the following sources are available to help with your questions and provide information on EPA regulations:

A. RCRA, Superfund, and EPCRA Hotline -- 1-800-424-9346
(In the Washington, D.C. area, call (703) 412-9810)

B. EPA Small Business Ombudsman Hotline -- 1-800-368-5888

C. The EPA Web Site at:
www.epa.gov/docs/epacfr40/chapt-I.info/subch-I/

D. Your Trade Association

Initial Notifications

If you do not currently have an EPA Identification Number and you handle regulated waste, you must submit an initial notification. Please refer to information contained in Sections I through III of this booklet to help you determine whether you handle a regulated waste, whether any exemptions or exclusions apply to you, and how you should file EPA Form 8700-12. Circumstances under which you should submit an initial notification include:

1. If you generate, transport, treat, store, or dispose of hazardous wastes. Refer to Section I for further information and a description of exclusions or exemptions; or

2. If you store recyclable materials. (Recyclable materials are defined as hazardous wastes that are recycled.) The recycling process itself is exempt from regulation, but facilities that store recyclable materials prior to recycling them must notify EPA and obtain an EPA Identification Number. Refer to Section I for further information and a description of exemptions; or

3. If you are a large quantity handler of universal waste. Refer to Section II for further information and a description of exemptions. (Notification is required for people who have not previously notified EPA of their hazardous waste activities or who have not already sent a notification to EPA as required by 40 CFR Part 165); or

4. If you transport, process, re-refine, burn, or market off-specification used oil for energy recovery. Refer to Section III for further information and for a description of exemptions. (Notification is required for people who have not previously notified EPA of their hazardous waste activities or have not notified under 40 CFR Part 266, Subpart E, which was replaced by 40 CFR Part 279.)

Subsequent Notifications

Even if you have submitted an initial notification and have received an EPA Identification Number, you may be required to submit a subsequent notification. Please refer to Sections I through III and V of this booklet for information on when and how to complete a subsequent notification. In general, you should submit a subsequent notification under the following circumstances:

1. If your installation moves to another location; or
2. If your installation contact changes; or
3. If the ownership of your installation changes; or
4. If an additional owner has been added or replaced since the installation's initial notification; or
5. If the type of regulated waste activity you conduct changes.

Contents of This Booklet

Following is a list of the sections contained in this booklet and the information covered in those sections.

Section I. How to Determine if You Must Notify EPA of Your Hazardous Waste Activities

Section II. How to Determine if You Must Notify EPA of Your Universal Waste Handling Activities

Section III. How to Determine if You Must Notify EPA of Your Used Oil Management Activities

Section IV. How to File EPA Form 8700-12, "Notification of Regulated Waste Activity" (Information on How and Where to File Your Form; Plus a List of State Contacts Where You Can Get Information, Obtain Forms, and Send Your Completed Forms)

Section V. Line-by-Line Instructions for Completing EPA Form 8700-12 (EPA Form 8700-12 is provided at the end of this booklet.)

Section VI. Definitions (to Help You Understand and Complete EPA Form 8700-12)

Section VII. EPA Hazardous Waste Numbers for Waste Streams Commonly Generated by Small Quantity Generators

Appendix 1: Typical Hazardous Waste Streams Produced by Small Quantity Generators

Appendix 2: Typical Hazardous Waste Streams and EPA Hazardous Waste Numbers

After your completed notification is received, you will be sent a written acknowledgment that will include your EPA Identification Number. You must use this number on all communications with EPA regarding your regulated waste activities.

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I. How to Determine if You Must Notify EPA of Your Hazardous Waste Activities

All persons who generate, transport, treat, store, or dispose of hazardous waste and all persons who store recyclable materials prior to recycling them are required to notify EPA (or their State agency if the State is authorized to operate its own hazardous waste program) of their hazardous waste activities. These persons must obtain an EPA Identification Number unless their solid waste has been excluded from regulation or their hazardous waste has been exempted as outlined below. These respective notification requirements are found in 40 CFR Parts 262, 263, 264, 265, and 266.

In addition to the discussion below, you will need to refer to 40 CFR Part 261 to help you determine if the waste you handle is both a solid waste and a hazardous waste that is regulated under RCRA. If you need help making this determination after reading these instructions, contact the addressee listed for your State in Section IV.C. of these instructions.

To determine if you handle a solid waste that is also a hazardous waste and regulated under RCRA, ask yourself the following questions.

A. Do I Handle a Solid Waste?

40 CFR 261.2 defines "solid waste" as any discarded material that is not excluded under Section 261.4(a) or that is not excluded by variance granted under Sections 260.30 and 260.31. A discarded material is any material which is:

1. Abandoned, as explained in §261.2(b); or
2. Recycled, as explained in §261.2(c); or
3. Considered inherently waste-like as explained in §261.2(d); or
4. A military munition identified as a solid waste in 40 CFR 266.202.

If you do not handle a solid waste, you do not need to notify EPA.

B. Has My Solid Waste Been Excluded from the Regulations under Section 261.4?

The list of general exclusions can be found in 40 CFR 261.4. If the solid waste that you handle has been excluded, either by rule or special variance, then you do not need to notify EPA for that solid waste. If your solid waste was not excluded from regulation, you need to determine if it is a hazardous waste that EPA regulates. EPA regulates a solid waste as hazardous waste in two ways:

1. By specifically listing the solid waste as a hazardous waste and assigning it a unique EPA Hazardous Waste Code Number; or
2. By regulating it because it possesses any of four hazardous waste characteristics and assigning it a generic EPA Hazardous Waste Code Number.

C. Is My Solid Waste Specifically Listed as a Hazardous Waste?

Sections 261.30 through 261.33 of 40 CFR identify certain solid wastes that EPA has specifically listed as hazardous. Persons who handle listed hazardous waste are subject to regulation and must notify EPA of their hazardous waste activities unless they are exempted as discussed below. Refer to these sections of 40 CFR to see if your solid waste is included as a "listed hazardous waste." If you are handling a newly regulated hazardous waste and have already notified EPA prior to that hazardous waste being regulated **and already have an EPA Identification Number,** you do not need to submit a subsequent notification for that newly regulated hazardous waste.

D. Does My Solid Waste Possess a Hazardous Characteristic?

Even if your solid waste is not specifically listed as a hazardous waste, it may still be hazardous because it exhibits certain hazardous characteristics. These characteristics are:

1. Ignitability;
2. Corrosivity;
3. Reactivity; and
4. Toxicity.

Sections 261.20 through 261.24 of 40 CFR explain each of the characteristics and outline the testing procedures you should use to determine if your solid waste meets these characteristics. Persons who handle characteristic hazardous waste that is regulated must notify EPA of their activities unless they are exempted, as discussed below. If you are handling a newly regulated hazardous waste and have already notified EPA prior to that hazardous waste being regulated **and already have an EPA Identification Number,** you do not need to submit a subsequent notification for that newly regulated hazardous waste.

E. Has My Hazardous Waste Been Exempted from the Regulations under Section 261.5 and 261.6(a)(3)?

Sections 261.5 and 261.6(a)(3) of 40 CFR list certain hazardous wastes that are not subject to RCRA regulation. If the hazardous waste that you handle has been exempted, then you do not need to notify EPA for that hazardous waste.

II. How to Determine if You Must Notify EPA of Your Universal Waste Handling Activities

Under 40 CFR Part 273, Subpart C, Large Quantity Handlers of Universal Waste who accumulate a total of 5,000 kilograms or more of universal wastes at any time are required to notify EPA (or their State agency if the State is authorized to operate its own universal waste program) of their universal waste activities and obtain an EPA Identification Number, unless they have previously notified EPA of their hazardous waste activities. In addition, Large Quantity Handlers of Universal Waste who have already sent a notification to EPA as required by 40 CFR Part 165 are not required to notify EPA of their universal waste activities for recalled universal waste pesticides. Large Quantity Handlers of Universal Waste must notify EPA of their universal waste activities and obtain an EPA Identification Number before meeting or exceeding the 5,000 kilogram storage limit.

Small Quantity Handlers of Universal Waste are exempt from these notification requirements.

***Note:** Please refer to the regulations in 40 CFR Part 273 to ensure that you are aware of all the requirements that apply to your universal waste handling activities.*

III. How to Determine if You Must Notify EPA of Your Used Oil Management Activities

Under 40 CFR Part 279, Subparts E, F, G, and H, respectively, persons who transport used oil; process or re-refine used oil; burn off-specification used oil for energy recovery; or market used oil fuel, are required to notify EPA (or their State agency if the State is authorized to operate its own used oil program) and obtain an EPA Identification Number, unless they are exempt as outlined below. Off-specification used oil may be burned for energy recovery in an industrial furnace, boiler, or hazardous waste incinerator subject to regulation under Subpart O of 40 CFR Part 264 or 265.

Used oil transporters; used oil processors/re-refiners; off-specification used oil burners; and used oil fuel marketers who have not previously notified EPA of their hazardous waste activities or notified under 40 CFR Part 266, Subpart E (replaced by 40 CFR Part 279) must notify EPA to identify their used oil management activities.

Note: Please refer to the regulations in 40 CFR Part 279 to ensure that you are aware of all the requirements that apply to your used oil management activities.

Who is exempt from used oil notification requirements?

1. **Persons who burn on-specification used oil fuel:** Used oil that is to be burned for energy recovery and that meets the specification provided under 40 CFR 279.11 is exempt from the regulations. **However, the person who first claims that the used oil meets the specification is subject to notification as a used oil fuel marketer and certain other requirements (see 40 CFR Part 279, Subpart H).** The burner of fuel that meets the specification at 40 CFR 279.11 is not required to notify.
2. **Used oil generators** are not required to notify EPA.
3. **Used oil generators operating used oil-fired space heaters:** Persons who burn only used oil that they generate (or used oil received from household do-it-yourself used oil changers) in used oil-fired space heaters are exempt from the notification requirement provided that the device is vented to the outdoors and the device is not designed to have a capacity greater than 0.5 million BTU/hour.

IV. How to File EPA Form 8700-12, "Notification of Regulated Waste Activity"

Initial Notifications

If you do not currently have an EPA Identification Number and you handle a regulated waste, you must submit an initial notification for your regulated waste activities. Please refer to Sections I through III of this booklet for more information on whether you must notify EPA of these regulated waste activities. You can satisfy this initial notification requirement by completing and signing the enclosed EPA Form 8700-12 and mailing it to the appropriate address listed in Part C of this section.

Per the Hazardous Waste Import Regulations, 40 CFR 262.60, *foreign generators should not apply for an EPA Identification Number.* These regulations state that when filling out a U.S. manifest, you must include the name and address of the foreign generator, and the name, address, and EPA Identification Number of the importer. Please contact the U.S. firms involved with your shipments and determine which firm will serve as the importer.

Subsequent Notifications

Even if you have submitted an initial notification and have received an EPA Identification Number, you may be required to submit a subsequent notification. Please refer to information contained in Sections I through III and Section V of this booklet for instructions on when and how to complete a subsequent notification. In general, you can comply with this subsequent notification requirement by completing specific parts of and signing the enclosed EPA Form 8700-12 and mailing it to the appropriate address in Part C of this section.

A. How Many Forms Should I File?

A person who is subject to the hazardous waste, universal waste and/or used oil management regulations under RCRA should submit one notification per installation. If you conduct hazardous waste, universal waste, and/or used oil management activities at more than one installation, you must submit a separate notification for each installation.

If you only transport regulated wastes and do not generate, treat, store, or dispose of hazardous wastes; qualify as a large quantity handler of universal wastes; or process/re-refine used oil, burn off-specification used oil fuel, or market used oil fuel, you may submit one notification that covers all transportation activities your company conducts. This notification should be sent to the appropriate address (listed in Part C) that serves the State where your company has its headquarters or principal place of business. However, if you are a transporter who also engages in one or more of the regulated waste activities listed above, you must complete and submit a separate notification to cover each installation.

B. Can I Request that this Information Be Kept Confidential?

All information you submit in an initial or subsequent notification can be released to the public, according to the Freedom of Information Act, unless it is determined to be confidential by EPA pursuant to 40 CFR Part 2. Since notification information is very general, EPA believes it is unlikely that any information in your notification could qualify to be protected from release. However, you may make a claim of confidentiality by printing the word "CONFIDENTIAL" on both sides of EPA Form 8700-12 and on any attachments. EPA will take action on the confidentiality claims in accordance with 40 CFR Part 2.

C. Where Should I Send My Completed Form?

Listed alphabetically in Table 1 are the addresses and phone numbers of the proper contacts in each State where you can get additional information and more forms, and where you should mail your completed forms. As shown in Table 1, EPA and many States have arranged for the States to answer your questions and receive completed forms. In a few instances, the workload is shared between EPA and the State, or handled by EPA alone; this workload sharing is indicated on Table 1. For your convenience, Table 2 lists the addresses and phone numbers for EPA Regional contacts; however, you should refer to Table 1 first. *To avoid delay and confusion, follow the directions in Table 1 for your State very carefully.*

Table 1 (continued)

Connecticut
Obtain information or forms from, and mail completed forms to:
Department of Environmental Protection
Bureau of Waste Management
Waste Engineering and Enforcement Division
79 Elm Street
Hartford, Connecticut 06106-5127
(860) 424-3372

Delaware
Obtain information or forms from, and mail completed forms to:
Delaware Department of Natural Resources and Environmental Control
Solid and Hazardous Waste Management Branch
Attn: Tracy Hamburg
89 Kings Highway
Dover, Delaware 19901
(302) 739-3689

District of Columbia
Obtain information or forms from, and mail completed forms to:
Department of Health
Environmental Health Administration
Attn: Mark Hughes
51 N Street, N.E., Third Floor
Washington, D.C. 20002
(202) 535-2285

Florida
Obtain information or forms from, and mail completed forms to:
Hazardous Waste Regulation Section
Department of Environmental Regulation
Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400
(904) 488-0300

Georgia
Obtain information or forms from, and mail completed forms to:
Hazardous Waste Branch
Environmental Protection Division
Georgia Department of Natural Resources
Floyd Towers East, Room 1154
205 Butler Street, S.E.
Atlanta, Georgia 30334
(404) 656-7802

Guam
Obtain information from and mail completed forms to:
Guam Environmental Protection Agency
P.O. Box 22439-GMF
(Calibration Lab Building)
Barrigada, Guam 96921
Obtain forms from:
U.S. EPA Region 9
RCRA Notifications
75 Hawthorne Street, WST-6-Tetratech
San Francisco, California 94105
(415) 495-8895

Hawaii
Obtain information or forms from, and mail completed forms to:
U.S. EPA Region 9
RCRA Notifications
75 Hawthorne Street, WST-6-Tetratech
San Francisco, California 94105
(415) 495-8895

Idaho
Obtain information or forms from, and mail completed forms to:
Idaho Department of Health and Welfare
Division of Environmental Quality
State Waste Management and Remediation Program
Hazardous Waste Notifications
1410 N. Hilton Street
Boise, Idaho 83706
(208) 373-0210

Table 2
U.S. EPA Regional Contacts for the RCRA Notification Form

U.S. EPA Region 1
Office of Ecosystem Protection
Hazardous Waste Program Unit
One Congress Street, Suite 1100
Boston, MA 02114-2023
(617) 918-1640
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont

U.S. EPA Region 2
Division of Environmental Planning and Protection
RCRA Programs Branch
290 Broadway Street, 22nd Floor
New York, NY 10007-1866
(212) 637-4106
New Jersey, New York, Puerto Rico, Virgin Islands

U.S. EPA Region 3
Waste and Chemicals Management Division,
3WC11, 1650 Arch Street
Philadelphia, PA 19103-2029
(215) 814-3413
Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia

U.S. EPA Region 4
Hazardous Waste Management Division
RCRA Permitting Section
61 Forsyth Street
Atlanta, GA 30303
(404) 562-8440
Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee

U.S. EPA Region 5
RCRA Activities
77 West Jackson Boulevard
P.O. Box A3587
Chicago, IL 60690
(312) 886-4001
Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin

U.S. EPA Region 6
Multimedia Planning and Permitting Division (6PD-I)
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733
(214) 665-6750
Arkansas, Louisiana, New Mexico, Oklahoma, Texas

U.S. EPA Region 7
Air, RCRA, and Toxics Division
RCRA Enforcement and State Programs Branch (ARTD/RESP)
901 N. 5th Street
Kansas City, KS 66101
(913) 551-7126
Iowa, Kansas, Missouri, Nebraska

U.S. EPA Region 8
Office of Partnerships and Regulatory Assistance
999 18th Street, Suite 500
Denver, CO 80202-2466
(303) 312-6319
Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming

U.S. EPA Region 9
RCRA Notifications
75 Hawthorne Street, WST-6-Tetratech
San Francisco, CA 94105
(415) 495-8895
Arizona, California, Hawaii, Nevada, American Samoa, Guam, Northern Mariana Islands

U.S. EPA Region 10
Office of Waste and Chemicals Management, WCM-126
1200 Sixth Avenue
Seattle, WA 98101
(206) 553-2859
From within Alaska, toll-free:
(800) 550-7272
Alaska, Idaho, Oregon, Washington

V. Line-by-Line Instructions for Completing EPA Form 8700-12

Initial Notification

All persons submitting an initial notification must complete Items I through X in their entirety.

Subsequent Notification

All persons submitting a subsequent notification must complete Items I, II, IV, VI, VII, IX, and X in their entirety. Whether you must complete Items III, V, and VIII depends on the circumstances under which you are required to submit a subsequent notification.

General Instructions

Type or print in black ink all items except Item X, "Signature," leaving a blank box between words. The boxes are spaced at 1/4" intervals which accommodate elite type (12 characters per inch). When typing, hit the space bar twice between characters. If you print, place each character in a box. Abbreviate if necessary to stay within the number of boxes allowed for each item. If you must use additional sheets, indicate clearly the number of the Item on EPA Form 8700-12 to which the information on the separate sheet applies.

Item I -- Installation's EPA ID Number:

Place an "X" in the appropriate box to indicate whether this is your initial or a subsequent notification *for this installation in this location.* Leave the EPA Identification Number blank if this is your initial notification *for this installation.* If this is a subsequent notification, enter the EPA Identification Number assigned to this installation in the boxes provided.

Items II and III -- Name and Location of Installation:

Complete Items II and III. Please note that the address you give for Item III, Location of Installation, must be a physical address, *not a post office box or route number.*

County Code and Name: Give the county code, if known. If you do not know the county code, enter the county name, from which EPA can automatically generate the county code. If the county name is unknown, contact the local Post Office. To obtain a list of county codes, contact the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia, 22161 or at (703) 487-4650. The list of codes is contained in the Federal Information Processing Standards Publication (FIPS PUB) number 6-3.

***Note:** A subsequent notification is required when the location of the installation changes.*

Item IV – Installation Mailing Address:

Please enter the Installation Mailing Address. If the Mailing Address and the Location of Installation (Item IV) are the same, you can print "Same" in the box for Item IV.

Item V – Installation Contact:

Enter the name, title, and business telephone number of the person who should be contacted regarding information submitted in this notification.

***Note:** A subsequent notification is required when the installation contact changes.*

Item VI – Installation Contact Address:

A. **Code:** If the contact address is the same as the location of installation address listed in Item IV or the installation mailing address listed in Item IV, place an "X" in the appropriate box to indicate where the contact may be reached. If the location of installation address, the installation mailing address, and the installation contact address are all the same, mark the "Location" box. If the contact address is *not* the same as those addresses in either Item III or IV, place an "X" in the "Other" box and complete Item VI.B. If an "X" is entered in either the location or mailing box, Item VI.B. should be left blank.

B. **Address:** Enter the contact address *only* if the contact address is different from either the location of installation address (Item IV) or

the installation mailing address (Item IV), and if Item VI.A. was marked "Other."

Item VII - Ownership:

A. **Name:** Enter the name of the legal owner(s) of the installation, including the property owner. Also enter the address and phone number where this individual can be reached. Use the comment section in XI or additional sheets if necessary to list more than one owner.

B. **Land Type:** Using the codes listed below, indicate in VII.B. the code which *best describes* the current legal status of the land on which the installation is located:

F = Federal
S = State
I = Indian
P = Private
C = County
M = Municipal*
D = District
O = Other

** If the Land Type is best described as Indian, County or District, please use those codes. Otherwise, use Municipal.*

C. **Owner Type:** Using the codes listed below, indicate in VII.C. the code which *best describes* the legal status of the current owner of the installation:

F = Federal
S = State
I = Indian
P = Private
C = County
M = Municipal*
D = District
O = Other

** If the Owner Type is best described as Indian, County or District, please use those codes. Otherwise, use Municipal.*

D. Change of Owner Indicator: *(If this is your installations initial notification, leave Item VII.D. blank and skip to Item VIII. If this is a subsequent notification, complete Item VII.D. as directed below.)*

A subsequent notification is required when the owner of an installation changes. The new owner must notify EPA of the change, even if the previous owner already received an EPA Identification Number. Because an EPA Identification Number is site-specific, the new owner will keep the existing EPA Identification Number for that location. If the installation moves to another location, the owner/operator must notify EPA of this change. In this instance, a new EPA Identification Number will be assigned, since the installation has changed locations.

If the owner of this installation has changed since the installation's initial notification, place an "X" in the box marked "Yes" and enter the date the owner changed.

If the owner of this installation has not changed since the installation's initial notification, place an "X" in the box marked "No" and skip to Item VIII.

If an additional owner(s) has been added or replaced since the installation's initial notification, place an "X" in the box marked "Yes." Use the comment section in XI to list any additional owners, the dates they became owners, and which owner(s) (if any) they replaced. If necessary, attach a separate sheet of paper.

Item VIII -- Type of Regulated Waste Activity:

A. Hazardous Waste Activities: Mark an "X" in the appropriate box(es) to show which hazardous waste activities are being conducted **at this installation.**

1. **Generator:** If you generate a hazardous waste that is listed in 40 CFR 261.31 through 261.33 or identified by one or more hazardous waste characteristic(s) contained in 40 CFR 261.21 through 261.24, mark an "X" in the appropriate box for the quantity of non-acutely hazardous waste that is generated per calendar month. The regulations for hazardous waste generators are found in 40 CFR Part 262.

Note: *If you generate acutely hazardous wastes listed in 40 CFR 261.31, 261.32 or 261.33(e), please refer to 40 CFR 261.5(e) to determine under what circumstances you must notify EPA.*

2. **Hazardous Waste Transporter:** If you transport hazardous waste, indicate if it is your own hazardous waste, if you transport it for commercial purposes, or mark both boxes if both classifications apply. Mark an "X" in each appropriate box to indicate the method(s) of transportation you use. Hazardous waste transporters do not have to complete Item IX of the notification, but must sign the certification in Item X. The Federal regulations for hazardous waste transporters are found in 40 CFR Part 263.

3. **Treater/Storer/Disposer:** If you treat, store or dispose of regulated hazardous waste, place an "X" in this box. (Burning hazardous wastes in boilers and industrial furnaces and storing hazardous wastes before recycling them fall into this category as well.) You are reminded to contact the appropriate addressee listed for your State in Section IV.C. of this booklet to request Part A of the RCRA Permit Application. The Federal regulations for owners or operators of hazardous waste installations are found in 40 CFR Parts 264, 265, and 266.

4. **Exempt Boiler and/or Industrial Furnace:** If you burn hazardous wastes in a smelting, melting, or refining furnace solely for metals recovery, as described in 40 CFR 266.100(c), or to recover economically significant amounts of precious metals, as described in 40 CFR 266.100(f), mark an "X" in the box to indicate that you qualify for the smelting, melting and refining furnace exemption.

   If you burn small quantities of hazardous waste in an on-site boiler or industrial furnace in accordance with the conditions in 40 CFR 266.108, place an "X" in the box to indicate that you qualify for the Small Quantity On-Site Burner Exemption.

5. **Underground Injection Control:** If you generate, treat, store, or dispose of hazardous waste and there is an underground injection well located at your installation, place an "X" in the appropriate box. The Federal regulations for owners or operators of underground injection wells are found in 40 CFR Part 148.

B. **Universal Waste Handling Activities:** Mark an "X" in the appropriate box to indicate that universal waste handling activities are taking place **at this installation and will result in the universal waste handler becoming a Large Quantity Handler of Universal Waste.** The Federal regulations for large quantity handlers of universal waste are found in 40 CFR Part 273, Subpart C.

C. **Used Oil Management Activities:** Mark an "X" in the appropriate box(es) to indicate which used oil management activities are taking place **at this installation.** The Federal regulations for used oil management are found in 40 CFR Part 279.

1. **Used Oil Transporter/Transfer Facility:** If you transport used oil and/or own or operate a used oil transfer facility, place an "X" in the appropriate box(es) to indicate this used oil management activity.

2. **Used Oil Processor/Re-Refiner:** If you process and/or re-refine used oil, place an "X" in the appropriate box(es) to indicate this used oil management activity.

3. **Off-Specification Used Oil Burner:** If you burn off-specification used oil fuel, place an "X" in the box to indicate this used oil management activity.

4. **Used Oil Fuel Marketer:** If you market off-specification used oil directly to a burner, mark an "X" in box 1a. If you are the first to claim the used oil meets the used oil specification established in 40 CFR 279.11, mark an "X" in box 1b. If either of these boxes is marked, you must also notify (or have previously notified) as a used oil transporter, used oil processor/re-refiner, or off-specification used oil fuel burner, unless you are a used oil generator. (Used oil generators are not required to notify.)

Note: A subsequent notification is required when the type of regulated waste activity changes.

Item IX -- Description of Hazardous Wastes:

Note: Only persons involved in hazardous waste activities (Item VIII.A.) need to complete this item. Hazardous waste transporters requesting an EPA Identification Number do not need to complete this item, but must sign the "Certification" in Item X.

You will need to refer to 40 CFR Part 261 in order to complete this Item. Part 261 identifies those solid wastes that EPA defines as hazardous and regulates under RCRA. If you need help completing this section, please contact the appropriate addressee for your State as listed in Section IV.C. of this booklet.

A. **Listed Hazardous Wastes:** If you handle hazardous wastes that are listed in 40 CFR Part 261, Subpart D, enter the appropriate 4-digit code(s) in the boxes provided.

Note: If you handle more than 12 listed hazardous wastes, please continue listing the hazardous waste codes on the extra sheet provided at the end of this booklet. If you have more waste codes than will fit on the notification and the additional sheet, feel free to photocopy the additional sheet and use that as well. Attach any additional sheets to the rest of EPA Form 8700-12 before mailing it to the appropriate EPA Regional or State office.

B. Characteristic Hazardous Wastes: If you handle hazardous wastes that are not listed in 40 CFR Part 261, Subpart D, but do exhibit a characteristic of hazardous waste as defined in 40 CFR Part 261, Subpart C, you should describe these wastes by the EPA hazardous waste number for the characteristic. Place an "X" in the box next to the characteristic of the wastes that you handle. If you mark "4. Toxicity Characteristic," please list the specific EPA hazardous waste number(s) for the specific contaminant(s) in the box(es) provided. Refer to Section VII to determine the appropriate hazardous waste number(s).

Note: If you handle more than four Toxicity Characteristic (TC) hazardous wastes, please continue listing the hazardous waste codes on the extra sheet provided at the end of this booklet. If you have more TC waste codes than will fit on the notification and the additional sheet, feel free to photocopy the additional sheet and use that as well. Attach any additional sheets to the rest of EPA Form 8700-12 before mailing it to the appropriate EPA Regional or State office.

C. Other Wastes: If you handle other wastes or State-regulated wastes that have a waste code, enter the appropriate code(s) in the boxes provided.

Item X – Certification:

This certification must be signed by the owner, operator, or an authorized representative of your installation. An "authorized representative" is a person responsible for the overall operation of the installation (i.e., a plant manager or superintendent, or a person of equal responsibility). *All notifications must include this certification to be complete.*

Item XI – Comments:

Use this space for any additional comments and attach additional sheets, if necessary.

VI. Definitions

The following definitions are included to help you to understand and complete EPA Form 8700-12:

Act or RCRA means the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984, 42 U.S.C. Section 6901 *et seq.*

Authorized Representative means the person responsible for the overall operation of the installation or an operational unit (i.e., part of an installation), e.g., superintendent or plant manager, or person of equivalent responsibility.

Boiler means an enclosed device using controlled flame combustion and having the following characteristics:

1. The unit has physical provisions for recovering and exporting energy in the form of steam, heated fluids, or heated gases;
2. The unit's combustion chamber and primary energy recovery section(s) are of integral design (i.e., they are physically formed into one manufactured or assembled unit);
3. The unit continuously maintains an energy recovery efficiency of at least 60 percent, calculated in terms of the recovered energy compared with the thermal value of the fuel;
4. The unit exports and utilizes at least 75 percent of the recovered energy, calculated on an annual basis (excluding recovered heat used internally in the same unit, for example, to preheat fuel or combustion air or drive fans or feedwater pumps); or
5. The unit is one which the Regional Administrator has determined, on a case-by-case basis, to be a boiler, after considering the standards in 40 CFR 260.32.

Disposal means the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

EPA Identification (ID) Number means the number assigned by EPA to each hazardous waste generator, hazardous waste transporter, and treatment, storage, or disposal installation; large quantity handler of universal wastes; used oil transporter, used oil processor/re-refiner, off-specification used oil fuel burner, and used oil fuel marketer.

Hazardous Waste means a hazardous waste as defined in 40 CFR 261.3.

Hazardous Waste Generator means any person, by site, whose act or process produces hazardous waste identified or listed in 40 CFR Part 261.

Hazardous Waste Storage means the holding of hazardous waste for a temporary period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere.

Hazardous Waste Transporter means a person engaged in the off-site transportation of hazardous waste by air, rail, highway, or water.

Hazardous Waste Treatment means any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such hazardous waste, or so as to recover energy or material resources from the hazardous waste, or so as to render such hazardous waste nonhazardous, or less hazardous; safer to transport, store or dispose of; or amenable for recovery, amenable for storage, or reduced in volume. Such term includes any activity or processing designed to change the physical form or composition of hazardous waste so as to render it nonhazardous.

Industrial Furnace means any of the following enclosed devices that are integral components of manufacturing processes and that use thermal treatment to accomplish recovery of materials or energy: cement kilns; lime kilns; aggregate kilns; phosphate kilns; coke ovens; blast furnaces; smelting, melting and refining furnaces; titanium dioxide chloride process oxidation reactors; methane reforming furnaces; pulping liquor recovery furnaces; combustion devices used in the recovery of sulfur values from spent sulfuric acid; halogen acid furnaces, as defined under industrial furnace in 40 CFR 260.10; and such other devices as the Administrator may add to this list.

Installation means the physical plant or location at which one or more of the following regulated waste activities occurs: the generation, transportation, treatment, storage, or disposal of hazardous wastes; the storage of hazardous wastes before they are recycled; the accumulation of 5,000 kg or more of universal wastes; and the transportation (and temporary storage during transportation), processing/re-refining, burning, or marketing of used oil. An installation may consist of several treatment, storage, or disposal operational units. (For entities that only transport regulated wastes, the term installation refers to the headquarters of that entity's operations.)

Large Quantity Handler of Universal Waste means a universal waste handler (as defined in 40 CFR 273.6) who accumulates 5,000 kilograms or more total of universal waste (batteries, pesticides, or thermostats, collectively) at any time. This designation is retained through the end of the calendar year in which 5,000 kilograms or more of universal wastes are accumulated.

Municipality means a city, village, town, borough, county, parish, district, association, Indian tribe or authorized Indian tribal organization, designated and approved management agency under Section 208 of the Clean Water Act, or any other public body created by or under State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes.

Off-Specification Used Oil Burner means an installation where used oil not meeting the specification requirements in 40 CFR 279.11 (off-specification used oil) is burned for energy recovery in devices identified in Section 279.61(a).

Off-Specification Used Oil Fuel means used oil fuel that does not meet the specification provided under 40 CFR 279.11.

On-Specification Used Oil Fuel means used oil fuel that meets the specification provided under 40 CFR 279.11.

Operator means the person responsible for the overall operation of an installation.

Owner means a person who owns an installation or part of an installation, including the property owner.

Small Quantity On-Site Burner Exemption means that persons who burn small quantities of hazardous waste in an on-site boiler or industrial furnace, in accordance with 40 CFR 266.108, are conditionally exempt from regulation for that activity.

Smelting, Melting, and Refining Furnace Exemption means that, under 40 CFR 266.100(c), owners or operators of smelting, melting, and refining furnaces that process hazardous wastes solely for metals recovery are conditionally exempt from regulation, except for 40 CFR 266.101 and 266.112, provided they comply with limited requirements set forth in Section 266.100(c). Similarly, 40 CFR 266.100(f) provides that owners or operators of smelting, melting and refining furnaces that process hazardous wastes for the recovery of precious metals are conditionally exempt from regulation, except for 40 CFR 266.112, provided they comply with limited requirements specified in Section 266.100(f).

Underground Injection Control means the subsurface emplacement of fluids through a bored, drilled or driven well; or through a dug well, where the depth of the dug well is greater than the largest surface dimension. Underground injection wells are regulated under both the Safe Drinking Water Act and the Resource Conservation and Recovery Act (see 40 CFR Part 148).

Used Oil means any oil that has been refined from crude oil, or any synthetic oil, that has been used, and as a result of such use, is contaminated by physical or chemical impurities.

Used Oil Fuel Marketer means any person who conducts either of the following activities:

1. Directs a shipment of off-specification used oil from their installation to an off-specification used oil burner; or
2. First claims that used oil that is to be burned for energy recovery meets the used oil fuel specifications set forth in 40 CFR 279.11.

Used Oil Management Activities, for the purposes of EPA Form 8700-12, include used oil transportation; used oil processing and re-refining; burning off-specification used oil fuel; and used oil fuel marketing.

Used Oil Processing means chemical or physical operations designed to produce from used oil, or to make used oil more amenable for production of, fuel oils, lubricants, or other used oil-derived products. Processing includes, but is not limited to: blending used oil with virgin petroleum products, blending used oils to meet the fuel specification, filtration, simple distillation, chemical or physical separation, and re-refining.

Used Oil Processor means an installation that processes on- or off-specification used oil.

Used Oil Re-Refiner means an installation that produces lubricating oils and greases, industrial fuel, asphalt extender, gasoline, and other products from on- or off-specification used oil.

Used Oil Transfer Facility means any transportation-related facility, including loading docks, parking areas, storage areas, and other areas where shipments of used oil are held for more than 24 hours during the normal course of transportation and not longer than 35 days. Transfer facilities that store used oil for more than 35 days are subject to regulation under 40 CFR Part 279, Subpart F.

Used Oil Transporter means any person who transports used oil, any person who collects used oil from more than one generator and transports the collected oil, and owners and operators of used oil transfer facilities. Used oil transporters may consolidate or aggregate loads of used oil for purposes of transportation but, with the following exception, may not process used oil. Used oil transporters may conduct incidental processing operations that occur in the normal course of used oil transportation (e.g., settling and water separation), but that are not designed to produce (or make more amenable for production of) used oil-derived products or used oil fuel.

VII. EPA Hazardous Waste Numbers for Waste Streams Commonly Generated by Small Quantity Generators

EPA recognizes that generators of small quantities of hazardous waste, many of which are small businesses, may not be familiar with the manner in which hazardous waste materials are identified in the Code of Federal Regulations. In order to aid small quantity generators in determining the EPA Hazardous Waste Numbers for their hazardous wastes that are needed to complete EPA Form 8700-12, two appendices are enclosed.

Appendix 1 lists 18 general industry categories that contain small quantity generators. For each of these categories, commonly generated hazardous wastes are identified. Appendix 2 lists EPA Hazardous Waste Numbers for each hazardous waste stream identified in Appendix 1.

To use these appendices:

1. Locate your industry in Appendix 1 to identify the hazardous waste streams common to your activities.

2. Find each of your hazardous waste streams in Appendix 2, and review the more detailed descriptions of typical hazardous wastes to determine which hazardous waste streams actually result from your activities.

3. If you determine that a hazardous waste stream does apply to you, report the 4-digit EPA Hazardous Waste Number in Item IX.B. of EPA Form 8700-12, "Notification of Regulated Waste Activity."

The industries and hazardous waste streams described here do not provide a comprehensive list but rather serve as a guide to potential small quantity generators in determining which of their solid wastes, if any, are hazardous. Except for the pesticide category, this insert does not include EPA Hazardous Waste Numbers for commercial chemical products that are hazardous when discarded unused. These chemicals and their EPA Hazardous Waste Numbers are listed in 40 CFR 261.33.

If the specific Hazardous Waste Number that should be applied to your hazardous waste stream is unclear, please refer to 40 CFR Part 261. *Copies of Part 261 and other EPA regulations in 40 CFR are available at most libraries and on EPA's Web Site at: www.epa.gov/docs/epacfr40/chapt-I.info/subch-I/*

In those cases where more than one Hazardous Waste Number is applicable, all should be used. If you have any questions, or if you are unable to determine the proper EPA Hazardous Waste Numbers for your hazardous wastes, contact your State hazardous waste management agency as listed in Section IV of this booklet, or the RCRA, Superfund, and EPCRA Hotline at 1-800-424-9346 (or in the Washington, D.C. area at (703) 412-9810).

Appendix 1
Typical Hazardous Waste Streams Produced by Small Quantity Generators

LABORATORIES
Acids/Bases, Heavy Metals/Inorganics, Ignitable Wastes, Reactives, Solvents

PRINTING AND ALLIED INDUSTRIES
Acids/Bases, Heavy Metals/Inorganics, Ink Sludges, Spent Plating Wastes, Solvents

PESTICIDE END USERS AND APPLICATION
Heavy Metals/Inorganics, Services, Pesticides, Solvents

CONSTRUCTION
Acids/Bases, Ignitable Wastes, Solvents

EQUIPMENT REPAIR
Acids/Bases, Ignitable Wastes, Lead Acid Batteries, Solvents

FURNITURE/WOOD MANUFACTURING & REFINISHING
Ignitable Wastes, Solvents

OTHER MANUFACTURING (textiles, plastics, leather)
Heavy Metals/Inorganics, Solvents

LAUNDRIES AND DRY CLEANERS
Dry Cleaning Filtration Residues, Solvents

EDUCATIONAL AND VOCATIONAL SHOPS
Acids/Bases, Ignitable Wastes, Pesticides, Reactives, Solvents

BUILDING CLEANING AND MAINTENANCE
Acids/Bases, Solvents

VEHICLE MAINTENANCE
Acids/Bases, Heavy Metals/Inorganics, Ignitable Wastes, Lead Acid Batteries, Solvents

WOOD PRESERVING
Preserving Agents

MOTOR FREIGHT TERMINALS AND RAILROAD
Acids/Bases, Transportation, Heavy Metals/Inorganics, Ignitable Wastes, Lead Acid Batteries, Solvents

FUNERAL SERVICES
Solvents (formaldehyde)

METAL MANUFACTURING
Acids/Bases, Cyanide Wastes, Heavy Metals/Inorganics, Ignitable Wastes, Reactives, Solvents, Spent Plating Wastes

CHEMICAL MANUFACTURERS
Acids/Bases, Cyanide Wastes, Heavy Metals/Inorganics, Ignitable Wastes, Reactives, Solvents

CLEANING AGENTS AND COSMETICS
Acids/Bases, Heavy Metals/Inorganics, Ignitable Wastes, Pesticides, Solvents

FORMULATORS
Acids/Bases, Cyanide Wastes, Heavy Metals/Inorganics, Ignitable Wastes, Pesticides, Reactives, Solvents

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Appendix 2
Typical Hazardous Waste Streams and EPA Hazardous Waste Numbers

ACIDS/BASES:

Acids, bases or mixtures having a pH less than or equal to 2 or greater than or equal to 12.5, or liquids that corrode steel at a rate greater than 0.25 inches per year, are considered to be corrosive (for a complete description of corrosive wastes, see 40 CFR 261.22, Characteristic of Corrosivity). All corrosive materials and solutions have the EPA Hazardous Waste Number D002. The following are some examples of the more commonly used corrosives:

Examples of Corrosive Waste Streams	
Acetic Acid	Oleum
Ammonium Hydroxide	Perchloric Acid
Chromic Acid	Phosphoric Acid
Hydrobromic Acid	Potassium Hydroxide
Hydrochloric Acid	Sodium Hydroxide
Hydrofluoric Acid	Sulfuric Acid
Nitric Acid	

DRY CLEANING FILTRATION RESIDUES:

Cooked powder residue (perchloroethylene plants only), still residues and spent cartridge filters containing perchloroethylene or valclene are hazardous and have an EPA Hazardous Waste Number of F002. Still residues containing petroleum solvents with a flash point less than 140F are also considered hazardous, and have an EPA Hazardous Waste Number of D001.

HEAVY METALS/INORGANICS:

Heavy Metals and other inorganic waste materials exhibit the characteristic of TCLP Toxicity and are considered hazardous if the extract from a representative sample of the waste has any of the specific constituent concentrations as shown in 40 CFR 261.24, Table 1. This may include dusts, solutions, wastewater treatment sludges, paint wastes, waste inks, and other such materials which contain heavy metals/inorganics (note that wastewater treatment sludges from electroplating operations containing nickel and cyanide are identified as F006). The following are TCLP Toxic:

Waste Stream	EPA Hazardous Waste Number
Arsenic	D004
Barium	D005
Cadmium	D006
Chromium	D007
Lead	D008
Mercury	D009
Selenium	D010
Silver	D011

Appendix 2 (continued)

IGNITABLE WASTES:

Ignitable wastes include any flammable liquids, non-liquids, and contained gases that have a flashpoint less than 140F (for a complete description of ignitable wastes, see 40 CFR 261.21, Characteristic of Ignitability). Examples are spent solvents (see also solvents), solvent still bottoms, ignitable paint wastes (paint removers, brush cleaners and stripping agents), epoxy resins and adhesives (epoxies, rubber cements and marine glues), and waste inks containing flammable solvents. Unless otherwise specified, all ignitable wastes have an EPA Hazardous Waste Number of D001.

Some commonly used ignitable compounds are:

Waste Stream	EPA Hazardous Waste Number
Acetone	F003
Benzene	D001
n-Butyl Alcohol	F003
Chlorobenzene	F002
Cychlohexanone	F003
Ethyl Acetate	F003
Ethylbenzene	F003
Ethyl Ether	F003
Ethylene Dichloride	D001
Methanol	F003
Methyl Isobutyl Ketone	F003
Petroleum Distillates	D001
Xylene	F003

INK SLUDGES CONTAINING CHROMIUM AND LEAD:

This includes solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead. All ink sludges have an EPA Hazardous Waste Number of K086.

LEAD ACID BATTERIES:

Used lead acid batteries should be reported on the notification form only if they are not recycled. Used lead acid batteries that are recycled do not need to be counted in determining the quantity of waste that you generate per month, nor do they require a hazardous waste manifest when shipped off your premises. (Note: Special requirements do apply if you recycle your batteries on your own premises -- see 40 CFR 266.80.)

Waste Stream	EPA Hazardous Waste Number
Lead Dross	D008
Spent Acids	D002
Lead Acid Batteries	D008, D002

Appendix 2 (continued)

ORGANIC WASTES:

See 40 CFR 261.24, Table 1 - Maximum Concentration of Contaminants for the Toxicity Characteristic, for a list of constituents and regulatory levels.

PESTICIDES:

Pesticides, pesticide residues, washing and rinsing solutions and dips which contain constituent concentrations at or above Toxicity Characteristic regulatory levels (see 40 CFR 261.24) are hazardous waste. Pesticides that have an oral LD50 toxicity (rat) < 50 mg/kg, inhalation LC50 toxicity (rat) < 2 mg/L or a dermal LD 50 toxicity (rabbit) < 200 mg/kg, are hazardous materials. The following pesticides would be hazardous waste if they are technical grade, unused and disposed. For a more complete listing, see 40 CFR 261.32-33 for specific listed pesticides, discarded commercial chemical products, and other wastes, wastewaters, sludges, and by-products from pesticide production.

(Note that while many of these pesticides are no longer in common use, they are included here for those cases where they may be found in storage.)

Appendix 2 (continued)

Waste Stream	EPA Hazardous Waste Number
Aldicarb	P070
Aldrin	P004
Amitrole	U011
Arsenic Pentoxide	P011
Arsenic Trioxide	P012
Cacodylic Acid	U136
Carbamic Acid, Methylnitroso-Ethyl Ester	U178
Chlordane	U036
Copper Cyanides	P029
1,2-Dibromo-3-Chloropropane	U066
1,2-Dichloropropane	U083
1,3-Dichloropropene	U084
2,4-Dichlorophenoxy Acetic Acid	U240
DDT	U061
Dieldrin	P037
Dimethoate	P044
Dimethylcarbamoyl Chloride	U097
Dinitrocresol	P047
Dinoseb	P020
Disodium Monomethane arsonate	D004
Disulfoton	P039
Endosulfan	P050
Endrin	P051
Ethylmercuric Chloride	D009
Famphur	P097
Nepthachlor	P059
Hexachlorobenzene	U127
Kepone	U142
Lindane	U129
2-Methoxy Mercuric Chloride	D009
Methoxychlor	D014
Methyl Parathion	P071
Monosodium Methanearsonate	D004
Nicotine	P075
Parathion	P089
Pentachloronitrobenzene	U185
Pentachlorophenol	U242
Phenylmercuir Acetate	D009
Phorate	P094
Strychnine	P108
2,4,5-Trichlorophenoxy Acetic Acid	U232
2-(2,4,5-Trichlorophenoxy)-Propionic Acid	U233
Thallium Sulfate	P115
Thiram	U244
Toxaphene	P123
Warfarin	U248

Appendix 2 (continued)

SOLVENTS:

Spent solvents, solvent still bottoms or mixtures containing solvents are often hazardous. This includes solvents used in degreasing and paint-brush cleaning, and distillation residues from reclamation. The following are some commonly used hazardous solvents (see also Ignitable Wastes for other hazardous solvents, and 40 CFR 261.31 for most listed hazardous waste solvents):

Waste Stream	EPA Hazardous Waste Number
Benzene	D001
Carbon Disulfide	F005
Carbon Tetrachloride	F001
Chlorobenzene	F002
Cresols	F004
Cresylic Acid	F004
O-Dichlorobenzene	F002
Ethanol	D001
Ethylene Dichloride	D001
Isobutanol	F005
Isopropanol	D001
Kerosene	D001
Methyl Ethyl Ketone	F005
Methylene Chloride	F001(Sludges) F002(Still Bottoms)
Naphtha	D001
Nitrobenzene	F004
Petroleum Solvents (Flash-point less than 140F)	D001
Pyridine	F005
1, 1, 1-Trichloroethane	F001(Sludges) F002(Still Bottoms)
Tetrachloroethylene	F001(Sludges) F002(Still Bottoms)
Toluene	F005
Trichloroethylene	F001(Sludges) F002(Still Bottoms)
Trichlorofluoromethane	F002
Trichlorotrifluoroethane	F002
White Spirits	D001

REACTIVES:

Reactive wastes include reactive materials or mixtures which are unstable, react violently with or form explosive mixtures with water, generate toxic gases or vapors when mixed with water (or when exposed to pH conditions between 2 and 12.5 in the case of cyanide- or sulfide-bearing wastes), or are capable of detonation or explosive reaction when irritated or heated (for a complete description of reactive wastes, see 40 CFR 261.23, Characteristic

Appendix 2 (continued)

of Reactivity). Unless otherwise specified, all reactive wastes have an EPA Hazardous Waste Number of D003. The following materials are commonly considered to be reactive:

Waste Stream	EPA Hazardous Waste Number
Acetyl Chloride	D003
Chromic Acid	D003
Cyanides	D003
Organic Peroxides	D003
Perchlorates	D003
Permanganates	D003
Hypochlorites	D003
Sulfides	D003

SPENT PLATING AND CYANIDE WASTES:

Spent plating wastes contain cleaning solutions and plating solutions with caustics, solvents, heavy metals and cyanides. Cyanide wastes may also be generated from heat treatment operations, pigment production and manufacturing of anti-caking agents. Plating wastes are generally Hazardous Waste Numbers F006-F009. Heat treatment wastes are generally Hazardous Waste Numbers F010-F012. See 40 CFR 261.31 for a more complete description of plating wastes.

WOOD PRESERVING AGENTS:

Compounds or mixtures used in wood preserving, including the wastewater treatment sludge from wastewater treatment operations, are considered hazardous wastes. Bottom sediment sludges from the treatment of wastewater from wood preserving processes that use creosote or pentachlorophenol are hazardous, and have an EPA Hazardous Waste Number of K001. In addition, wastewaters, process residuals, preservative drippage, and spent formulations from certain wood preserving processes are also hazardous wastes and carry EPA Hazardous Waste Numbers F032, F034 or F035, depending on the contaminants they contain. Unless otherwise indicated, specific wood preserving components are as follows:

Waste Stream	EPA Hazardous Waste Number(s)
Chromated Copper Arsenate	D004, F035
Creosote	K001, F034
Pentachlorophenol	K001, F032

HAWAII ADMINISTRATIVE RULES

TITLE 11

DEPARTMENT OF HEALTH

CHAPTER 262

HAZARDOUS WASTE MANAGEMENT

STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE

OFFICIAL

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Subchapter I Appendix

§11-262-100 Appendix

SUBCHAPTER A

GENERAL

§11-262-10 Purpose, scope, and applicability. (a) This chapter establishes standards for generators of hazardous waste. Chapters 11-260 through 11-280 govern hazardous waste management in the State. Reference to the other chapters may be necessary, specifically chapters 11-260 and 11-261 which are essential for defining terms and determining if hazardous waste is being generated.

(b) Sections 11-261-5(c) and (d) must be used to determine the applicability of provisions of this chapter that are dependent on calculations of the quantity of hazardous waste generated per month.

(c) A generator who treats, stores, or disposes of hazardous waste on-site must only comply with the following sections and subsections of this chapter with respect to that waste: section 11-262-11 for determining whether or not the generator has a hazardous waste, section 11-262-12 for obtaining an EPA identification number, section 11-262-34 for accumulation of hazardous waste, subsections 11-262-40(c) and (d) for recordkeeping, section 11-262-43 for additional reporting, and if applicable, section 11-262-70 for farmers.

(d) Any person who exports or imports hazardous waste subject to the federal manifesting requirements of 40 CFR Part 262, or subject to the universal waste management standards of 40 CFR Part 273, or subject to chapter 11-273, to or from the countries listed in section 11-262-58(a)(1) for recovery must comply with subchapter H.

(e) Any person who imports hazardous waste from outside of the United States into the State must comply with the standards applicable to generators established in this chapter.

(f) A farmer who generates waste pesticides which are hazardous waste and who complies with all of the requirements of section 11-262-70 is not required to comply with other standards in this chapter, or chapter 11-270, 11-264, 11-265, or 11-268 with respect to such pesticides.

(g) A person who generates a hazardous waste as defined by chapter 11-261 is subject to the compliance requirements and penalties prescribed in sections 342J-7 and 342J-9, HRS if the generator does not comply with the requirements of this chapter.

(h) An owner or operator who initiates a shipment of hazardous waste from a treatment, storage, or disposal facility must comply with the generator standards established in this chapter.

(i) Persons responding to an explosives or munitions emergency in accordance with section 11-264-1(g)(8)(i)(D) or (iv) or section 11-265-1(c)(11)(i)(D) or (iv), and section 11-270-

1(c)(3)(i)(D) or (iii) are not required to comply with the standards of this chapter.

(j) All references in tables and appendices to provisions of the Code of Federal Regulations shall be construed to mean the State rule analogue of the referenced federal regulation (for example, 40 CFR 260.1 shall be construed to mean section 11-260-1 of the Hawaii Administrative Rules).

Note 1: The provisions of section 11-262-34 are applicable to the on-site accumulation of hazardous waste by generators. Therefore, the provisions of section 11-262-34 only apply to owners or operators who are shipping hazardous waste which they generated at that facility.

Note 2: A generator who treats, stores, or disposes of hazardous waste on-site must comply with the applicable standards and permit requirements set forth in chapters 11-264, 11-265, 11-266, 11-268, and 11-270.

[Eff 6/18/94; am 3/13/99; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.10)

§11-262-11 Hazardous waste determination. A person who generates a solid waste, as defined in section 11-261-2, must determine if that waste is a hazardous waste using the following method:

(a) He should first determine if the waste is excluded from regulation under section 11-261-4.

(b) He must then determine if the waste is listed as a hazardous waste in subchapter D of chapter 11-261.

(c) For purposes of compliance with chapter 11-268, or if the waste is not listed in subchapter D of chapter 11-261, the generator must then determine whether the waste is identified in subchapter C of chapter 11-261 by either:

(1) Testing the waste according to the methods set forth in subchapter C of chapter 11-261; or

(2) Applying knowledge of the hazard characteristic of the waste in light of the materials or the processes used.

(d) If the waste is determined to be hazardous, the generator must refer to chapters 11-261, 11-264, 11-265, 11-266, 11-268, and 11-273 for possible exclusions or restrictions pertaining to management of the specific waste. [Eff 6/18/94; am 3/13/99; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.11)

§11-262-12 EPA identification numbers. (a) A generator must not treat, store, dispose of, transport, or offer for transportation, hazardous waste without having received an EPA identification number from the Administrator or the director.

(b) A generator who has not received an EPA identification number may obtain one by applying to the director using EPA form 8700-12. Upon receiving the request the Administrator or director will assign an EPA identification number to the generator.

(c) A generator must not offer his hazardous waste to transporters or to treatment, storage, or disposal facilities that have not received an EPA identification number. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.12)

SUBCHAPTER B

THE MANIFEST

§11-262-20 General requirements. (a) A generator who transports, or offers for transportation, hazardous waste for offsite treatment, storage, or disposal must prepare a Manifest OMB control number 2050-0039 on EPA form 8700-22, and, if necessary, EPA form 8700-22A, according to the instructions included in the Appendix to this chapter.

(b) A generator must designate on the manifest one facility which is permitted to handle the waste described on the manifest.

(c) A generator may also designate on the manifest one alternate facility which is permitted to handle his or her waste in the event an emergency prevents delivery of the waste to the primary designated facility.

(d) If the transporter is unable to deliver the hazardous waste to the designated facility or the alternate facility, the generator must either designate another facility or instruct the transporter to return the waste.

(e) The requirements of this subchapter do not apply to hazardous waste produced by generators of greater than one-hundred kg but less than one-thousand kg in a calendar month where:

(1) The waste is reclaimed under a contractual agreement pursuant to which:
  (i) The type of waste and frequency of shipments are specified in the agreement;
  (ii) The vehicle used to transport the waste to the recycling facility and to deliver regenerated material back to the generator is owned and operated by the reclaimer of the waste; and
(2) The generator maintains a copy of the reclamation agreement in his or her files for a period of at least three years after termination or expiration of the agreement.

(f) The requirements of this subchapter and section 11-262-32(b) do not apply to the transport of hazardous wastes on a public or private right-of-way within or along the border of

contiguous property under the control of the same person, even if such contiguous property is divided by a public or private right-of-way. Notwithstanding section 11-263-10(a), the generator or transporter must comply with the requirements for transporters set forth in sections 11-263-30 and 11-263-31 in the event of a discharge of hazardous waste on a public or private right-of-way. [Eff 6/18/94; am 3/13/99; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.20)

§11-262-21 Acquisition of manifests. (a) If the state to which the shipment is manifested (consignment state) supplies the manifest and requires its use, then the generator must use that manifest.

(b) If the consignment state does not supply the manifest, then the generator must use the State's manifest.

(c) [Reserved] [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.21)

§11-262-22 Number of copies. The manifest consists of at least the number of copies which will provide the generator, each transporter, and the owner or operator of the designated facility with one copy each for their records and another copy to be returned to the generator. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.22)

§11-262-23 Use of the manifest. (a) The generator must:
(1) Sign the manifest certification by hand; and
(2) Obtain the handwritten signature of the initial transporter and date of acceptance on the manifest; and
(3) Retain one copy, in accordance with subsection 11-262-40(a).

(b) The generator must give the transporter the remaining copies of the manifest.

(c) For shipments of hazardous waste within the United States solely by water (bulk shipments only), the generator must send three copies of the manifest dated and signed in accordance with this section to the owner or operator of the designated facility or the last water (bulk shipment) transporter to handle the waste in the United States if exported by water. Copies of the manifest are not required for each transporter.

(d) For rail shipments of hazardous waste within the State which originate at the site of generation, the generator must send at least three copies of the manifest dated and signed in accordance with this section to:

(1) The next non-rail transporter, if any; or

(2) The designated facility if transported solely by rail; or
(3) The last rail transporter to handle the waste in the United States if exported by rail.

(e) For shipments of hazardous waste to a designated facility in an authorized state which has not yet obtained authorization by EPA to regulate that particular waste as hazardous, the generator must assure that the designated facility agrees to sign and return the manifest to the generator, and that any out-of-state transporter signs and forwards the manifest to the designated facility. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.23)

SUBCHAPTER C

PRE-TRANSPORT REQUIREMENTS

§11-262-30 Packaging. Before transporting hazardous waste or offering hazardous waste for transportation off-site, a generator must package the waste in accordance with the applicable United States Department of Transportation (DOT) regulations on packaging under 49 CFR Parts 173, 178, and 179. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.30)

§11-262-31 Labeling. Before transporting or offering hazardous waste for transportation off-site, a generator must label each package in accordance with the applicable U.S. Department of Transportation regulations on hazardous materials under 49 CFR Part 172. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.31)

§11-262-32 Marking. (a) Before transporting or offering hazardous waste for transportation off-site, a generator must mark each package of hazardous waste in accordance with the applicable U.S. Department of Transportation regulations on hazardous materials under 49 CFR Part 172;

(b) Before transporting hazardous waste or offering hazardous waste for transportation off-site, a generator must mark each container of one-hundred and ten gallons or less used in such transportation with the following words and information displayed in accordance with the requirements of 49 CFR 172.304:

HAZARDOUS WASTE -- Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency.
Generator's Name and Address ---------- .

Manifest Document Number ---------- .
[Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.32)

§11-262-33 Placarding. Before transporting hazardous waste or offering hazardous waste for transportation off-site, a generator must placard or offer the initial transporter the appropriate placards according to U.S. Department of Transportation regulations for hazardous materials under 49 CFR Part 172, Subpart F. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.33)

§11-262-34 Accumulation time. (a) Except as provided in subsections (d), (e), and (f), a generator may accumulate hazardous waste on-site for ninety days or less without a permit or without having interim status, provided that:

(1) The waste is placed:
(i) In containers and the generator complies with subchapter I of chapter 11-265; and/or
(ii) In tanks and the generator complies with subchapter J of chapter 11-265, except subsection 11-265-197(c) and section 11-265-200; and/or
(iii) On drip pads and the generator complies with subchapter W of chapter 11-265 and maintains the following records at the facility:
(A) A description of procedures that will be followed to ensure that all wastes are removed from the drip pad and associated collection system at least once every ninety days; and
(B) Documentation of each waste removal, including the quantity of waste removed from the drip pad and the sump or collection system and the date and time of removal; and/or .
(iv) The waste is placed in containment buildings and the generator complies with subchapter DD of chapter 11-265, has placed its professional engineer certification that the building complies with the design standards specified in section 11-265-1101 in the facility's operating record. The professional engineer certification is required prior to operation of the unit. The owner or operator shall maintain the following records at the facility:
(A) A written description of procedures to ensure that each waste volume remains in the unit for no more than ninety days, a written

description of the waste generation and management practices for the facility showing that they are consistent with respecting the ninety day limit, and documentation that the procedures are complied with; or

(B) Documentation that the unit is emptied at least once every ninety days.

In addition, such a generator is exempt from all the requirements in subchapters G and H of chapter 11-265, except for section 11-265-111 and section 11-265-114.

(2) The date upon which each period of accumulation begins is clearly marked and visible for inspection on each container;

(3) While being accumulated on-site, each container and tank is labeled or marked clearly with the words, ``Hazardous Waste''; and

(4) The generator complies with the requirements for owners or operators in subchapters C and D in chapter 11-265, with section 11-265-16, and with paragraph 11-268-7(a)(4).

(b) A generator who accumulates hazardous waste for more than ninety days is an operator of a storage facility and is subject to the requirements of chapters 11-264 and 11-265 and the permit requirements of chapter 11-270 unless he has been granted an extension to the ninety-day period. Such extension may be granted by the department if hazardous wastes must remain on-site for longer than ninety days due to unforeseen, temporary, and uncontrollable circumstances. An extension of up to thirty days may be granted at the discretion of the director on a case-by-case basis.

(c)(1) A generator may accumulate as much as fifty-five gallons of hazardous waste or one quart of acutely hazardous waste listed in subsection 11-261-33(e) in containers at or near any point of generation where wastes initially accumulate, which is under the control of the operator of the process generating the waste, without a permit or interim status and without complying with subsection (a) of this section provided he:

(i) Complies with sections 11-265-171, 11-265-172, and subsection 11-265-173(a); and

(ii) Marks his containers either with the words ``Hazardous Waste'' or with other words that identify the contents of the containers.

(2) A generator who accumulates either hazardous waste or acutely hazardous waste listed in subsection 11-261-33(e) in excess of the amounts listed in paragraph (c)(1) of this section at or near any point of generation must, with respect to that amount of excess waste, comply within three days with subsection (a) of

this section or other applicable provisions of chapters 11-260 through 11-279. During the three day period the generator must continue to comply with subparagraphs (c)(1)(i) through (ii) of this section. The generator must mark the container holding the excess accumulation of hazardous waste with the date the excess amount began accumulating.

(d) A generator who generates greater than one-hundred kilograms but less than one-thousand kilograms of hazardous waste in a calendar month may accumulate hazardous waste on-site for 180 days or less without a permit or without having interim status provided that:

(1) The quantity of waste accumulated on-site never exceeds six-thousand kilograms;

(2) The generator complies with the requirements of subchapter I of chapter 11-265, except for sections 11-265-176 and 11-265-178;

(3) The generator complies with the requirements of section 11-265-201 in subchapter J of chapter 11-265;

(4) The generator complies with the requirements of paragraphs (a)(2) and (a)(3) of this section, the requirements of subchapter C of chapter 11-265, the requirements of 11-268-7(a)(4); and

(5) The generator complies with the following requirements:

(i) At all times there must be at least one employee either on the premises or on call (i.e., available to respond to an emergency by reaching the facility within a short period of time) with the responsibility for coordinating all emergency response measures specified in subparagraph (d)(5)(iv) of this section. This employee is the emergency coordinator.

(ii) The generator must post the following information next to the telephone:

(A) The name and telephone number of the emergency coordinator;

(B) Location of fire extinguishers and spill control material, and, if present, fire alarm; and

(C) The telephone number of the fire department, unless the facility has a direct alarm.

(iii) The generator must ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures, relevant to their responsibilities during normal facility operations and emergencies;

(iv) The emergency coordinator or his or her designee must respond to any emergencies that arise. The applicable responses are as follows:

(A) In the event of a fire, call the fire department or attempt to extinguish it using a fire extinguisher;
(B) In the event of a spill, contain the flow of hazardous waste to the extent possible, and as soon as is practicable, clean up the hazardous waste and any contaminated materials or soil;
(C) In the event of a fire, explosion, or other release which could threaten human health outside the facility or when the generator has knowledge that a spill has reached surface water, the generator must immediately notify the federal National Response Center (using their 24-hour toll free number 800/424-8802) and the Hawaii Department of Health's Hazard Evaluation and Emergency Response Office via the State Hospital at (808) 247-2191 after business hours or directly at (808) 586-4249 during business hours. The report must include the following information:
(1) The name, address, and U.S. EPA identification number of the generator;
(2) Date, time, and type of incident (e.g., spill or fire);
(3) Quantity and type of hazardous waste involved in the incident;
(4) Extent of injuries, if any; and
(5) Estimated quantity and disposition of recovered materials, if any.

(e) A generator who generates greater than one-hundred kilograms but less than one-thousand kilograms of hazardous waste in a calendar month and who must transport his waste, or offer his waste for transportation, over a distance of two-hundred miles or more for off-site treatment, storage or disposal may accumulate hazardous waste on-site for two-hundred and seventy days or less without a permit or without having interim status provided that he complies with the requirements of subsection (d) of this section.

(f) A generator who generates greater than one-hundred kilograms but less than one-thousand kilograms of hazardous waste in a calendar month and who accumulates hazardous waste in quantities exceeding six-thousand kilograms or accumulates hazardous waste for more than one-hundred and eighty days (or for more than two-hundred and seventy days if he must transport his waste, or offer his waste for transportation, over a distance of two-hundred miles or more) is an operator of a storage facility and is subject to the requirements of chapters 11-264 and 11-265 and the permit requirements of chapter 11-270 unless he has been

granted an extension to the 180 day (or 270 day if applicable) period. Such extension may be granted by the department if hazardous wastes must remain on-site for longer than 180 days (or 270 days if applicable) due to unforeseen, temporary, and uncontrollable circumstances. An extension of up to thirty days may be granted at the discretion of the director on a case-by-case basis.

(g) Failure to comply with any provision of this section shall constitute a violation of these rules as to which the department may take enforcement action under HRS section 342J-7, including but not limited to 342J-7(a)(1), (a)(2), and (a)(3). [Eff 6/18/94; am 3/13/99; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.34)

SUBCHAPTER D

RECORDKEEPING AND REPORTING

§11-262-40 Recordkeeping. (a) A generator must keep a copy of each manifest signed in accordance with subsection 11-262-23(a) for three years or until he receives a signed copy from the designated facility which received the waste. This signed copy must be retained as a record for at least three years from the date the waste was accepted by the initial transporter.

(b) A generator must keep a copy of each Biennial Report and Exception Report for a period of at least three years from the due date of the report.

(c) A generator must keep records of any test results, waste analyses, or other determinations made in accordance with section 11-262-11 for at least three years from the date that the waste was last sent to on-site or off-site treatment, storage, or disposal.

(d) The periods or retention referred to in this section are extended automatically during the course of any unresolved enforcement action regarding the regulated activity or as requested by the director. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.40)

§11-262-41 Biennial report. (a) A generator who ships any hazardous waste off-site to a treatment, storage or disposal facility within the United States must prepare and submit a single copy of a Biennial Report to the director by March 1 of each even numbered year. The Biennial Report must be submitted on a form approved by the director, must cover generator activities during the previous year, and must include the following information:

(1) The EPA identification number, name, and address of the generator;
(2) The calendar year covered by the report;
(3) The EPA identification number, name, and address for each off-site treatment, storage, or disposal facility in the United States to which waste was shipped during the year;
(4) The name and EPA identification number of each transporter used during the reporting year for shipments to a treatment, storage or disposal facility within the United States;
(5) A description, EPA hazardous waste number (from chapter 11-261, subchapter C or D), U.S. DOT hazard class, and quantity of each hazardous waste shipped off-site for shipments to a treatment, storage or disposal facility within the United States. This information must be listed by EPA identification number of each such off-site facility to which waste was shipped.
(6) A description of the efforts undertaken during the year to reduce the volume and toxicity of waste generated.
(7) A description of the changes in volume and toxicity of waste actually achieved during the year in comparison to previous years to the extent such information is available for years prior to 1984.
(8) The certification signed by the generator or authorized representative.

(b) Any generator who treats, stores, or disposes of hazardous waste on-site must submit a biennial report covering those wastes in accordance with the provisions of chapters 11-270, 11-264, 11-265, and 11-266. Reporting for exports of hazardous waste is not required on the Biennial Report form. A separate annual report requirement is set forth at section 11-262-56. [Eff 6/18/94; am 3/13/99; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.41)

§11-262-42 Exception reporting.

(a) (1) A generator of greater than one-thousand kilograms of hazardous waste in a calendar month who does not receive a copy of the manifest with the handwritten signature of the owner or operator of the designated facility within thirty-five days of the date the waste was accepted by the initial transporter must contact the transporter and/or the owner or operator of the designated facility to determine the status of the hazardous waste.
(2) A generator of greater than one-thousand kilograms of hazardous waste in a calendar month must submit an Exception Report to the director if he has not received

a copy of the manifest with the handwritten signature of the owner or operator of the designated facility within forty-five days of the date the waste was accepted by the initial transporter. The Exception Report must include:
(i) A legible copy of the manifest for which the generator does not have confirmation of delivery;
(ii) A cover letter signed by the generator or his authorized representative explaining the efforts taken to locate the hazardous waste and the results of those efforts.

(b) A generator of greater than one-hundred kilograms but less than one-thousand kilograms of hazardous waste in a calendar month who does not receive a copy of the manifest with the handwritten signature of the owner or operator of the designated facility within sixty days of the date the waste was accepted by the initial transporter must submit a legible copy of the manifest, with some indication that the generator has not received confirmation of delivery, to the director. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.42)

§11-262-43 Additional reporting. The director, as he deems necessary under HRS section 342J-6, may require generators to furnish additional reports concerning the quantities and disposition of wastes identified or listed in chapter 11-261. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.43)

§11-262-44 Special requirements for generators of between 100 and 1000 kilograms per month. A generator of greater than 100 kilograms but less than 1000 kilograms of hazardous waste in a calendar month is subject only to the following requirements in this subchapter:
(a) Subsections 11-262-40(a), (c), and (d), recordkeeping;
(b) Subsection 11-262-42(b), exception reporting; and
(c) Section 11-262-43, additional reporting. [Eff 6/18/94; am 3/13/99; comp] (Auth: HRS §§342J-4, 342J-31, 342J-32, 342J-35) (Imp: 40 C.F.R. §262.44)

SUBCHAPTER E

EXPORTS OF HAZARDOUS WASTE

§11-262-50 Applicability. This subchapter establishes requirements applicable to exports of hazardous waste. Except to the extent section 11-262-58 provides otherwise, a primary

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HAWAII ADMINISTRATIVE RULES

TITLE 11

DEPARTMENT OF HEALTH

CHAPTER 263

HAZARDOUS WASTE MANAGEMENT

STANDARDS APPLICABLE TO TRANSPORTERS OF HAZARDOUS WASTE

Subchapter A General

§11-263-10 Scope.
§11-263-11 EPA identification number.
§11-263-12 Transfer facility requirements.

Subchapter B Compliance With the Manifest System and Recordkeeping

§11-263-20 The manifest system.
§11-263-21 Compliance with the manifest.
§11-263-22 Recordkeeping.

Subchapter C Hazardous Waste Discharges

§11-263-30 Immediate action.
§11-263-31 Discharge clean up.

UNOFFICIAL

SUBCHAPTER A

GENERAL

§11-263-10 Scope. (a) This chapter establishes standards which apply to persons transporting hazardous waste into, within, and out of the State if the transportation requires a manifest

under chapter 11-262.

(b) These rules do not apply to on-site transportation of hazardous waste by generators or by owners or operators of permitted hazardous waste management facilities.

(c) A transporter of hazardous waste must also comply with chapter 11-262, Standards Applicable to Generators of Hazardous Waste, if he:

(1) Transports hazardous waste into the United States from abroad; or

(2) Mixes hazardous wastes of different United States Department of Transportation (DOT) shipping descriptions by placing them into a single container.

(d) A transporter of hazardous waste subject to the federal manifesting requirements of 40 CFR Part 262, or subject to the waste management standards of 40 CFR Part 273, or subject to chapter 11-273, that is being imported from or exported to any of the countries listed in 40 CFR 262.58(a)(1) for purposes of recovery is subject to this subchapter and to all other relevant requirements of subchapter H of chapter 11-262, including, but not limited to, section 11-262-84 for tracking documents.

(e) The regulations in this chapter do not apply to transportation during an explosives or munitions emergency response, conducted in accordance with section 11-264-1(g)(8)(i)(D) or (iv) or 11-265-1(c)(11)(i)(D) or (iv), and section 11-270-1(c)(3)(i)(D) or (iii).

(f) Section 11-266-203 identifies how the requirements of this chapter apply to military munitions classified as solid waste under section 11-266-202.

(g) All references in tables and appendices to provisions of the Code of Federal Regulations shall be construed to mean the State rule analogue of the referenced federal regulation (for example, 40 CFR 260.1 shall be construed to mean section 11-260-1 of the Hawaii Administrative Rules). [Eff 6/18/94; am 3/13/99; comp] (Auth: HRS §§342J-4, 342J-31, 342J-33, 342J-35) (Imp: 40 C.F.R. §263.10)

§11-263-11 EPA identification number. (a) A transporter must not transport hazardous wastes without having received an EPA identification number from the Administrator or the director.

(b) A transporter who has not received an EPA identification number may obtain one by applying to the director using EPA Form 8700-12. Upon receiving the request, the Administrator or director will assign an EPA identification number to the transporter. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-33, 342J-35) (Imp: 40 C.F.R. §263.11)

§11-263-12 Transfer facility requirements. A transporter

who stores manifested shipments of hazardous waste in containers meeting the requirements of section 11-262-30 at a transfer facility for a period of ten days or less is not subject to regulation under chapters 11-270, 11-264, 11-265, and 11-268 with respect to the storage of those wastes. [Eff 6/18/94; comp] (Auth: HRS §§342J-4, 342J-31, 342J-33, 342J-35)(Imp: 40 C.F.R. §263.12)

SUBCHAPTER B

COMPLIANCE WITH THE MANIFEST SYSTEM AND RECORDKEEPING

§11-263-20 The manifest system. (a) A transporter may not accept hazardous waste from a generator unless it is accompanied by a manifest signed in accordance with the provisions of section 11-262-20. In the case of exports other than those subject to subchapter H of chapter 11-262, a transporter may not accept such waste from a primary exporter or other person if he or she knows the shipment does not conform to the EPA Acknowledgment of Consent; and unless, in addition to a manifest signed in accordance with the provisions of section 11-262-20, such waste is also accompanied by an EPA Acknowledgment of Consent which, except for shipment by rail, is attached to the manifest (or shipping paper for exports by water (bulk shipment)). For exports of hazardous waste subject to the requirements of chapter 11-262, subchapter H, a transporter may not accept hazardous waste without a tracking document that includes all information required by section 11-262-84.

(b) Before transporting the hazardous waste, the transporter must sign and date the manifest acknowledging acceptance of the hazardous waste from the generator. The transporter must return a signed copy to the generator before leaving the generator's property.

(c) The transporter must ensure that the manifest accompanies the hazardous waste. In the case of exports, the transporter must ensure that a copy of the EPA Acknowledgment of Consent also accompanies the hazardous waste.

(d) A transporter who delivers a hazardous waste to another transporter or to the designated facility must:

(1) Obtain the date of delivery and the handwritten signature of that transporter or of the owner or operator of the designated facility on the manifest; and

(2) Retain one copy of the manifest in accordance with section 11-263-22; and

(3) Give the remaining copies of the manifest to the accepting transporter or designated facility.

(e) The requirements of subsections (c), (d) and (f) do not apply to water (bulk shipment) transporters if:

(1) The hazardous waste is delivered by water (bulk shipment) to the designated facility; and

(2) A shipping paper containing all the information required on the manifest (excluding the EPA identification numbers, generator certification, and signatures) and, for exports, an EPA Acknowledgment of Consent accompanies the hazardous waste; and

(3) The delivering transporter obtains the date of delivery and handwritten signature of the owner or operator of the designated facility on either the manifest or the shipping paper; and

(4) The person delivering the hazardous waste to the initial water (bulk shipment) transporter obtains the date of delivery and signature of the water (bulk shipment) transporter on the manifest and forwards it to the designated facility; and

(5) A copy of the shipping paper or manifest is retained by each water (bulk shipment) transporter in accordance with section 11-263-22.

(f) For shipments involving rail transportation, the requirements of subsections (c), (d) and (e) do not apply and the following requirements do apply:

(1) When accepting hazardous waste from a non-rail transporter, the initial rail transporter must:
  (i) Sign and date the manifest acknowledging acceptance of the hazardous waste;
  (ii) Return a signed copy of the manifest to the non-rail transporter;
  (iii) Forward at least three copies of the manifest to:
    (A) The next non-rail transporter, if any; or,
    (B) The designated facility, if the shipment is delivered to that facility by rail; or
    (C) The last rail transporter designated to handle the waste in the United States;
  (iv) Retain one copy of the manifest and rail shipping paper in accordance with section 11-263-22.

(2) Rail transporters must ensure that a shipping paper containing all the information required on the manifest (excluding the EPA identification numbers, generator certification, and signatures) and, for exports an EPA Acknowledgment of Consent accompanies the hazardous waste at all times.

(3) When delivering hazardous waste to the designated facility, a rail transporter must:
  (i) Obtain the date of delivery and handwritten signature of the owner or operator of the designated facility on the manifest or the shipping paper (if the manifest has not been received by the facility); and
  (ii) Retain a copy of the manifest or signed shipping

paper in accordance with section 11-263-22.

(4) When delivering hazardous waste to a non-rail transporter a rail transporter must:

(i) Obtain the date of delivery and the handwritten signature of the next non-rail transporter on the manifest; and

(ii) Retain a copy of the manifest in accordance with section 11-263-22.

(5) Before accepting hazardous waste from a rail transporter, a non-rail transporter must sign and date the manifest and provide a copy to the rail transporter.

(g) Transporters who transport hazardous waste out of the United States must:

(1) Indicate on the manifest the date the hazardous waste left the United States; and

(2) Sign the manifest and retain one copy in accordance with subsection 11-263-22(c); and

(3) Return a signed copy of the manifest to the generator; and

(4) Give a copy of the manifest to a U.S. Customs official at the point of departure from the United States.

(h) A transporter transporting hazardous waste from a generator who generates greater than one-hundred kilograms but less than one-thousand kilograms of hazardous waste in a calendar month need not comply with the requirements of this section or those of section 11-263-22 provided that:

(1) The waste is being transported pursuant to a reclamation agreement as provided for in subsection 11-262-20(e);

(2) The transporter records, on a log or shipping paper, the following information for each shipment:

(i) The name, address, and U.S. EPA identification number of the generator of the waste;

(ii) The quantity of waste accepted;

(iii) All U.S. Department of Transportation-required shipping information;

(iv) The date the waste is accepted; and

(3) The transporter carries this record when transporting waste to the reclamation facility; and

(4) The transporter retains these records for a period of at least three years after termination or expiration of the agreement. [Eff 6/18/94; am 3/13/99; comp] (Auth: HRS 342J-4, 342J-31, 342J-33, 342J-35) (Imp: 40 C.F.R. §263.20)

§11-263-21 Compliance with the manifest. (a) The transporter must deliver the entire quantity of hazardous waste which he has accepted from a generator or a transporter to:

(1) The designated facility listed on the manifest; or

(2) The alternate designated facility, if the hazardous waste cannot be delivered to the designated facility because an emergency prevents delivery; or

(3) The next designated transporter; or

(4) The place outside the United States designated by the generator.

(b) If the hazardous waste cannot be delivered in accordance with subsection (a), the transporter must contact the generator for further directions and must revise the manifest according to the generator's instructions. [Eff 6/18/94; comp] (Auth: HRS 342J-4, 342J-31, 342J-33, 342J-35) (Imp: 40 C.F.R. §263.21)

§11-263-22 Recordkeeping. (a) A transporter of hazardous waste must keep a copy of the manifest signed by the generator, himself, and the next designated transporter or the owner or operator of the designated facility for a period of three years from the date the hazardous waste was accepted by the initial transporter.

(b) For shipments delivered to the designated facility by water (bulk shipment), each water (bulk shipment) transporter must retain a copy of the shipping paper containing all the information required in paragraph 11-263-20(e)(2) for a period of three years from the date the hazardous waste was accepted by the initial transporter.

(c) For shipments of hazardous waste by rail within the State:

(i) The initial rail transporter must keep a copy of the manifest and shipping paper with all the information required in paragraph 11-263-20(f)(2) for a period of three years from the date the hazardous waste was accepted by the initial transporter; and

(ii) The final rail transporter must keep a copy of the signed manifest (or the shipping paper if signed by the designated facility in lieu of the manifest) for a period of three years from the date the hazardous waste was accepted by the initial transporter.

(d) A transporter who transports hazardous waste out of the United States must keep a copy of the manifest indicating that the hazardous waste left the United States for a period of three years from the date the hazardous waste was accepted by the initial transporter.

(e) The periods of retention referred to in this section are extended automatically during the course of any unresolved enforcement action regarding the regulated activity or as requested by the director. [Eff 6/18/94; comp]

(Auth: HRS §§342J-4, 342J-31, 342J-33, 342J-35) (Imp: 40 C.F.R. §263.22)

SUBCHAPTER C

HAZARDOUS WASTE DISCHARGES

§11-263-30 Immediate action. (a) In the event of a discharge of hazardous waste during transportation, the transporter must take appropriate immediate action to protect human health and the environment (e.g., notify local authorities, dike the discharge area).

(b) If a discharge of hazardous waste occurs during transportation and an official (State or county government or a Federal Agency) acting within the scope of his official responsibilities determines that immediate removal of the waste is necessary to protect human health or the environment, that official may authorize the removal of the waste by transporters who do not have an EPA identification number and without the preparation of a manifest.

(c) An air, rail, highway, or water transporter who has discharged hazardous waste must:

(1) Give notice, if required by 49 CFR 171.15, to the federal National Response Center (800-424-8802 or 202-426-2675); and to the State Department of Health, Hazard Evaluation and Emergency Response Office via the State Hospital (808-247-2191) after business hours or directly at (808) 586-4249 during business hours; and

(2) Report in writing as required by 49 CFR 171.16 to the Director, Office of Hazardous Materials Regulations, Materials Transportation Bureau, Department of Transportation, Washington, DC 20590.

(d) A water (bulk shipment) transporter who has discharged hazardous waste must give the same notice as required by 33 CFR 153.203 for oil and hazardous substances. [Eff 6/18/94; am 3/13/99; comp] (Auth: HRS 342J-4, 342J-31, 342J-33, 342J-35) (Imp: 40 C.F.R. §263.30)

§11-263-31 Discharge clean up. A transporter must clean up any hazardous waste discharge that occurs during transportation or take such action as may be required or approved by Federal, State, or county officials so that the hazardous waste discharge no longer presents a hazard to human health or the environment. [Eff 6/18/94; comp] (Auth: HRS 342J-4, 342J-31, 342J-33, 342J-35) (Imp: 40 C.F.R. §263.31)

Appendix E

Portions of HAR §4-66, Pesticides

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SUBTITLE 6 DIVISION OF PLANT INDUSTRY

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§4-66-40 Special local need; classification
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Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 6

Botanical Survey

BOTANICAL SURVEY
KALOKO-HONOKOHAU BUSINESS PARK
NORTH KONA, HAWAI'I

by

Winona P. Char

CHAR & ASSOCIATES
Botanical Consultants
Honolulu, Hawai'i

Prepared for: LANIHAU PARTNERS, L.P.

April 2000

SUMMARY

Existing environment: Two vegetation types are recognized on the project site. Quarry scrub vegetation covers the 'a'a lava flow on the northern half of the property. Almost all of the 'a'a flow has been bulldozed and disturbed at some time by the quarry operation. Where the flow is actively used by the quarry and other related businesses, there are few, if any, plants. On the northeast corner of the property, there are a few clumps of 'ohi'a lehua (Metrosideros polymorpha) trees. Three plants of the ko'oko'olau (Bidens micrantha ssp. ctenophylla), a candidate endangered species, are found just outside the boundary in this area. Other parts of the 'a'a flow support low, dense koa haole shrubs (Leucaena leucocephala) and fountain grass (Pennisetum setaceum). Along the access road, the vegetation consists of scattered patches of mostly weedy vegetation on largely barren areas.

Koa haole shrubland occurs on the pahoehoe flows on the south half of the property. It is composed of koa haole shrubs, 4 to 6 feet tall, with a dense cover of fountain grass between the shrubs. Scattered through the shrubland are trees of kiawe (Prosopis pallida) and jacaranda (Jacaranda mimosifolia) and shrubs of Christmas berry (Schinus terebinthifolius), klu (Acacia farnesiana), maiapilo (Capparis sandwichiana), and noni (Morinda citrifolia). The koa haole shrubs are taller and the kiawe and Christmas berry become more common closer to the highway in a low lying area.

Impacts: The proposed development of the site is not expected to have a significant negative impact on the botanical resources as it is dominated by introduced or alien species such as koa haole, fountain grass, Christmas berry, and kiawe. No threatened and

endangered species or species of concern occur on the site. All of the native plants which are found on the site can also be found in similar lowland, dry environments in the West Hawai'i region and on most of the main Hawaiian Islands.

Plants of the ko'oko'olau, a candidate endangered species, are found just outside the project site near the northeast corner. At least four listed endangered species are known from the undisturbed portions of the Kaloko flow mauka of the project site. Development of the project site may increase the chances for fires.

Mitigation measures: It is recommended that a buffer zone at least 50 feet in width be established along the east (mauka) boundary and northeast corner. The buffer zone should also be maintained as a fire break.

BOTANICAL SURVEY
KALOKO-HONOKOHAU BUSINESS PARK
NORTH KONA, HAWAI'I

INTRODUCTION

The proposed Kaloko-Honokohau Business Park covers approximately 336.9 acres of land at Honokohau 1st and 2nd, North Kona. The project site is located immediately east (mauka) of Queen Ka'ahumanu Highway, between the Kaloko Industrial area and the McClean Honokohau Properties. A portion of the site, about 100 acres, already supports a quarry and other related uses. Lanihau Partners, L.P. is proposing to reclassify the property from the State Land Use "Conservation" to the "Urban" district.

A reconnaissance site visit with the project's planners, Lanihau Partners' representative, and subconsultants was made on 13 September 1999 to familiarize the subconsultants with the project boundaries, past and present uses, and accessibility. Field studies to assess the botanical resources on the project site were conducted on 26 October 1999 by two botanists. The primary objectives of the survey were to:

1) provide a general description of the vegetation on the site;
2) inventory the flora;
3) search for threatened and endangered species as well as species of concern; and
4) identify areas of potential environmental problems or concerns and propose appropriate mitigation measures.

SURVEY METHODS

Prior to undertaking the field studies, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area. Topographic maps as well as recent, colored aerial photographs were examined to determine vegetation cover patterns, terrain characteristics, access, boundaries, and reference points.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, disturbances, exposure, topography, drainage, etc. Plant identifications were made in the field; plants which could not be positively identified were collected for later determination in the herbarium, and for comparison with the recent taxonomic literature. The eastern (mauka) boundary was surveyed more intensively as endangered plants are known from the undisturbed portions of the Kaloko 'a'a lava flow located above the project site.

The species recorded are indicative of the season ("rainy" vs. "dry") and the environmental conditions at the time of the survey. A survey taken at a different time of the year and under varying environmental conditions would no doubt yield slight variations in the species list, especially of the weedy, annual plants.

DESCRIPTION OF THE VEGETATION

In 1966, a Conservation District Use Permit (CDUP) was granted which allowed quarry and related uses on a portion of the property. The area being quarried is part of the lower section of the Kaloko 'a'a flow; it is found on the northern half of the property. This part of the project site has been bulldozed and extensively disturbed by the quarry operation. The quarry scrub vegetation can vary from scattered patches of plants on largely

barren areas to low, closed scrub cover depending on how recently an area was disturbed.

On the southern half of the property, koa haole shrubland is found on dense, weathered pahoehoe flows. This portion of the site has not been bulldozed, for the most part, and was used for grazing at one time.

The two vegetation types are described in more detail below. An inventory of all the plant species found within the quarry scrub vegetation and the koa haole shrubland is presented in the species checklist at the end of this report.

Quarry Scrub Vegetation

The quarry and other related operations occupy most of the 'a'a lava flow on the site; the 'a'a lava flow is identified as "rLV" on the soil maps (Sato et al. 1973). The actively used areas are largely barren. Around some of the buildings and other structures there are small, weedy patches of koa haole or ekoa (Leucaena leucocephala), fountain grass (Pennisetum setaceum), weedy annuals, and sometimes a few ornamental plantings.

On those portions of the 'a'a flow which are not actively being used, the vegetation cover is variable depending on when it was last bulldozed and cleared. On the northeast corner just above the quarry pit, about 50 to 60% of the area is barren, bulldozed 'a'a. A few patches of fountain grass and Natal redtop grass (Melinis repens), 2 to 3 feet tall, are found scattered here and there. In some places, 'uhaloa (Waltheria indica), a small, native shrub, is locally common to abundant. Shrubs of koa haole, maiapilo or native caper (Capparis sandwichiana), sourbush (Pluchea carolinensis), Christmas berry (Schinus terebinthifolius), and noni (Morinda citrifolia) are found on rock piles; the shrubs are 1 to 6 feet tall. A few 'ohi'a lehua trees (Metrosideros

polymorpha) have been left in place on mounds of 'a'a 6 to 12 feet high. Three ko'oko'olau shrubs (Bidens micrantha subspecies ctenophylla), ranging in height from 3 to 6 feet tall, are found either on the boundary line or just outside the boundary on the adjacent property owned by TSA International, Ltd. The boundaries had not been flagged and staked at the time of this survey. Another cluster of about 10 plants is found roughly 200 feet east of the project site. The Bidens is a candidate for listing as an endangered species (U.S. Fish and Wildlife Service 1999).

To the south of the quarry pit, the 'a'a flow supports a scrub vegetation composed of shrubs of koa haole, 3 to 6 feet tall, and clumps of fountain grass. The koa haole and fountain grass cover is about 70 to 80%. Scattered here and there with about 5% cover are shrubs of Christmas berry and noni, and a few small trees of kiawe (Prosopis pallida). This area appears to have been surface cleared during the earlier days of quarry operation. In some places, there are furrows 2 to 3 feet deep.

An old Hawaiian foot trail is found on the lower south side of the 'a'a flow. Dense straw-colored fountain grass covers the trail, while on both sides of the trail there is only barren or bulldozed black 'a'a. The trail can be easily identified on the colored aerial photographs.

Along the highway and the quarry access road, the 'a'a flow is primarily barren with scattered clumps of fountain grass. A few rock piles support patches of Guinea grass (Panicum maximum), fountain grass, koa haole, and ivy gourd vines (Coccinia grandis).

Koa Haole Shrubland

Koa haole shrubs, from 4 to 6 feet tall, form a dense cover on on the pahoehoe lava flows on the southern half of the project

site; the pahoehoe flows are identified as "rLW" on the soil maps (Sato et al. 1973). Dense clumps of fountain grass fill in the matrix between the koa haole shrubs. Scattered through this shrubland are trees of jacaranda (Jacaranda mimosifolia) and kiawe, 15 to 20 feet tall. Shrubs which are occasionally observed in this vegetation type include Christmas berry, klu (Acacia farnesiana), alahe'e (Psydrax odorata), 'a'ali'i (Dodonaea viscosa), and maiapilo. Plant cover is about 70 to 95%. There are a few pahoehoe hummocks which are more sparsely vegetated. These usually support patches of Natal redtop grass, 'uhaloa, and Portulaca pilosa. In some places, there is a dense growth of lichens on the exposed pahoehoe hummocks. Small caves harbor two diminutive native species, the kumu niu fern (Doryopteris decipiens) and 'ala'ala wai nui (Peperomia blanda var. floribunda).

Closer to the highway, the pahoehoe flows appear to be older and are more weathered and reddish-brown in color. This older flow supports a thin layer of soil and is in a low lying swale or bowl area. The koa haole shrubs are taller, 10 to 12 feet tall, and there are more kiawe trees and Christmas berry shrubs. Fountain grass cover is also dense in this area. In some places under the koa haole shrubs, fame flower (Talinum triangulare), a stout, fleshy herb with yellow flowers belonging the the portulaca family, is abundant. Along the highway there are a few overgrown bulldozer paths.

DISCUSSION AND RECOMMENDATIONS

Mixed light industrial and commercial uses as well as the retention and expansion of the existing quarry are planned for the site. These developments are not expected to have a significant negative impact on the botanical resources.

The vegetation on the project site is dominated by introduced or

alien species, primarily koa haole and fountain grass. Introduced species are all those plants which were brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact (1778). A total of 46 species were inventoried on the project site. Of these, 29 (63%) are introduced; 2 (4%) are originally of Polynesian introduction; and 15 (33%) are native. Of the natives, 11 are indigenous, that is, they are native to the Hawaiian Islands and elsewhere. Four plants are endemic, that is, they are native only to the Hawaiian Islands; these plants are the kumu niu fern (Doryopteris decipiens), maiapilo (Capparis sandwichiana), lama (Diospyros sandwicensis), and 'ohi'a lehua (Metrosideros polymorpha). None of the plants is a threatened and endangered species or a species of concern (U.S. Fish and Wildlife Service 1999). All of the plants can be found in similar dry, lowland environments throughout the West Hawai'i region and most of the main Hawaiian Islands.

The ko'oko'olau (Bidens micrantha subspecies ctenophylla), a candidate endangered species, is found near the northeast corner just outside of the project site. In addition, several listed endangered species are known from the undisturbed portions of the Kaloko 'a'a flow above the project site (Char 1991; L. Mehrhoff, U.S. Fish and Wildlife Service, pers. comm.). These species are the 'aiea (Nothocestrum breviflorum), ma'oloa (Neraudia ovata), hala pepe (Pleomele hawaiiensis), and Mariscus fauriei. Shrubs of the ko'oko'olau are also known from the Kaloko flow.

It is recommended that a 50-foot wide buffer zone be established along the east (mauka) boundary and the northeast corner. The buffer zone would also be maintained as a firebreak. No developement would take place within the buffer zone. It is also recommended that the location of the Bidens be more accurately mapped when property's boundaries are surveyed.

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PLANT SPECIES LIST -- Kaloko-Honokohau Business Park, Hawai'i

The following checklist is an inventory of all the plants observed during the field studies. The plant names are arranged alphabetically by families within each of three groups: Ferns, Dicots, and Monocots. The taxonomy and nomenclature of the Ferns follow Lamoureux (1988), while the flowering plants, Dicots and Monocots, are in accordance with Wagner et al. (1990). The few recent name changes for the flowering plants follow those reported in the Hawaii Biological Survey series (Evenhuis and Miller, eds., 1995-1998; Evenhuis and Eldredge, eds., 1999).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name(s), when known.
3. Biogeographic status. The following symbols are used:
   - E = endemic = native only to the Hawaiian Islands.
   - I = indigenous = native to the Hawaiian Islands and also elsewhere.
   - I? = questionably indigenous = data not clear if dispersal by natural or human-related mechanisms, but weight of evidence suggests probably indigenous.
   - P = Polynesian = plants originally of Polynesian introduction prior to Western contact, that is, Cook's discovery of the islands in 1778.
   - X = introduced or alien = all those plants brought to the Hawaiian Islands by humans, intentionally or accidentally, after Western contact (1778).
4. Presence (+) or absence (-) of a particular species within each of two vegetation types recognized on the project site (see text for discussion):
   - q = Quarry Scrub Vegetation
   - k = Koa Haole Shrubland

Scientific name	Common name	Status	Vegetation type q	Vegetation type k
FERNS				
NEPHROLEPIDACEAE (Sword fern family)				
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	hairy sword fern.	X	-	+
SINOPTERIDACEAE (Cliffbrake fern family)				
Doryopteris decipiens (Hook.) J. Sm.	kumu niu, 'iwa'iwa 'okupukupu	E	-	+
FLOWERING PLANTS				
DICOTS				
ANACARDIACEAE (Mango family)				
Schinus terebinthifolius Raddi	Christmas berry, wilelaiki	X	+	+
ASCLEPIADACEAE (Milkweed family)				
Stapelia gigantea N.E. Brown	carrion flower, Zulu giant	X	-	+
ASTERACEAE (Daisy family)				
Pluchea carolinensis (Jacq.) G. Don	pluchea, sourbush	I	+	+
Tridax procumbens L.	coat buttons	X	+	+
BIGNONIACEAE (Bignonia family)				
Jacaranda mimosifolia D. Don	jacaranda	X	+	+
BUDDLEIACEAE (Butterfly bush family)				
Buddleia asiatica Lour.	dogtail, huelo 'ilioholei	X	+	+
CAPPARACEAE (Caper family)				
Capparis sandwichiana DC	maiapilo, pua pilo	X	+	+
CONVOLVULACEAE (Morning glory family)				
Ipomoea indica (J. Burm.) Merr.	koali 'awahia koali 'awa, koali	I	+	+

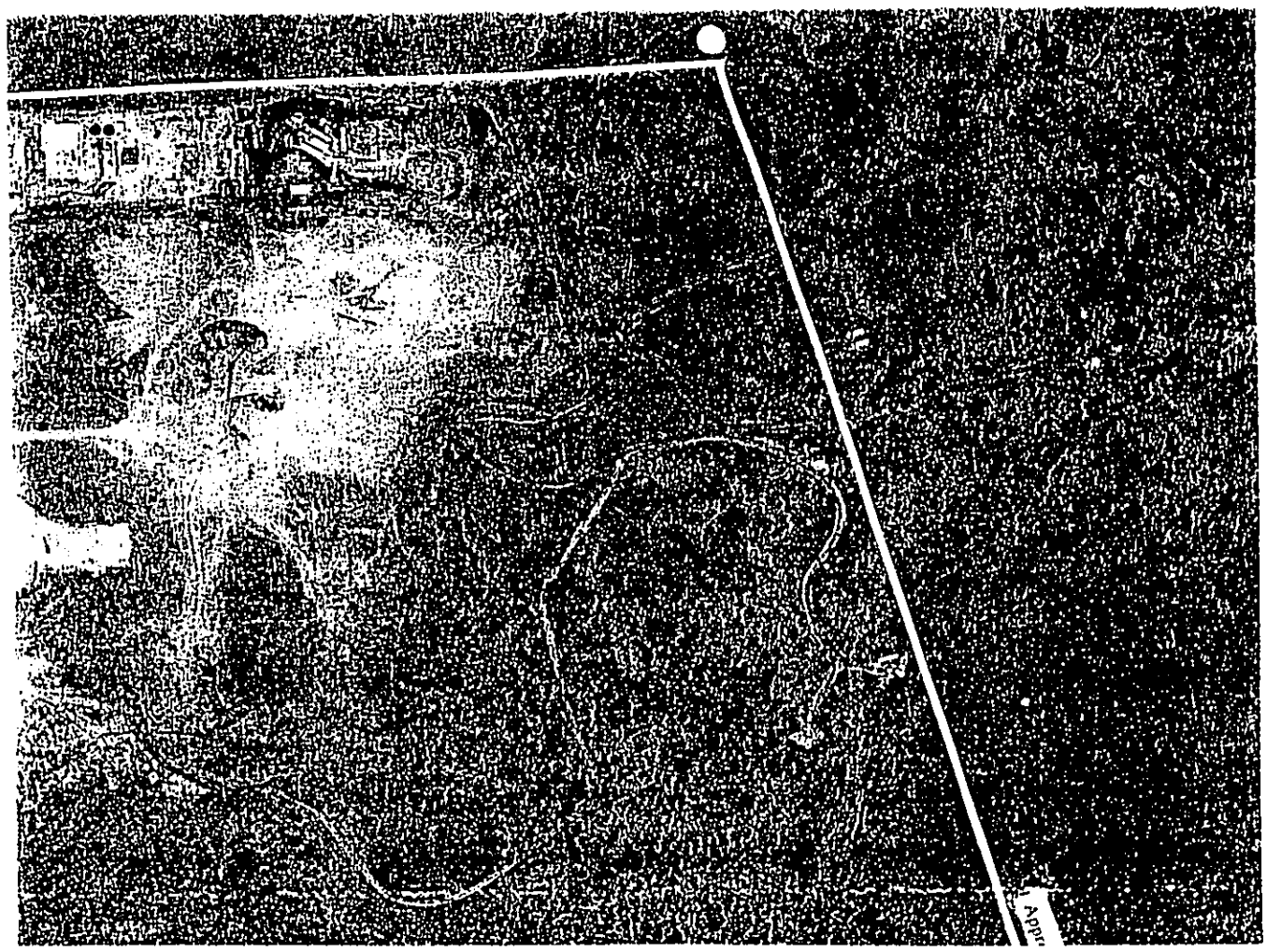
Scientific name	Common name	Status	Vegetation type g	k
MENISPERMACEAE (Moonseed family)				
Cocculus orbiculatus (L.) DC	huehue, hue	I	+	-
MYOPORACEAE (Naio family)				
Myoporum sandwicense A. Gray	naio, false sandalwood	I	-	+
MYRTACEAE (Myrtle family)				
Metrosideros polymorpha Gaud.	'ohi'a lehua, 'ohi'a, lehua	E	+	-
PASSIFLORACEAE (Passion flower family)				
Passiflora foetida L.	running pop, pohapoha	X	+	-
PHYTOLACCACEAE (Pokeweed family)				
Rivina humilis L.	coral berry, rouge plant	X	-	+
PIPERACEAE (Pepper family)				
Peperomia blanda var. floribunda (Miq.) H. Huber	'ala'ala wai nui	I	-	+
PLUMBAGINACEAE (Leadwort family)				
Plumbago zeylanica L.	'ilie'e, hilie'e	I	-	+
PORTULACACEAE (Purslane family)				
Portulaca oleracea L.	common purslane, pigweed, 'ihi	X	-	+
Portulaca pilosa L.		X	+	+
Talinum fruticosum (L.) Juss.	talinum, fameflower	X	+	+
RUBIACEAE (Coffee family)				
Morinda citrifolia L.	noni	P	+	+
Psydrax odorata (G. Forster) A.C. Smith & S.P. Darwin	alahe'e, walahe'e	I	-	+
SAPINDACEAE (Soapberry family)				
Dodonaea viscosa Jacq.	'a'ali'i, 'a'ali'i ku makani	I	+	+

Scientific name	Common name	Status	Vegetation type g	k
CRASSULACEAE (Orpine family)				
Kalanchoe pinnata (Lam.) Pers.	air plant, 'oliwa ku kahakai	X	-	+
CUCURBITACEAE (Gourd family)				
Coccinia grandis (L.) Voigt	ivy gourd, coccinia	X	+	+
EBENACEAE (Ebony family)				
Diospyros sandwicensis (A. DC) Fosb.	lama	E	+	-
EUPHORBIACEAE (Spurge family)				
Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge, koko kahiki	X	-	+
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X	+	+
FABACEAE (Pea family)				
Acacia farnesiana (L.) Willd.	klu	X	-	+
Chamaecrista nictitans (L.) Moench	partridge pea, lauki	X	+	-
Desmodium tortuosum (Sw.) DC	Florida beggarweed	X	+	-
Indigofera suffruticosa Mill.	indigo, 'iniko	X	+	-
Leucaena leucocephala (Lam.) de Wit	koa haole, ekoa	X	+	+
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X	+	+
Tephrosia purpurea (L.) Pers.	'auhuhu, ahuhu	P	-	+
GOODENIACEAE (Goodenia family)				
Scaevola sericea Vahl	naupaka kahakai, beach naupaka	I	+	-
LAMIACEAE (Mint family)				
Hyptis pectinata (L.) Poit.	comb hyptis	X	+	-
Plectranthus parviflorus Willd.	'ala'ala wai nui pua ki, spurflower	I	-	+
MALVACEAE (Mallow family)				
Sida fallax Walp.	'ilima	I	-	+

Figure 1. Approximate location of Bidens micrantha ssp. ctenophylla -- white dot on northeast corner, just outside the project site.

Scientific name	Common name	Status	Vegetation type q	k
STERCULIACEAE (Cacao family)				
Waltheria indica L.	'uhaloa, hi'aloa, kanakaloa	I?	+	+
MONOCOTS				
COMMELINACEAE (Spiderwort family)				
Commelina benghalensis L.	hairy honohono	X	-	+
POACEAE (Grass family)				
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X	+	-
Dactyloctenium aegyptium (L.) Willd.	beach wiregrass	X	-	+
Melinis repens (Willd.) Zizka	Natal redtop, Natal grass	X	+	+
Panicum maximum Jacq.	Guinea grass	X	+	-
Pennisetum setaceum (Forssk.) Chiov.	fountain grass	X	+	+

RECEIVED AS FOLLOWS



Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 7

Faunal Survey

REPORT:

Faunal Survey of Avian and Mammalian Species within the Proposed Kaloko-Honokohau Business Park, North Kona, Hawai'i.

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February 2000

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Introduction:

This report summarizes the findings of a two day ornithological and mammalian survey of the proposed Kaloko-Honokohau Business Park site. Fieldwork was conducted on December 4th ,5th and 10th 1999. The area surveyed is located between the Kaloko Light Industrial Area to the north and the McClean Honokohau Properties Industrial Development to the south. The western boundary of the subject property directly abuts Queen Ka-'ahu-manu Highway, and is located directly across the road from the Kaloko-Honokohau National Historic Park, in the North Kona District, Island of Hawai'i (Figure 1).

The primary purpose of the survey was to determine if there were any federally listed endangered, threatened, proposed, or candidate avian or mammalian species on, or in the immediate vicinity of the proposed development site. In addition, we were asked to assess the probability of any usage of the site by listed species given the habitat available.

Avian phylogenetic order used in this report follows *Birds Of The World: A Checklist 4th Edition* (Clements 1991), and the *1st ,2nd and 3rd Supplements to Birds Of The World: A Checklist 4th Edition* (Clements 1997, 1998, Clements and Principe, Jr. 1992); scientific nomenclature follows *The AOU Checklist of North American Birds 7th Edition* (AOU 1998), Mammal scientific names follow *Mammals in Hawaii* (Tomich 1986). Plant names follow *Manual of the Flowering Plants of Hawai'i* (Wagner *et al.* 1990). Place names follow *Place Names of Hawaii* (Pukui *et al.* 1976).

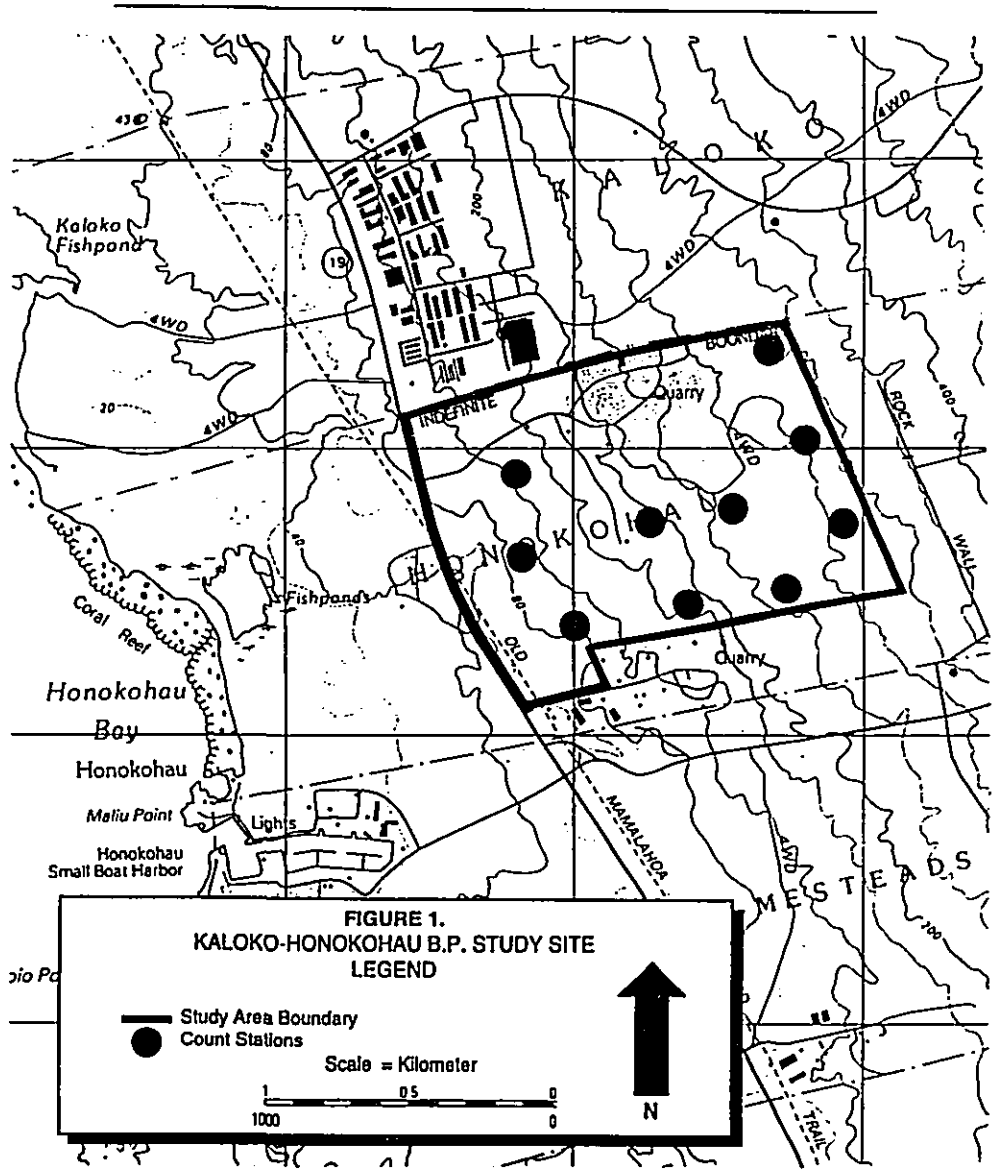
General Site Description:

The study site encompasses approximately 136 hectares located in portions of two ahupua'a, Honokohau 1 and 2. The site extends from an elevation of approximately 12 meters to 98 meters above sea level (Figure 1).

The terrain gently slopes from east to west and is composed of a mix of pahoehoe and a'a lava flows dating from the Holocene and Pleistocene ages (3000 - 5000 years ago) overlain on the north side of the site by a younger flow dating from somewhere between 1500 – 3000 years ago (Wolfe and Morris 1996).

The vegetation within the study site can be best characterized as a Lowland Vegetation Community with two recognizable vegetation associations. The vegetation on the lower or western part of the site falls within the Fountain Grass Grassland subtype of the Lowland Dry Grassland Community. This habitat is dominated by fountain grass (*Pennisetum setaceum*) an alien (introduced to Hawai'i by man) African grass.

The vegetation on the upper or eastern part of the site can be characterized as a degraded 'A'ali'i Lowland Shrubland subtype of the Lowland Dry Shrubland, although this portion



of the study site is also dominated by fountain grass and other alien weedy species (Gagne and Cuddihy 1990 in: Wagner *et al.* 1990). Approximately a third of the site is currently an active quarry operation. In which most of the vegetation has been bulldozed and there are numerous dozed roadways, trails and work areas.

Mammalian Survey Methods:

Observations of mammalian species were of an incidental nature. With the exception of the Hawaiian hoary bat (*Lasiurus cinereus semotus*), all other terrestrial mammals found on the Island of Hawai'i are alien species. Most are ubiquitous, no trapping program was proposed or undertaken to quantify the usage by alien mammalian species of the study site. A running tally was kept of all vertebrate species observed and heard while within the boundaries of the site. The survey of mammals other than bats was limited to visual and auditory detection, coupled with observation of scat, tracks and other animal sign.

Avian Survey Methods:

An initial reconnaissance visit was made to the site on December the 4th to identify habitat types present and to ascertain the general nature of the avian species present. Following the initial reconnaissance, 10 count stations were established within the study area (Figure 1). Six-minute unlimited distance counts were made at each station (Reynolds *et al.* 1980). Count stations were counted twice ; additionally, a tally was made of birds detected during the census time on site. Field observations were made with the aid of Leitz 10 X 42 binoculars and by listening for vocalizations. Counts were concentrated during the early morning hours between 0600 hrs. and 1100 hrs., the peak of daily bird activity. An additional 2 hours were spent on the evening of the 5th and 10th of December, 1999, in an attempt to detect nocturnally flying seabirds and owls overflying the area. Time not spent counting was used to search the site and the surrounding area for species not detected during count sessions.

Results:

The lone mammalian species seen during the course of this survey were several small Indian mongooses (*Herpestes a. auropunctatus*). In addition we encountered skeletal remains of feral goat (*Capra h. hircus*) and several cattle (*Bos taurus*). Scat of domestic dog (*Canis f. familiaris*), cat (*Felis catus*), donkey (*Equus a. asinus*) as well as that of goat was encountered in numerous places within the site. No live rodents were detected during the course of this survey; however, it is likely that roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*) and European house mice (*Mus domesticus*), utilize the site. Without conducting a trapping program, it is difficult to assess the population densities of these often hard-to-see mammals. All of these introduced mammalian species are deleterious to avian populations. Hawai'i's sole endemic terrestrial mammalian species, the endangered

Hawaiian hoary bat, or 'Ope'ape'a, was not detected.

A total of 15 avian species representing 9 families were detected during station counts (Table 1). All of the species detected are considered to be alien to the Hawaiian Islands. The most common species were House Finch (*Carpodacus mexicanus frontalis*), Zebra Dove (*Geopilia striata*) and Japanese White-eye (*Zosterops japonicus*) (Table 1). These three species represented 50% of the total birds recorded. House Finch records represent more that 35% of the total individual birds recorded. All of the birds detected are common species found throughout the leeward lowland areas on the Island of Hawai'i. No endangered or threatened avian species were detected within the proposed development site (Federal Register 1998, DLNR 1986). The findings of both the avian and mammalian surveys were consistent with the present habitat available on the site.

Previous Surveys:

There have only been four comprehensive bat surveys conducted on the Island of Hawai'i (Jacobs 1994, Cooper et al. 1995, Cooper and David 1995, David 1996). Only one of these surveys addressed lands close the study area addressed in this survey. David Jacobs conducted an Island wide survey between 1990-1993 which attempted to ascertain the distribution and abundance of Hawaiian hoary bats by sampling along paved principal roadways around the Island of Hawai'i (Jacobs 1994). The bulk of the remaining published literature relies heavily on anecdotal and incidental information on bat distribution and abundance on the Island (Baldwin 1950, Bryan 1955, Tomich 1986).

The first systematic surveys of the avifauna of Hawai'i were undertaken in 1976. Starting in that year and continuing until 1983 the U.S. Fish & Wildlife Service (USFWS) conducted a state wide survey of the avifauna of Hawai'i (Scott *et al.* 1986). During the course of the Hawaii Forest Bird Surveys program (HFBS) the subject property was not surveyed; it was already so denuded of native forest that it was not thought that any native forest birds could still survive in the habitat present. In recent years there have been several Environmental Impact Statement (EIS) level faunal surveys conducted on lands within the general vicinity of the study site (PBR 1991, CH2M Hill 1993, 1994, David, 1995a, 1995b, 1999a, 2000).

Discussion:

A one time survey can not provide a total picture of the wildlife utilizing any given area. Certain species will not be detected for one reason or another. Seasonal variations in populations coupled with seasonal usage and availability of resources will cause different usage patterns throughout a year or, in fact over a number of years. The project site and most of North Kona has been experiencing drought conditions for the past 3 years.

The findings of the mammalian survey are consistent with other surveys conducted

Table 1

Key To Table 1	
ST – A - Alien	RA / Relative Abundance = #birds/ stations

AVIAN SPECIES DETECTED DURING STATION COUNTS WITHIN THE KALOKO-HONOKOHAU BUSINESS PARK SITE

COMMON NAME	SCIENTIFIC NAME	ST	RA
PHEASANTS & ALLIES	Phasianidae		
Black Francolin.	*Francolinus francolinus.*	A	0.20
Erckel's Francolin	*Francolinus erckelii*	A	0.20
PIGEONS & DOVES	Columbidae		
Spotted Dove.	*Streptopelia chinensis.*	A	2.90
Zebra Dove.	*Geopelia striata.*	A	5.20
STARLINGS	Sturnidae		
Common Myna.	*Acridotheres tristis.*	A	1.50
SILVEREYES	Zosterops		
Japanese White-eye	*Zosterops japonicus*	A	3.50
LARKS	Alaudidae		
Sky Lark	*Alauda a. arvensis*	A	0.40
OLD WORLD SPARROWS	Passeridae		
House Sparrow	*Passer d. domesticus*	A	0.60
WAXBILLS & ALLIES	Estrildidae		
Lavender Waxbill	*Estrilda caerulescans*	A	0.10
Warbling Silverbill	*Lonchura malabarica.*	A	0.50
FRINGILLIDS	Fringillidae		
Yellow-fronted Canary	*Serinus mozambicus*	A	2.50
House Finch.	*Carpodacus mexicanus frontalis*	A	11.10
WARBLERS & SPARROWS	Emberizadae		
Yellow-billed Cardinal	*Paroaria capitata*	A	0.30
Saffron Finch	*Sicalsis flaveola*	A	0.30
Northern Cardinal	*Cardinalis cardinalis*	A	1.30

within the lowland areas of North Kona within the recent past (David 1995a, 1995b, 1999a, 1999b). It is likely that Hawaiian hoary bats overfly the project site upon occasion, as they have been seen in numerous lowland areas in North Kona on a seasonal basis (David 1993, R. David unpublished field notes 1975-1999, Jacobs 1994). Currently the site has little to offer a passing bat. There are no suitable roost trees and volent insect life appears at least from a cursory assessment to be low.

The low diversity and density of avian species detected during this survey is lower than one would ordinarily expect from the location of the project area. The ongoing drought has greatly impacted many of the lowland alien avian species normally present in this area. Results of recent faunal surveys conducted by the author in the lowland grassland areas of the North Kona District have shown greatly reduced avian diversity and density over the last year or so (David 1999a, 1999b) as compared to earlier surveys and publications covering the same general area (David 1989, 1990, 1991a, 1992, 1993, 1994, 1995a, 1995b). The habitat currently found on the site and within the fountain grass dominated lowland areas in North Kona do not provide resources necessary for the sustenance or nesting of native avian species. In a wetter year it is to be expected that additional resident avian alien species utilize the existing habitat within the project site. It is likely that following the further development of the site, and the installation of irrigated landscaping that many of the commonly occurring alien species currently found in North Kona will be recorded on the site. If lawns, parking lots and other open areas are created it is likely that these features will also attract a number of migratory shorebirds between the months of September and May each year. Many of the more than 80 species of migratory and extralimital avian species which have been recorded from Hawai'i have been recorded from coastal areas in North Kona (Pyle *et al.* 1988, David 1991b, Pyle 1992, 1997). The commoner of these are Pacific Golden Plover (*Pluvialis fulva*), Ruddy Turnstone (*Arenaria interpres*) and the Wandering Tattler (*Heteroscelus incanus*).

It is possible that small numbers of the endangered endemic Hawaiian subspecies of the Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*), or Ua'u over-fly the project site between the months of May and October (Banko 1980, Harrison 1990). This species was formerly common on the Island of Hawai'i (Wilson & Evans 1890-1899). This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea (Henshaw 1902), as well as the mid to high elevations of Mount Hualalai. It has within recent historic times been reduced to relictual breeding colonies located at high elevations on Mauna Loa and possibly Mount Hualalai (Banko 1980, Harrison 1990, Cooper & David 1995, Cooper *et al.* 1995, R. David Unpbl Field Notes 1986-1995, 1999).

The primary cause of mortality in Dark-rumped Petrels is thought to be predation by alien mammalian species at the nesting colonies (Day and Cooper 1998, Cooper and Day 1994). Collision with utility structures is considered to be the second most significant cause of mortality of this seabird species in Hawai'i. Nocturnally flying seabirds,

especially fledging birds, can become disoriented by exterior lighting on their way to sea in the Summer and Fall. When disoriented, seabirds often collide with manmade structures and, if not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Ainley and Podolsky 1993, Ainley *et al.* 1994, Cooper and Day 1994, Day and Cooper 1997, Cooper and Day 1998, Podolsky et al. 1998). There is no suitable nesting habitat within the project site for this species.

The principal potential impact that further development of this site poses to Dark-rumped Petrels is the increased threat of the downing of birds disoriented by exterior lighting which may be required in conjunction with the proposed development.

Two resident breeding endangered endemic waterbird species, Hawaiian Coot (*Fulica alai*) and Hawaiian Stilt *(Himantopus mexicanus knudseni)*, are historically known from Aimakapa Pond located along the shoreline within the Kaloko-Honokohau National Historic Park, which in turn is located directly down slope from the project site.

Aimakapa as an anchialine pond which is well on its way to senescence. The water circulation in the pond is severely restricted due in part to the buildup of a deep sediment layer which lines the bottom of the pond; this layer effectively limits the pond from free exchange of groundwater. This sediment layer coupled with the thick sand berm which separates the pond from the ocean and which also prevents the free exchange of water between the pond and the ocean has greatly decreased the hydrologic exchange of water required to maintain a healthy anchialine system. This is a natural process which accelerates as water exchange is reduced by sedimentation and the balance between production and consumption of nutrients is lost, which in turn results in algal dominated water columns. Finally, sedimentary infilling reduces the pond to a marsh and ultimately dry land (Marine Research Consultants 2000).

It is probable that the construction of this and other developments up slope from the pond will result in an increase in nutrients entering the pond. It is unlikely that the added nutrients will have a direct impact on trust vertebrate species currently utilizing resources present within the pond system. It is possible that the addition of nutrients to the system may prolong or increase the duration of algal blooms that have in recent years resulted in fish die-offs in the pond. These cycles will continue to increase and the pond will become senescent whether there is development up-slope or not, unless management actions to flush the pond are undertaken by the national park. The restoration of a functional makaha would provide park managers with a tool to reduce siltation and also control the outbreak of avian botulism within the pond system.

A potential impact to endangered avian resources within the national park might occur if contaminants migrate west (down slope) from the site into Aimakapa Pond.

Recommendations:

In the interest of reducing the potential for unwanted interactions between nocturnally flying Dark-rumped Petrel's with external lights and man made structures, it is recommended that any lights planned within the development site be shielded (Reed *et al.* 1985).

In order to preclude contaminants from reaching Aimakapa Pond the adherence to a strict Best Management Practices (BMP) contaminants program is recommended. The adherence to such a BMP, coupled with hydrologic studies to monitor local hydrology will eliminated or greatly reduce the potential risks of on site contaminants entering the groundwater and / or the Aimakapa Pond system

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Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 8

Archaeological Report

AN ARCHAEOLOGICAL INVENTORY SURVEY
OF AN APPROXIMATELY 300-ACRE SUBJECT PARCEL
IN THE *AHUPUA'A* OF HONOKŌHAU I AND II,
NORTH KONA DISTRICT, ISLAND OF HAWAI'I
(TMK 7-4-08: por. 5, 13, 30, 36)

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CULTURAL SURVEYS HAWAII
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ABSTRACT

Cultural Surveys Hawaii conducted an archaeological inventory survey with limited subsurface testing of an approximately 803-acre project (TMK 7-4-08: por. 5, 13, 30,60) for Lanihau Partners L.P, of which the proposed 300-acre Kaloko Honokōhau Business Park is a portion. Both the larger and the present project area are located within both Honokōhau I and II *ahupua'a*. The proposed 300-acre Kaloko Honokōhau Business Park is located between roughly the 40 foot and 320 foot contours.

Seventy-three archaeological sites were identified within the 300-acre parcel. The sites, primarily traditional Hawaiian sites, consists of dryland agricultural complexes, simple agricultural features, temporary, recurrent and permanent habitation sites, a refuge cave, human burials, animal containment features, an *ahupua'a* wall and various boundary walls, two petroglyphs, a network of trails, and *ahu* (shrines or markers).

Recommendations for the 73 sites include preservation of eight, data recovery for 31 and no further research for 34. The preservation sites include all identified burial sites, portions of two trails and a permanent habitation complex.

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I. INTRODUCTION

A. Project Background

An archaeological inventory survey with limited subsurface testing was conducted by Cultural Surveys Hawaii, in 1992 on 803 acres of Honokōhau I and II, to identify and evaluate historic and archaeological resources (Robins *et al.* 2000). The inventory survey was designed to meet the requirements of the State Historic Preservation Division/ Department of Land and Natural Resources (SHPD/DLNR) review process. The quality of significance was evaluated on a per site basis, utilizing criteria established by both the Hawaii and National Registers of Historic Places. The proposed project referred to as the Kaloko Honokohau Business Park (TMK 7-4-08: por. 5, 13, 30,60) encompasses a 300-acre portion of the 803-acre survey area, from roughly the 40 foot to the 320 foot elevational contours (Figures 1-3).

The proposed Kaloko-Honokōhau Business Park project area extends *mauka* or east of Queen Ka`ahumanu Highway for approximately 4000 ft. to the 320 ft. elevation contour. The project's southern boundary is Honokōhau II boundary except for the southern corner which is in Honokōhau II. The project's northern boundary is the Kaloko *ahupua`a* border. Infrastructure associated with the modern Honokōhau quarry operation are located in northeast quadrant of the project area.

The quarry portion of the project area is accessible through a main gate managed by the quarry operator. One main gravel road through the quarry area extends *mauka* from Queen Ka'ahumanu Highway and diverts into several spur roads, connecting the quarry area with its associated functions.

An on-site planning reconnaissance was conducted in April 1990 by Dr. Hallett H. Hammatt and Mr. Rodney Chiogioji of Cultural Surveys Hawaii (See below in Methods Section). Actual field work for the inventory survey was carried out during March 18 and July 15, 1992 under the direction of Jennifer J. Robins and overall guidance of Dr. Hallett H. Hammatt. Periodic field supervision was also provided by Douglas Borthwick, Brian Colin, William Folk and Matthew McDermott.

During different times the field crew consisted of: Alika Anixt, Timothy Barr, Brett Bronson, Tyler Campbell, Ingrid Carlson, Joy Collins, Tom Devereux, Edward Duncan, Melody Heidel, Ian Masterson, Bryce Myers, Michael Pfeffer, Mark Stride and Steve Whitworth.

The present document includes site descriptions, significance assessments, and recommendations specific to the 300-acre proposed Kaloko Honokōhau Business Park. Additionally, this report includes historic background, previous archaeology, site interpretation analysis, summaries based on the existing Inventory Survey report for the 803-acre parcel (Robins et al 2000).

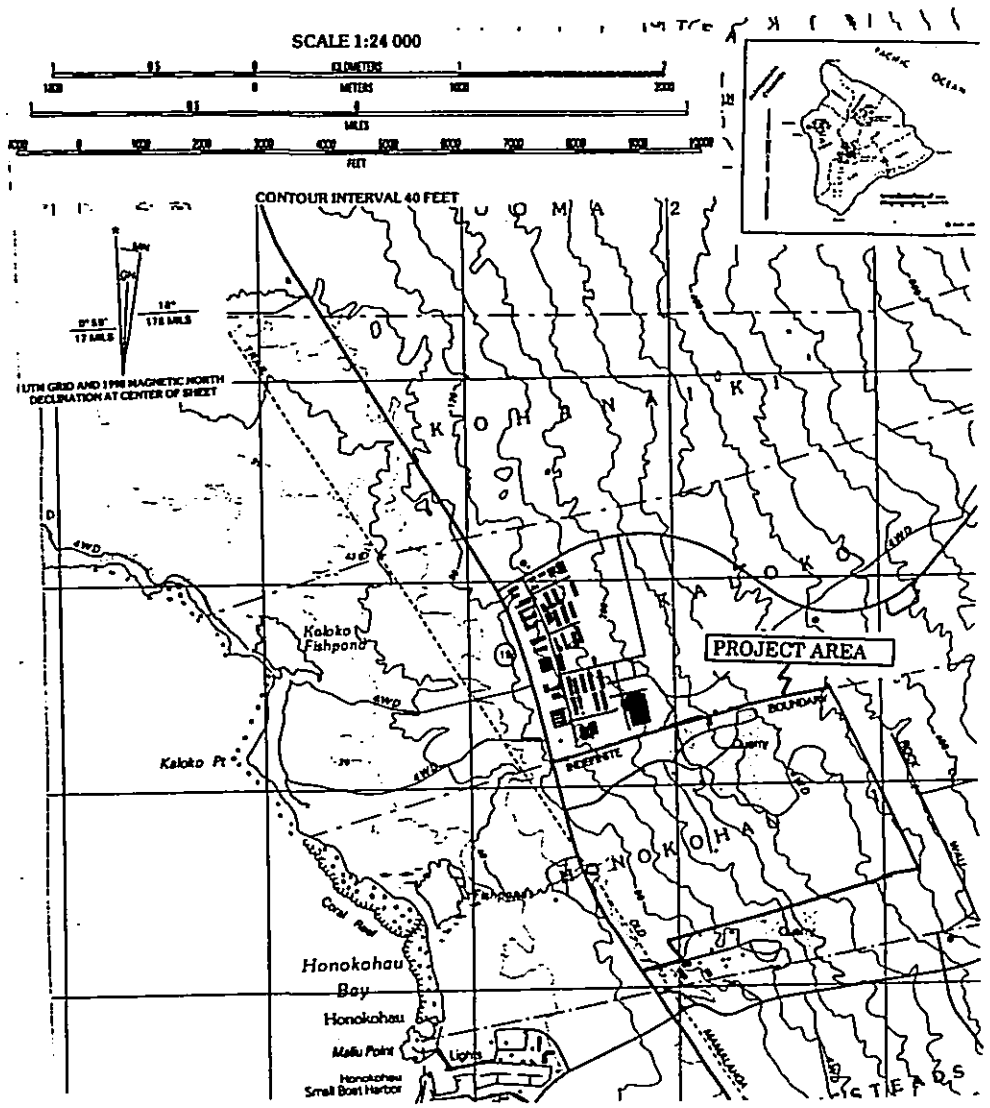

Figure 1 Portion of 1996 USGS 7.5 Minute Series Topographical Map, Keahole Point Quadrangle, Showing Project Area

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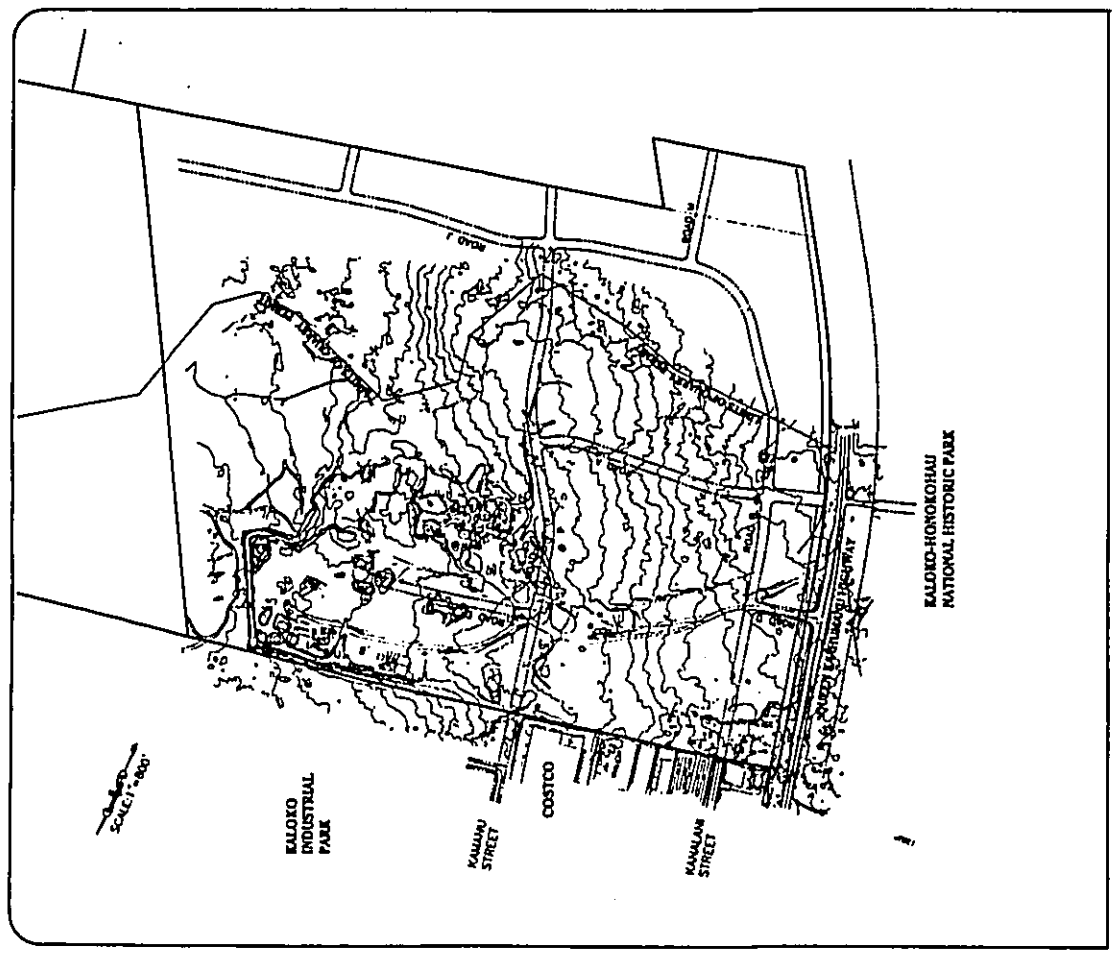

Figure 2 Kaloko Honokohau Business Park, Map by Oknharn & Assoc. Inc. 2000

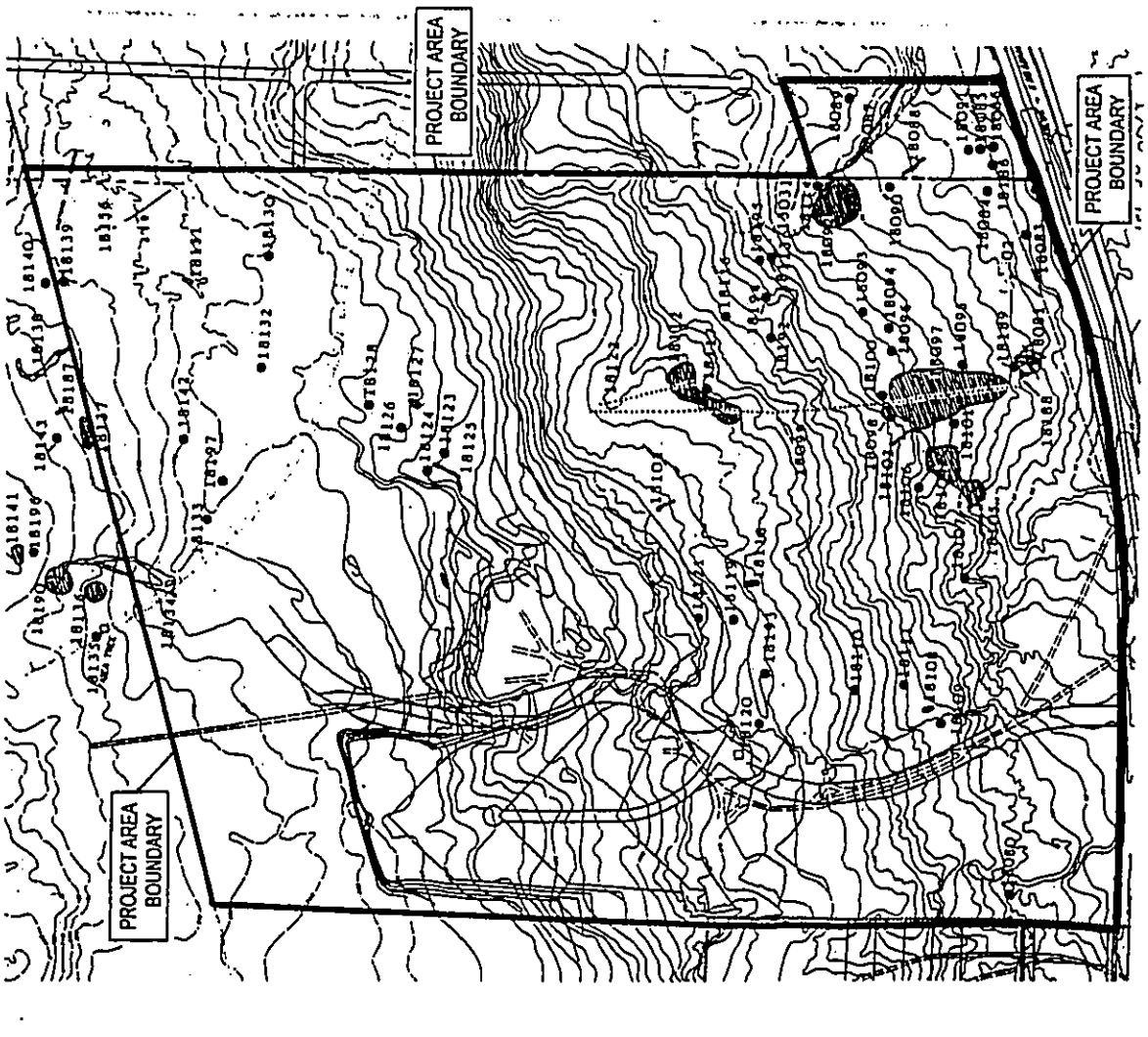

Figure 3 Project Area Showing Locations of Archaeological Sites

B. Scope of Work

The inventory survey scope of work was designed to meet the requirements of the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) review process. Survey procedures included:

1) A complete (100%) ground survey within for the entire 803-acre parcel inclusive of the proposed 300-acre Kaloko Honokōhau Business Park project area. All archaeological sites were located, described and mapped. Field documentation included photographs and scale drawings of most of the sites. All sites were assigned state site numbers. Evaluations including significance and recommended treatment of each site were developed in consultation with the land owner and SHPD/DLNR.

2) Limited subsurface testing to ascertain the presence or absence of human remains and intact cultural deposits, and to obtain datable samples for chronological information.

3) Research on historic and archaeological background, including investigation of historic maps, written records, and Land Commission Award documents.

4) Laboratory analysis of all collected artifacts and midden. Artifacts will remain curated at Cultural Surveys Hawaii until a location is chosen for permanent curation by Lanihau Partners L.P. in agreement with the DLNR-SHPD.

4) Preparation and submittal of a survey report.

C. Methods

Prior to the inventory survey, a planning reconnaissance involving approximately four hours of helicopter surveillance followed by a limited ground inspection of observed site areas and road accesses in May 1990 was carried out by Dr. Hallett H. Hammatt, Mr. Rodney Chiogioji (both of Cultural Surveys Hawaii) and Mr. James Greenwell, (President of Lanihau Partners L.P). This reconnaissance provided a general examination of the project interior in regards to the presence and types of sites, vegetation density and the determination of project boundaries and was used to facilitate the planning of the inventory survey. No letter report was generated as we dealt directly with the project owner.

The subsequent 100% ground survey was conducted by Cultural Surveys Hawaii Inc. over 62 days between March and July 1992, using pedestrian sweeps which were oriented in a north/south direction cross-cutting the slope. The sweep lines were arranged according to a set compass bearing at intervals spaced between 10.0 m. (32.8 ft.) and 20.0

m. (66.0 ft.) depending on ground visibility. Each located site was recorded in detail and most sites (except cattle walls and some of the minor agricultural features) were mapped to scale. All sites were photographed when possible. Temporary site numbers (prefixed by CSH) and feature designations, when necessary, were assigned to each site. Yellow flagging tape labeled with the temporary site number and other pertinent information was tied above the site and a second marker - using a white plastic or metal tag - was placed on the site structure itself. Each site was recorded by formal site type using descriptive categories presented in the Survey Results section of this report. Significance and recommended treatment were determined on the basis of site complexity, configuration, and apparent function (See 6-9). All sites were plotted onto a 1 in. = 400 ft. project map using measurements from a compass and tape to known landmarks. Significant sites preliminarily recommended for preservation were plotted on the project map by a professional survey company.

During the fieldwork an attempt was made to consolidate related features into site complexes. Estimations of feature association were typically based on the following considerations: proximity, similarity in construction technique, condition, functional inter-relationships, and inclusion within a larger enclosure wall. Likewise, concentrated agricultural features (e.g., mounds, terraces, and walled fields) were organized into groups or complexes according to their proximity and similar construction style. Each agricultural complex was recorded in detail and a portion was representatively mapped to scale.

Limited subsurface testing was conducted at a variety of site types located throughout the project area. The tested sites consisted of suspected burial platforms, agricultural features and habitations sites including lava tubes and surface structures. Terrace, platform and mound structures were tested using controlled excavation to the base of construction. Where soil was present, controlled excavation was extended to bedrock or culturally sterile soil layers with contents screened through 1/8-inch mesh screens. Results of the subsurface testing are included with the individual site descriptions and in an overall testing summary in the Survey Results section of this report.

II. NATURAL SETTING

The proposed Kaloko Honokōhau Business Park project area comprises approximately 300 acres in the *ahupua`a* of Honokōhau (Honokōhau I and Honokōhau II). The lands are located within the district of North Kona on the leeward coast of Hawai`i Island. The project area stretches between Queen Ka`ahumanu Highway (State Highway 19) at the 40 ft. a.m.s.l. to the 320 ft. a.m.s.l.

Kona weather is typified by afternoon showers brought on by warm air which has been moved inland by light sea breezes. The humid air gradually condenses over higher altitudes throughout the day. At night the land cools resulting in breezes which send warm air back out to sea. Rainfall in the project area averages 20 inches per year (Armstrong 1973).

The land surface is comprised predominately of exposed lava flows (Figure 4). The *Soil Survey of the Island of Hawaii* (Sato *et al.*, 1973) classifies the project area lands in two basic types as follows: 1) pahoehoe lava flow, 2) a`a lava flow. Although lava flows predominate in the project area, soil is commonly found in depressions and sinks in the lava flow surfaces.

The north side of the project area below 320 ft. a.m.s.l. includes a large section of a`a lava with a few fingers of a`a in the south and central portion. Pahoehoe lava dominates the central portion of the project area.

Winona P. Char in a *Botanical Survey of* Honokōhau *I and II* for Lanihau Partners L. P. (December 1991) described four regions of vegetation within the 803-acre parcel. Her area IV alone pertains to the present project area which is described as the Fountain Grass Shrubland (200-400 ft. a.m.s.l.).

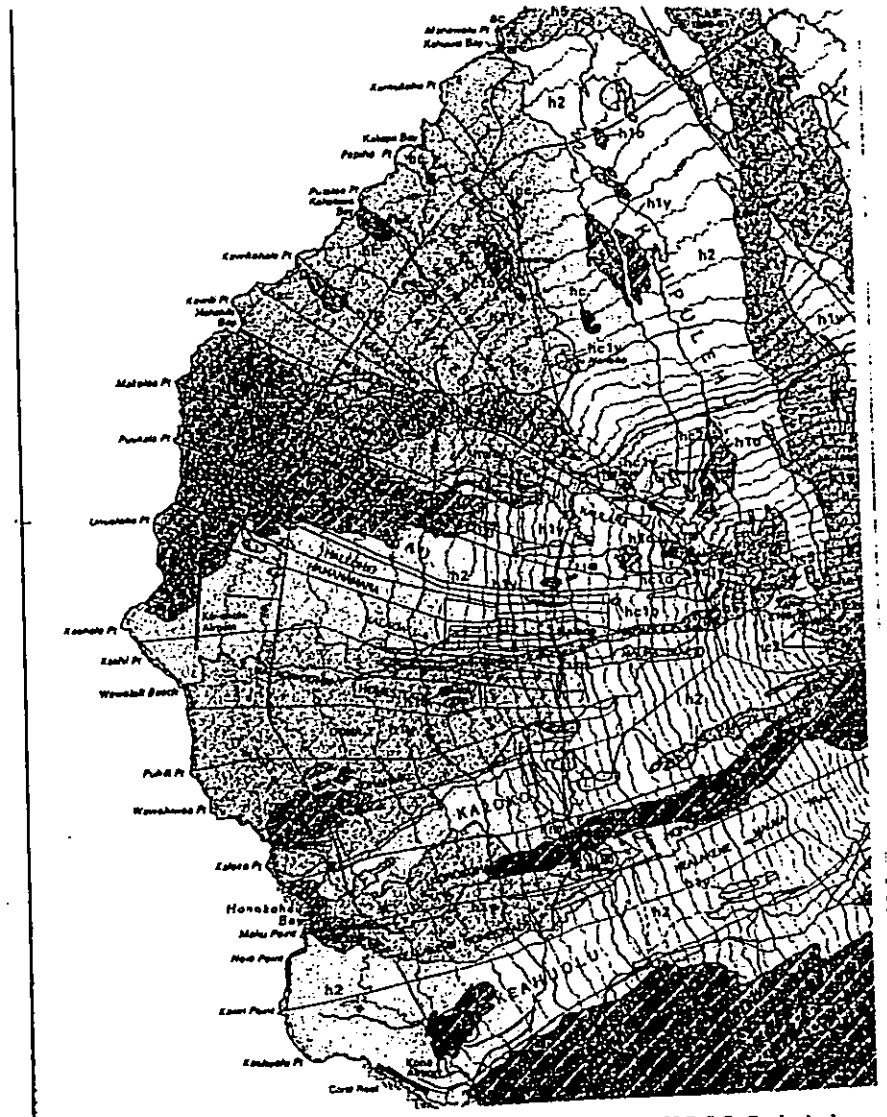

Figure 4 Portion of Lava Flow Age map for the Island of Hawai`i, U.S.G.S. Geological

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III. CULTURAL AND HISTORICAL SETTING

Introduction

I was born at Kailua at the time of the death of Kamehameha I...
Kahuanui (*kane*)

I was born at Honokōhau on Kealakehe Kona Hawaii, at the time of Palakee...
Kamohai (*kane*)

I was born at Kaloko North Kona Hawaii at the time of Keikipuipui, the building of the heiau at Kailua...
Nahuina (*kane*)

I was born at Kohala Hawaii, at the time of Kapai and of Keoua...
Hoohia (*kane*)

These statements, given by older Hawaiian men on August 12, 1873 during their testimonies to the Commission of Boundaries for the Third Judicial Circuit (Hawai'i island) on the boundaries of three adjacent *ahupua'a* - Honokōhauike (Honokōhau II), Honokōhaunui (Honokōhau I) and Kaloko - provide an insight into the perception of their history and of events marking the passage of time still extant among native Hawaiian residents of these *ahupua'a* well into the nineteenth century. The men's testimonies, when discussed later, will render a vibrant picture of the *ahupua'a* of Honokōhau II as it had shaped - and been shaped by - the Hawaiians prior to Euro-American contact.

The pioneer nineteenth-century Hawaiian historian Samuel M. Kamakau mentions Honokōhau in an account of an extraordinary day's reconnaissance of the west coast of Hawai'i island by the spy Ka-uhi-o-ka-lani, sent to the island by Kama-lala-walu, chief of Maui. Having reached Kawaihae by canoe at night, Ka-uhi-o-ka-lani "ran about that same evening [reaching as far south as Ka'awaloa] and returned before the canoes were dismantled..." Ka-uhi-o-ka-lani, recounting his journey and the landmarks he had observed, mentions: "I went on to the long stretch of sand, to the small bay with a point on that side and one on this side. There are large inland ponds." He is told that the "sandy stretch is 'Ohiki, and the walled-in ponds are Kaloko and Honokōhau." (Kamakau 1961: 56).

Kamakau also includes Honokōhau in a litany of lands inquired about following the division of Hawai'i island *ahupua'a* among the *ali'i* after the death of Kalaniopu'u in 1782. Keoua Kuahu-'ula asks Kiwala'o:

> 'Are Ola'a and Kea'au ours?' The chief answered, 'They have been given away; they are not ours.' 'How about Waiakea and Ponahawai?' 'They have been given away; they are not ours.'...'The two Napu'u and the two Honokahau are ours?' 'They have been given away; they are not ours.' (*ibid*, 120)

These accounts suggest that Honokōhau I and II were at least conspicuous in the Hawaiians' comprehension, as represented by Kamakau, of their history. However, other early nineteenth century documentation -censuses, missionary records, and reports of travelers - make no specific mention of either Honokōhau I or II. A more vivid picture of land use in the two *ahupua'a* is indicated in documentation produced during the second half of the 19th century.

The *Māhele* and *Kuleana* Documents (1848-1853)

Records for Land Commission Awards (LCAs) conferred at mid-century provide the first explicit clues to the possible traditional importance and to land usage patterns of the two Honokōhau *ahupua'a*. At the Māhele (1848), the *ahupua'a* were given to two members of the reigning *ali'i*. Honokōhau I - comprising 2653 acres - was awarded (LCA 11216) to Mikahela Kekauonohi, great-granddaughter of Kekaulike (ruler of Maui); Honokōhau II - 480 acres - was awarded (LCA 9971) to William Pitt Leleiohoku, husband of Nahienaena (daughter of Kamehameha) and, later, of Princess Ruth Ke'elikōlani.

Subsequent *kuleana* awards (1850s) within the two *ahupua'a* were given to eleven individuals, none of which are within the present project area. The *kuleana* were situated between the 800 and 1600 ft. a.m.s.l.

No individual *kuleana* claims were made in the present project area.

Commission of Boundaries Documents (1873)

Additional clues to the life of the two Honokōhau *ahupua'a* come to light in records of the 1873 Commission of Boundaries proceedings concerning the *ahupua'a*. The commission records concerning Honokōhau II are especially revealing. J.O. Dominis, agent for Ruth Ke'elikōlani (widow of William Pitt Leleiohoku), had petitioned a hearing by the commission "for the settlement of the boundaries of the land of Honokōhauike [i.e., Honokōhau II] situated in North Kona Island of Hawaii." Three witnesses, all native Hawaiians familiar with the *ahupua'a*, gave their testimonies on August 12, 1873. The testimonies contain many place names no longer indicated on modern maps. These place names are associated with land features and constructions which hint at the once thriving traditional Hawaiian life once occurring within the *ahupua'a*. The testimony of Hoohia suggests how intricately and usefully known the land was by its inhabitants:

> Commencing at the sea shore the boundary between Honokōhaunui and Honokōhauike is at a place called Kuanawai said place is in the water, thence up the sand beach to a place called Pohakuhaiku a heiau on the pahoehoe, from thence the boundary runs to Puumau an ai aina or ahua, an old resting place where a koa tree used to stand at a crook on the road thence up the iwi aina to Keauakaluapuaa a cave, thence to Ulukukahi a breadfruit tree thence to an ohia tree called Ohiakaumaia thence up the iwi aina to Kuakahela a lae ohia fruit trees, thence to Mumuku a breadfruit tree on the North Side. From Kuakahela the trail runs mauka along the boundary from

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Mumuku through Ikuana, an old kulana kauhale, and along the road, mauka to Kapiopio punawai, thence the boundary runs up mauka along the iwi to Kumumanaike, a water hole and bathing place. (The Government road is mauka of Mumuku.) From Kumumanaike the boundary runs to ma Laiula, a banana grove in the edge of the ohia woods; where Honokohaunui and Kealakehe unite thereby cutting Honokohauike off. There turn makai along Kealakehe to Waiha a punawai at the old kulana kauhale below the woods, thence makai along the iwi aina to Waiopapa, a punawai and ahua above the Government road, where you can look out to sea. Thence makai to Kaneopua an ai aina on the boundary, below the Govt. road, at the junction of ...[?] boundary of Kealakehe and Honokohauike. Thence makai to Kukanoonoo, an old kulana kauhale...thence makai to Kukuipualoa an ahua pohaku (resting place) coming to the aa. Thence to Kahawai aina, a mahina ai in aa, thence makai to Puunoho on the pahoehoe, said place is an ahua thence to Pahoehoeea, still on pahoehoe, thence makai to Maliu a lae. the sea bounds the land makai; and there is a very small fishing right cut off by the sea of Kealakehe and Honokohaunui.

Noteworthy in these boundary commission testimony are the references to the two old kūlana kauhale" (literally, a plurality of houses; hamlet, village, or residential cluster; See Pukui & Elbert 1984, Andrews 1985; and Kirch, ed. 1997), named Ikuana and Kukanoonoo, the three *pūnāwai* (water spring), and the "water hole and bathing place" Kumumanaike, all features of the *ahupua`a's mauka* portion. In the *makai* portion of the *ahupua`a*, the *heiau* identified as Pohakuhaiku may correspond to the unnamed *heiau* recorded approximately 500 feet inland from the coast and in the vicinity of the *ahupua`a* boundary during an archaeological survey (Emory and Soehren 1971) of the coastal region (see Previous Archaeological Research section of this report). Also mentioned is a *heiau* named Halekuo between the Government Road and the sea which informant Kamohai described as the wall above the school house and a few sentences later as a *heiau*. The following map (Figure 5) is an attempt to situate on the boundary of Honokōhau II the place names and features identified by Hoohia along with those mentioned by the other witnesses. These names create a poignant image of what must have been a comprehensive acquaintance with, use of, and feeling for the *ahupua`a* by its inhabitants.

Ranching

Archaeological studies have not focused upon sites of the ranching history period, although numerous cattle walls, corrals and tree protective walls have been well documented. Several museums also have displays of that part of our Hawaiian heritage and have artifacts and crafts associated with ranching, such as those at the Parker Ranch Museum and the Kona Historical Society Museum.

Cattle were first introduced to the island of Hawaii by George Vancouver in 1793 and horses in 1803 by Richard Cleveland. Kamehameha I, to give the cattle a change to reproduce and increase, put a 10-year protective taboo (*kapu*) on cattle and they flourished with no natural enemies. But by 1803, roaming wild cattle began to destroy homes, .

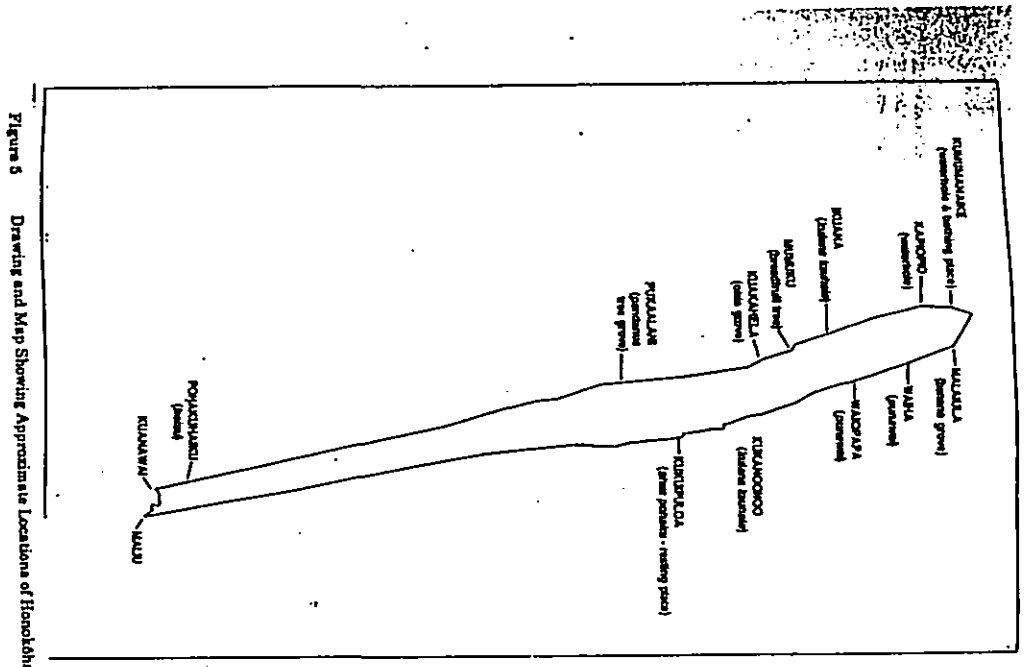
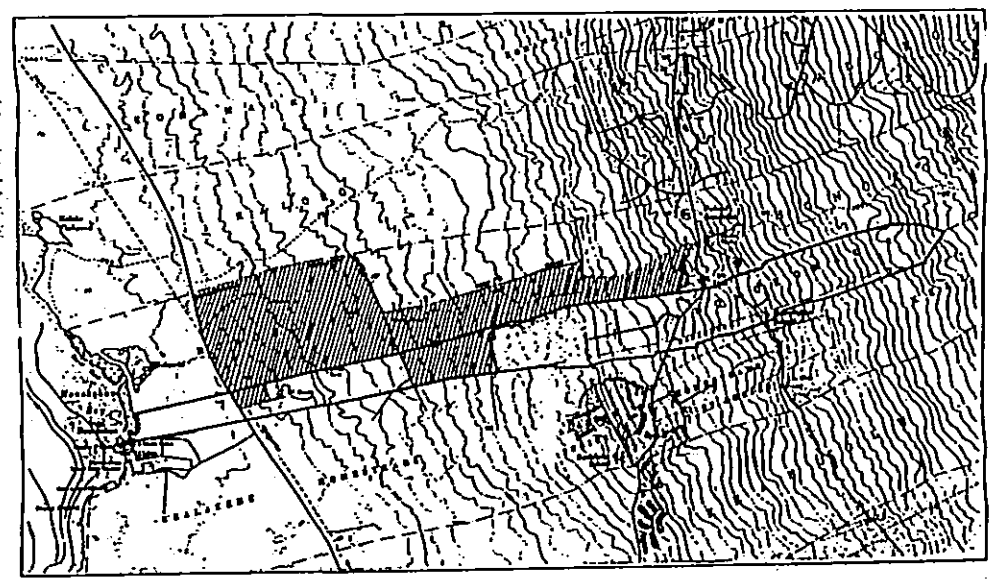


Figure 5 Drawing and Map Showing Approximate Locations of Honokōhau II Place Names and Associated Activities



gardens, and orchards. To respond to this destruction, Kamehameha I hired bullock hunters to kill cattle. For a while cattle hides and fat or tallow were a new island industry.

The residents in areas where cattle roamed freely, responded by either abandoning land or building stone walls to keep cattle out of the cultivated areas and away from their houses and sheds. These new walls were built higher than had previously been customary, in order to keep the cattle from eating the thatched roofs [(Lynn J. Martin, editor 1987) and *Aloha Cowboy* (Cowan-Smith, Virginia and Bonnie Domrose Stone (1998)]

In 1832, because of the increased value of cattle and the need to control them, Kamehameha III brought in *vaqueros* (cowhands or cow handlers of Mexican, Indian and Spanish descent) to train Hawaiians in the handling of horses and cattle. The Hawaiians and others who learned from these *vaqueros* became cowboys well before many in the Western United States (Martin 1987: p.20).

The development of organized cattle ranching, initiated around 1820, as with sugarcane plantations, was most changed by the *Māhele* (1848) laws which for the first time in Hawai'i, allowed for the ownership of land, and for the foreign-born settlers to own land. Fences and corrals were built in the vast tracts of formerly open land to contain the captured cattle, and then foreign stock was brought in for breeding. Once the fences and corrals were built, they needed to be maintained, and this was one of the many regular tasks of the Hawaiian *paniolo* in addition to the more occasional cattle round-ups and shipping to slaughter houses (Strazar in Ranching in Hawaii 1988: xiv-xv).

Specifically, for the project area. the development of the *mauka* portions of Honokōhau I and II during the last quarter of the nineteenth century and throughout the twentieth century would focus on the activities of the Greenwell family. Henry Nicholas Greenwell, an Englishman, had arrived on Hawai'i island during the 1850s and soon began purchasing and leasing land. After starting out growing oranges, Greenwell would expand his commercial interests to coffee and sheep and cattle ranching. The lands of Honokōhau became a part of Greenwell's holdings sometime between the 1870s and his death in 1891. During the twentieth century, the Greenwell Ranch lands of Kona were divided into three units with the Honokōhau holdings becoming the Frank Greenwell Ranch, named for a son of Henry N. Greenwell who had managed that section. A 1929 publication described the Frank Greenwell Ranch:

> This...is also known as Honokōhau Ranch and Hualalai Ranch. The total area is about 20,000 acres, one-half of which is suitable for grazing; it stretches from the sea to an elevation of 5400 feet. Four thousand acres of this area are fee simple, the remainder is leased land.
>
> The herd on this ranch is approximately 1500 head. Between 300-350 cattle averaging three to four years of age with an average weight of 525 pounds are marketed annually in Honolulu. In addition ninety head are annually slaughtered locally. The cattle for Honolulu are loaded at Napoopoo. The ranch is well fenced into fifteen paddocks by 20 miles of stone wall and 12 miles of wire fencing.

> The ranch now carries 9 Hereford and 3 Shorthorn bulls. Cattle are bred from June to February. From November to April only about one-half of the paddocks are used, the others being too dry over these months. September is perhaps the wettest month in Kona. Only enough horses for use on the ranch are raised. (Henke 1929: 26-27)

The Frank Greenwell Ranch subsequently became the Palani Ranch Company. According to information provided by the company, Palani Ranch in modern times has carried over 3000 head of Angus and Hereford cattle per year.

James M. Greenwell, grandson of H.N. Greenwell and son of Frank Greenwell, provided details of his family's life in Kona and, more specifically, at Honokōhau [personal communication 9/14/92]. Mr. Greenwell recalled that dairy cattle ranching on Henry N. Greenwell's Kona lands began in the 1870s at the time when the first Portuguese immigrants arrived in Hawai'i. Henry N. Greenwell formed partnerships with Portuguese families in which the families would live on Greenwell's land and turn out dairy products.

Mr. Greenwell remembered that his father Frank planted mango and other introduced trees on portions of the Honokōhau ranch property. Some of these trees were protected by individual surrounding walls.

Mr. Greenwell noted that, sometime early in this century, a paddock of the ranch below Palani Road but above the present project area was leased to the Kuni and Isomoto families for growing coffee. (During the present interview, Mr. Greenwell pointed out the house sites of these two families and referred to the area as "Kuni paddock".) After the collapse of the coffee market, the families grew avocado and citrus fruit trees. Mr. Greenwell recalled that the families would build protective walls around these trees to protect them from animals.

Coffee

Mr. Greenwell's reference to coffee growing by Japanese families brings to light another commercial activity within Honokōhau paralleling the development of ranching. Thomas Thrum, writing in the 1870s on the history of coffee in the Hawaiian Islands, records that coffee was first introduced "on Hawai'i, in . . . Kona, about...1828 or 9, Rev. Mr. Ruggles planting the first slips in Naole, Kona, - the property now occupied by H.N. Greenwell, Esq." (Thrum 1876: 46-47). Thrum notes that the coffee industry in Kona - the "center of [coffee] cultivation [on Hawai'i Island which] . . . both from soil and climate produces the choicest article" - subsequently expanded despite a scarcity of labor, fluctuating prices, occasional drought and blight.

Thrum mentions H.N. Greenwell again when he brings his account up to the 1870s and suggests that the burgeoning coffee industry in Kona was not based upon large plantation-type operations:

> Mr. H.N. Greenwell of Kona, trader, takes great pains in his selections for the market, and any bearing his mark is a sufficient guarantee in Honolulu market of fully ripe, well dried and clean aromatic coffee. There is an idea prevalent that Mr. G. is a grower of this article [*i.e.* coffee], but that is erroneous. The coffee is almost wholly in the hands of the natives with little patches here and there throughout the district, who gather it in its season and dispose of the same to the stores located near them. (Thrum 1876: 51)

With the influx of Japanese immigrants to the Hawaiian Islands during the second half of the nineteenth century, the cultivation of coffee at Kona would no longer be "almost wholly in the hands of the natives" though planting likely continued to be concentrated upon "little patches here and there throughout the district":

> Most Japanese immigrants in Kona came from three prefectures of Japan: Kumamoto-ken, Hiroshima-ken, and Yamaguchi-ken. They were mostly sugarcane laborers and coffee farmers, and lived in Kailua, Holualoa, Kainaliu, Kealakekua, Honaunau, Captain Cook, and Napoopoo. The majority of these immigrants came directly from Japan during periods of government contract or liberal immigration from 1885 to 1923. (Nakano 1990: 45)

Noboru Yamamoto, a kama'āina coffee grower of Kona, provided details of life in Kona during the earlier decades of this century when Japanese immigrant families were the mainstays of the coffee farming industry [personal communication 2/21/93]. Mr. Yamamoto remembers that most of the coffee farms were on leased land and ranged in size from five to seven acres. The trees were not distributed in any special order but had been planted wherever they would grow. It was only in the later 1930s, Mr. Yamamoto thinks, that he began to see farms with trees planted in straight rows. Mr. Yamamoto also noted that, after the coffee beans had been picked in the field, the beans were dried on wooden frames near the house. No drying operation took place in the field.

Mr. Yamamoto remembers both the Kuni and Isomoto families of Honokōhau. He believes that all members of the Kuni family who had operated the Honokōhau farm are presently deceased. He believes that one member of the Isomoto family survives today. Though coffee was a major economic commodity in Honokōhau, none was grown in the lower elevations (*i.e.* 40-320- ft. a.m.s.l.), within the present project area.

Early twentieth century maps and photographs show a village along the coast of Honokōhau comprising frame houses, a chapel and schoolhouse. No records were uncovered documenting dates of construction for these structures. Apparently, by the 1920s the village had been abandoned. During the second half of the present century, developments beyond ranching and coffee have occurred within Honokōhau. These include the establishment of the Kaloko-Honokōhau National Park at the coast, of an industrial park *mauka* of Queen Ka'ahumanu Highway, residential subdivisions off Māmalahoa Highway and Palani Road and of direct impact to the present project area, the modern quarry.

Summary

The historical record suggests that the *ahupua'a* of Honokōhau I and II experienced significant Hawaiian occupation during both prehistoric and historic times.

The coast of Honokōhau I and II was valued for its fish ponds and sandy coastline that provided easy access for seafarers. Boundary commission testimonies of the late 19th century provide names of at least two upland hamlets or villages or - presumably prehistoric and early historic - which, at the time of the testimonies, had already been abandoned. *Kuleana* award testimonies (although few in number) indicate the cultivation of taro and potatoes at the higher elevations.

Eventually purchased by the Greenwell Family, the *mauka* portions of the Honokōhau *ahupua'a* were converted into pasture by the early 20th century. It was during this time that coffee farming occurred at higher elevations (ca 1,000 ft. a.m.s.l.) than the present project area.

The Honokohau Quarry has impacted approximately 90+ acres of the project area since its inception in the 1960s. The quarry activities have included creating a large excavated block over 50 ft. deep, extensive bulldozing, construction of a number of buildings and associated roadways. The quarrying has affected the site distribution pattern within the project area due to the extensive/intensive land altering activities.

IV. PREVIOUS ARCHAEOLOGICAL RESEARCH

The first archaeological research undertaken in Honokōhau I and II *ahupua`a* focused on the coastal region.

John F.G. Stokes of the B.P. Bishop Museum in 1906 surveyed *heiau* sites on the island of Hawai`i; Stokes followed a list of *heiau* prepared by Thomas G. Thrum. Stokes records one site:

Pu`uoina Heiau

Bishop Museum Catalogue: 50-Ha-D12-1
State of Hawaii Catalogue: 1901

Heiau of Pu`uoina, described as in Honokōhau 2 *ahupua`a*, near the shore.
(Stokes and Dye 1991: 43)

Stokes's minimal entry for the *heiau* suggests that he did not personally inspect the *heiau* site.

In the late 1920s, John E. Reinecke of the B.P. Bishop Museum surveyed Hawai`i island archaeological sites extending from Kona to Kohala. In Reneicke's yet unpublished manuscript (Reinecke 1930: 11-12) detailing his survey, nine sites - Reinecke sites 38 to 42 -were documented within the coastal region of Honokōhau I and II. These sites include the *Pu`uoina Heiau* originally identified by T.G. Thrum and J.F.G. Stokes, various residential complexes and features, a portion of a *holua* (slide), petroglyphs, *papamū* and animal pens. The two fishponds - Aiopio in Honokōhau II and Aimakapa in Honokōhau I - and several modern burial sites are also mentioned in Reinecke's manuscript. Of particular significance is Reinecke's detailed description of *Pu`uoina Heiau* which he noted was utilized as a canoe platform at the time of his survey. A "broken house wall", which he had been told was a remnant of an old school house, was located along the coastline of Honokōhau I.

During the second half of the twentieth century archaeological investigations of Honokōhau have been generated in response to increased development within the *ahupua`a*. These studies are discussed below; their locations are shown in Figure 6. In 1961 Kenneth P. Emory, at the request of the Department of Land and Natural Resources, directed an archaeological reconnaissance along the coast of Honokōhau I and II, Kealakehe and Kaloko *ahupua`a* (Emory and Soehren 1971). As a result of this work, a total of 33 sites were recorded specifically in Honokōhau I and II, most of which included those sites earlier identified by Reinecke; all sites were assigned Bishop Museum numbers. These sites - as indicated in Reinecke's survey - include residential clusters (*kahua hale*) and complexes focused predominantly along the inland perimeter of Aimakapa Fishpond and scattered to the south in Honokōhau II. Recorded sites include: two *heiau* (one of which is *Puuoina Heiau* - both are located in Honokōhau II), the *holua*, animal pens, burial platforms, a "clearing" (leveled areas of an a`a flow), petroglyphs, *papamū* and trails. A graveyard described as "modern" by Reinecke was further documented by Emory and Soehren. These graves represent both traditional Hawaiian and European burial practices.

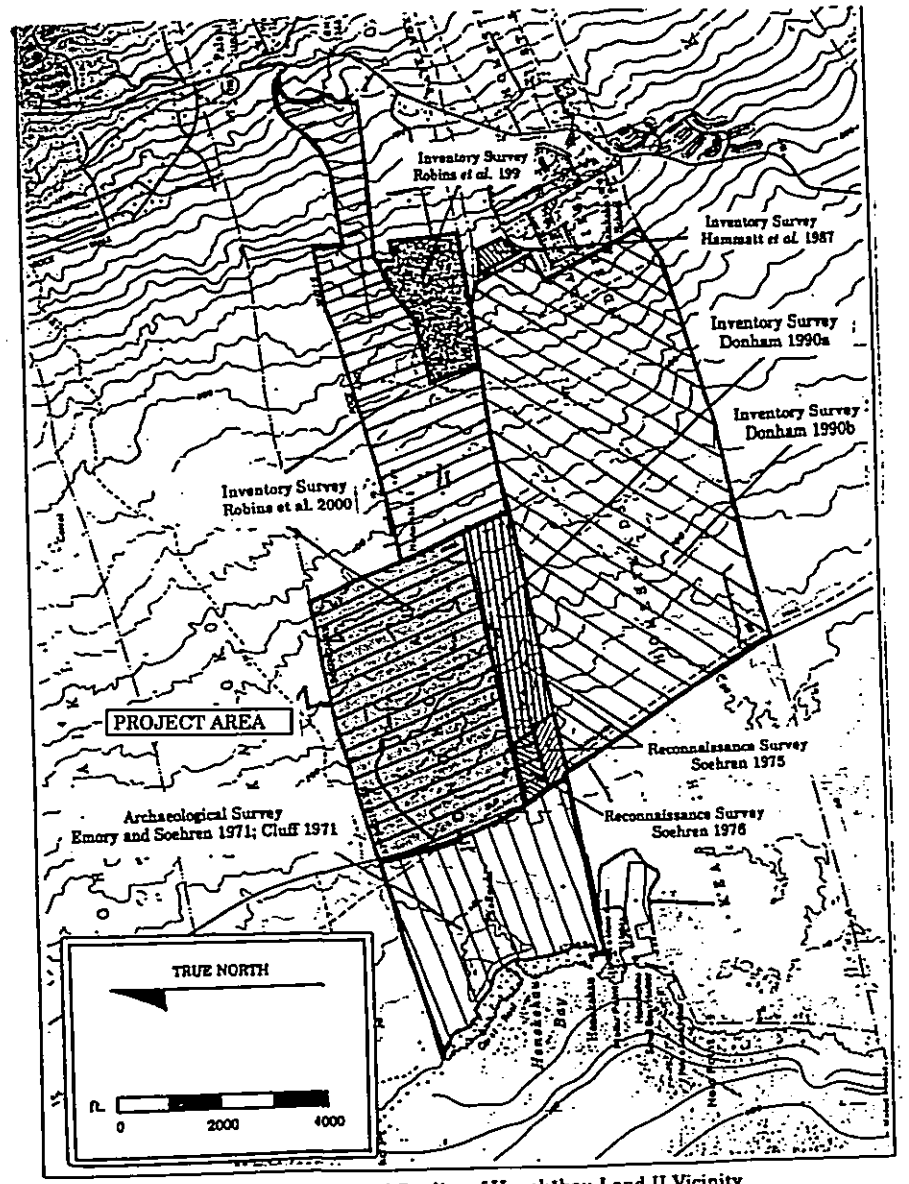


Figure 6 Previous Archaeological Studies of Honokōhau I and II Vicinity

The burial remains were placed within excavated pits in the lava and are covered by corrugated iron and/or a paved surface. One grave clearly of European style is a concrete tomb engraved: "W.P. Kahale. Born in Dec. 31, 1857. Died in Oct. 15, 1915" (*ibid*, 4). An abbreviated historical background section of the Emory and Soehren report reveals that up into the 1920s "frame houses stood about the bay" along with an "abandoned school and chapel" (Emory and Soehren 1971).

Emory and Soehren suggest that the Honokōhau coast - with its fishponds and easy access for canoes - was reserved specifically for the *ali'i*. This is evidenced, they believe, by the multitude of house sites, *holua*, and prominent *heiau*, and the fact that the lands of Honokōhau were given to *ali'i* during the *Māhele*.

In 1969, under the direction of Deborah Cluff (1971), a subsequent archaeological survey of the Honokōhau coastal area was conducted at the request of the Lanihau Corporation. This work was accomplished to supplement the reconnaissance work of Emory and Soehren's survey, expand survey coverage and to provide significance evaluations and recommended treatments of the cultural resources. Cluff's survey focused specifically on Honokōhau I and II, extending from the coast to Queen Ka'ahumanu Highway. The survey was separated into six discrete areas, designated Areas 1 though 6 (Figure 7). Although the methodology is a bit unclear, it appears that Cluff expanded the site inventory with detailed mapping and formal descriptions of 61 "features". The features are assigned Bishop Museum site numbers following consecutively from Emory and Soehren's site numbering system. Area 1, between the coast line and Kaloko *ahupua'a*, contained an estimated 100 sites including trails, rock shelters, walls and scattered graves. In a section within Area 1, designated Area 2, 10 features (predominantly grave sites) were mapped and recorded in detail. Area 3, located adjacent to Queen Ka'ahumanu Highway and south of Kaloko *ahupua'a* contained only 2 sites, a burial and a trail. Fifty-two (52) features, located in Area 4 along the inland perimeter of Aimakapa Fishpond, were mapped in detail; these features include a prominent burial ground on a finger of a'a, various enclosures and platform structures (functions not indicated), shelters, and trails. Area 5 is located adjacent to Queen Ka'ahumanu Highway and north of Kealakehe *ahupua'a*. An estimated 200 scattered features were identified in Area 5 including, primarily, temporary cave and constructed shelters, and animal pens. Cluff suggests that Area 6, located along a coastal sector from the south boundary of Honokōhau II and Aimakapa Fishpond, contains the most significant cultural resources in the survey area. Cluff noted "The archaeological features contained within this area are ... elaborately constructed" ... "and suggest a greater permanency of occupation than those sites in Areas 1 to 5. (Cluff 1971:13) such as permanent habitation and including the *holua*, *heiau* and a multitude of grave sites. Cluff also believes that the cultural resources reflect a good record of cultural change from prehistory into historic times. Archaeological sites in Area 6, thus, were recommended for preservation and 24 sites for "salvage work" or data recovery.

Following the Emory and Soehren (1971) and Cluff (1971) studies of coastal Honokōhau, the National Park Service of the Department of the Interior prepared an Environmental Impact Statement (EIS) study for a proposal to convert approximately 1300 acres of land and offshore water area into a Kaloko and Honokōhau National Cultural Park

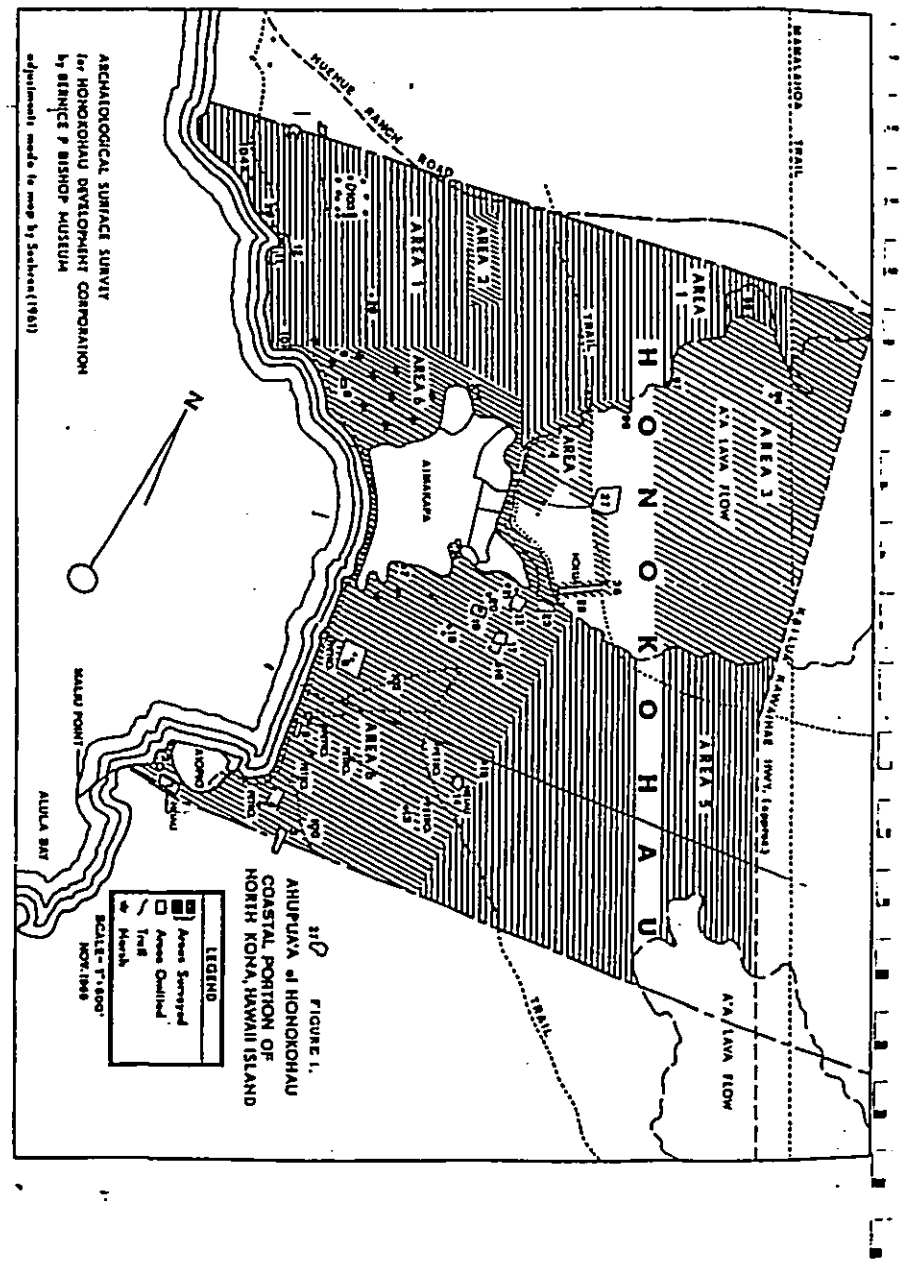


Figure 7 Deborah Cluff Map of Coastal Areas of Honokōhau (Cluff 1971:4, Figure 1)

(National Park Service 1975). This study outlines the cultural and ecological significance of the Honokōhau/Kaloko coastal region and presents plans for cultural interpretation, as well as an estimated impact of the cultural park on the land.

Archaeological studies of the inland portions of Honokōhau II, began with the construction of the Queen Ka'ahumanu Highway. Francis K.W Ching and Paul H. Rosendahl conducted a reconnaissance survey for the highway corridor (Ching and Rosendahl 1968). Two sites were identified within the Honokōhau corridor, including a possible terrace, platform, and a foot trail.

In 1975 Lloyd J. Soehren conducted a reconnaissance survey of Honokōhau II of approximately 100 acres between the Queen Ka'ahumanu Highway and an inland elevation of 350 ft. a.m.s.l. (TMK 7-4-08:26, 30 & 33) (Figure 8). Nineteen sites were identified in two designated parcels, including a foot trail (extending from Aimakapa Pond into Kealakehe), a portion of the Māmalahoa Trail, a habitation platform and paved area, lava tube caves, and suspected burial platforms. Soehren tested five of the suspected burials, none of which yielded human remains. Interestingly, Soehren postulates that these suspected burial sites were of great antiquity and, therefore, the skeletal remains have disintegrated over time.

In 1976 Soehren conducted a similar level of archaeological reconnaissance in TMK 7-4-08:30, 33 in Honokōhau II, Soehren identified three sites including another portion of the Māmalahoa Trail, a collapsed cairn, and a low stone wall.

Paul H. Rosendahl, Inc. conducted an archaeological inventory survey of 89.5 acres in Honokōhau II. This project area covers the width of the *ahupua'a*, beginning at approximately 1000 feet (305.0 m.) east of Queen Ka'ahumanu Highway and extending to the 350 ft. elevation contour (Donham 1990a). It encompasses portion 26 (TMK 7-4-08) of Soehren's reconnaissance survey area. The survey area abuts the present project area along the southern project boundary. A total of 60 sites were documented within the project area; eight (8) sites previously identified by Soehren were relocated. The site inventory is dominated by features (69% of the total 207 features) related to agriculture and by temporary habitation sites. A portion of a *maukalmakai* kerbstone trail (Site 50-10-28-13006) was also identified in the eastern portion of the project. Excavations were conducted at four sites: a possible burial mound and three cave shelters. No human burials were encountered as a result of the testing. Radiocarbon analysis of five charcoal samples taken from the three cave sites produced calendric dates extending into the modern era, ranging between 1630-1955 and 1650-1955. Other samples produced less definitive dates with alternate ranges.

Paul H. Rosendahl, Inc. (PHRI) completed an archaeological inventory survey of a 950-acre project area in lands of Kealakehe and Keahuolu *ahupua'a* (Donham 1990b). The project area encompasses the width of Kealakehe and extends between the Queen Ka'ahumanu Highway to as high as Palani Road in Keahuolu. The PHRI survey documented 82 sites including four previously identified sites. The sites include agricultural features (87.6 % of the feature total) related to intensive agriculture

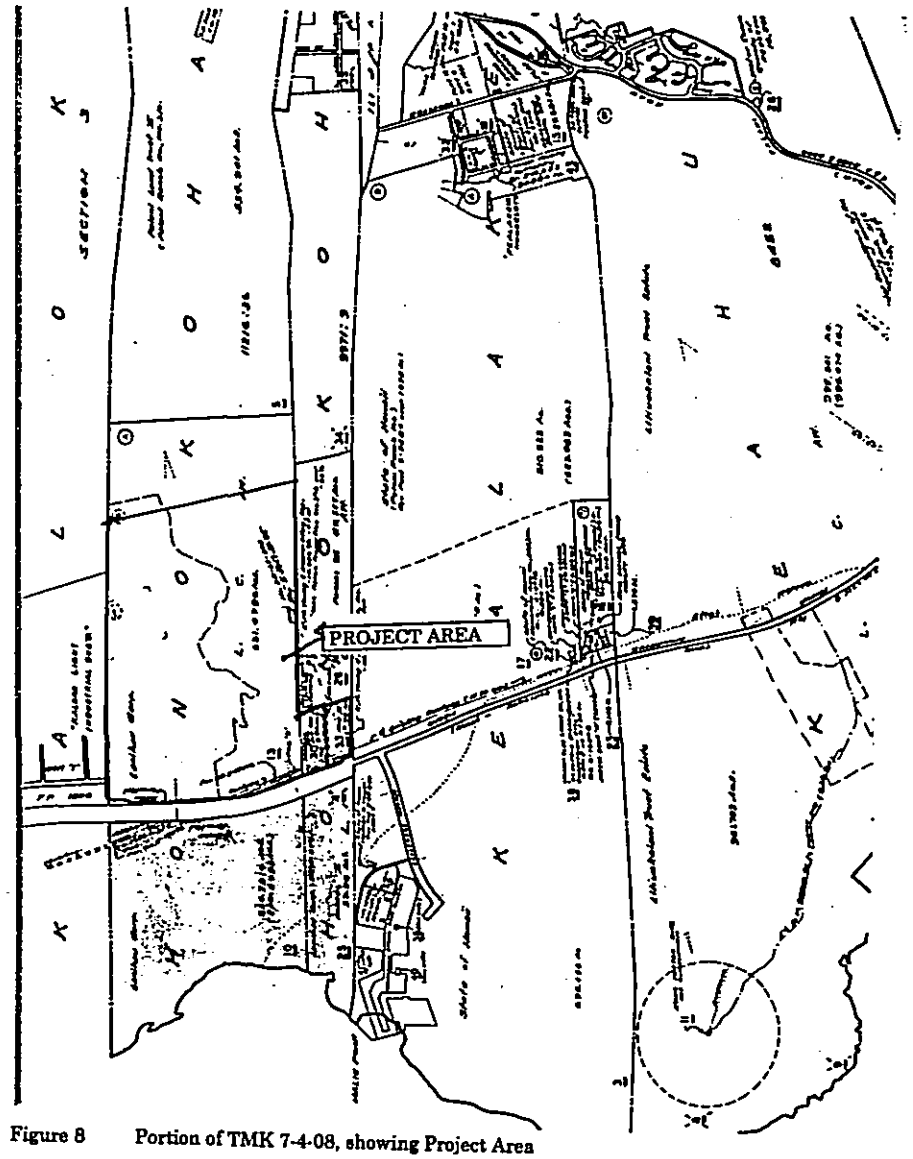


Figure 8 Portion of TMK 7-4-08, showing Project Area

habitation units, trails, possible ceremonial features, possible burial features and land division and ranching features. Of the total site inventory, 54 sites were recommended for "Further Data Collection"; 10 sites were recommended for "Further Data Collection - Preservation With Interpretive Development"; four (4) sites were recommended for "Further Data Collection-Possible Preservation With Interpretive Development"; four (4) sites were recommended for "Further Data Collection-Possible Preservation `As Is'"; and one site was recommended for preservation "As Is". During a subsequent survey PHRI identified three sites (K-15, K-16 and K-17) within Honokōhau II, which were allotted State Site numbers 16302, 16033, and 16034. Based on the documentation the sites were interpreted as temporary habitation (16032) and agricultural (16033 and 16034 (Burgett and Rosendahl 1992:2).

An inventory survey and test excavations were undertaken by Cultural Surveys Hawaii (CSH) within an approximately 82-acre parcel of Honokōhau I (Robins *et al.* 1993). The project area, referred to as "Project 82", is situated east of the present study area between approximately 540 to 810 ft. a.m.s.l. The inventory survey identified 39 sites and complexes, including permanent and temporary residences, intensive dryland agricultural features, human burial, animal pens, an *ahupua`a* wall (between Honokōhau I and II), and structures related to cattle ranching (including "tree walls;" walls around trees to protect them from animal depredation). A concentration of permanent residences were identified at approximately 740 ft. a.m.s.l, representing the lowest elevation of permanent habitation in the project area, with intensive agriculture occurring as low as 550 ft. a.m.s.l. The Robins *et al.* Report suggests that the project area is a transitional area located between a more concentrated inland settlement of the Upland Zone to the east and the lower margins of intensive dryland agriculture in Honokōhau II (*ibid*, 107). Two of the sites - a possible burial platform (Site 50-10-28-18329) and a permanent habitation complex (Site 50-10-28-18343) - were subjected to subsurface testing. A radiocarbon date range of 1645-1950 was obtained from the habitation site (Site 18343) excavation, and a trade bead was collected from this site's surface.

Of the 39 recorded sites in the Project 82 area, 23 were recommended for data recovery and two sites - a burial cave and the subsurface tested permanent habitation site (Site 18343) are preservation status.

Data Recovery work was conducted at two sites (50-10-28-18343 and -18349 in the project 82 parcel subsequently referred to as Paniolo Subdivision. Based on Data Recovery analysis site 50-10-28-18343 was interpreted as an early historic habitation site containing ranching era artifacts. Site -18349 was interpreted as a high walled permanent habitation *ca.* A.D. 1300-1650 (Hammatt *et al.* In progress)

In 1993, Cultural Surveys Hawaii conducted a reconnaissance (Borthwick *et al.* 1993) and subsequent inventory survey of the proposed Kealakehe Parkway Extension, Alternatives 10 and 11 (Barr *et al.* 1994).

A total of 83 sites were located in the Kealakehe Parkway Extension project area. Of the 83 sites, 47 sites were previously recorded as part of the 803-acre inventory survey

(Robins *et al*, 2000) and three sites were previously recorded by PHRI in the Kealakehe Planned Community project area (Burgett 1992). The remaining 33 sites were newly identified during the Kealakehe Parkway Extension survey, the majority of which were located between roughly 550 to 1000 ft. a.m.s.l. in Honokōhau I (Kelly Greenwell property). North and *mauka* (i.e upslope) of the present project area. The sites included intensive agricultural complexes; temporary, recurrent and permanent habitations; historic homesteads (and associated agriculture); animal pens; human burials; petroglyphs and *papamū*; a kerbstone trail; and cart road. In concert with the future treatment of the sites previously identified in the ahupua`a of Honokōhau I and II (Robins *et al.* 2000), mitigation preliminarily established for sites in the Honokōhau 803-acre project), 60 sites were to be subjected to data recovery, seven sites were to be preserved and no further work was warranted for the remaining 16 sites.

The distribution of sites in Kealakehe Parkway Extension project corridors revealed an elevation-based pattern of land use: (1) a band of prehistoric permanent habitation around 600 ft. a.m.s.l.; (2) variations of intensive agricultural methods above approximately 550 ft. a.m.s.l.; and (3) a concentration of historic homesteads and associated agriculture around 900 ft. a.m.s.l. The pattern indicates increasing intensity of use above approximately 550 ft. a.m.s.l.

During the Kealakehe Parkway Extension inventory survey, ten sites (including lava tubes and surface structures) were subjected to subsurface testing. Radiocarbon analysis of samples from five sites provided date ranges within late prehistory and historic times, with one sample, taken from a deep deposit in a lava tube, yielding a probable date range of 1439-1693 A.D. (Barr *et al.* 1994:249).

Summary

The archaeological resources identified by these previous studies indicate an intricate pattern of traditional Hawaiian settlement in Honokōhau I and II during prehistoric and early historic times, and immigrant occupation of a small, upland portion of Honokōhau I during the early 20th century.

Three distinct bands of traditional prehistoric and early historic permanent habitation are indicated in both Honokōhau I and II: (1) on the coast of both ahupua`a; (2) around 500 ft. a.m.s.l. in Honokōhau I and; (3) around 900 ft. in Honokōhau II. In association with the inland settlements, a wide variation of traditional methods of intensive dryland agriculture was identified in both Honokōhau I and II between 500 ft. a.m.s.l. and 1100 ft. a.m.s.l. in Honokōhau I.

Temporary habitations occur more frequently in the lower, drier lands between Queen Ka`ahumanu Highway and approximately the 350 ft. a.m.s.l. that make up the present project area.. Associated with these short-term habitation sites are *mauka-makai* trails in each *ahupua`a*.

A discrete concentration of historic immigrant (Japanese) homesteads, associated primarily with coffee farming, was identified in Honokōhau I around 950 ft. a.m.s.l. These sites also contained features related to animal husbandry and concrete ovens large enough for the commercial production of charcoal. As evidenced by the apparent modification of dryland agriculture walls (*kuaiwi*) in the homestead area, the historic farmers re-used the Hawaiian field system features for their cultivation endeavors.

The 300-acre Kaloko Honokōhau Business Park parcel falls within a transitional zone (i.e intermediate zone) between the coastal zone and the lower limit of the upland zone. Surveys have indicated temporary habitations, non-intensive agriculture, procurement of available resources (*e.g.* lithics), trails, and lava tube related sites would be anticipated in this transitional zone. In the present project are, however, modern quarrying activities have occurred over at least 1/3 of the 300 acres. The quarrying activities have altered by bulldozing, excavating and construction, the landscape and therefore site types and distribution within the project area.

V. SURVEY RESULTS

A. Site Table

Table 1 lists by State Site Number all the sites and features in the Kaloko-Honokōhau Business Park. There are seven columns: the first for the State Site number; the second showing the Cultural Surveys Hawai'i, Inc. field number and feature; the third shows the formal site or feature type; the fourth gives the interpretive function (with P, T, and R representing the Permanent, Temporary and Recurrent Habitations); the fifth is the Probable Age of either Pre-historic or Historic or a combination of both; the sixth column gives the letters of Significance assigned according to national and state historic preservation standards; and the last column gives the recommended treatment of DR, NFR, or P (Data Recovery, No Further Research, or Preserve).

[see following pages for table]

Table 1 - Site Table Kaloko Honokōhau Business Park

SHPD SITE #	CSH SITE #	FORMAL SITE FEATURE	FEATURE TYPE	INTERPRETIVE FUNCTION	PRIORITY	SIGNIFICANCE	RECOMMEND TREATMENT
50-10-27-00002	3	Kerbstone trail	Trail, Portion of Mamalahoa Tr	PH/H	A,C,D,E		P
50-10-27-13031	37	Wall segment	Undetermined	PH	D		NFR
50-10-27-18080	1	Walls	Undetermined	PH	D		DR
50-10-27-18081	2	Petroglyphs	Symbolic	PH	D,E		P
50-10-27-18083	4	Outcrop,modified	Hab. (T)	PH	D		DR
50-10-27-18084	5	Rockshelter	Hab. (T)	PH	D		DR
50-10-27-18085	6	Lava tube	Hab. (T)	PH	D		DR
50-10-27-18086	7	Pecked pahoehoe basin	Undetermined	PH	D		NFR
50-10-27-18087	8	Wall	Undetermined	PH	D		NFR
50-10-27-18088	9	Lava tube	Hab. (T)/burial	PH/H	D,E		P
50-10-27-18089	10	Outcrop, modified	Ag.	PH	D		NFR
50-10-27-18090	11	Complex	Hab. (T)	PH	D		DR
	11A	Lava tube					
	11B	Sink, modified					
50-10-27-18091	12	Petroglyph	Symbolic	H	C,D,E		NFR
50-10-27-18092	13	Complex	Hab. (R)	PH	D		DR
	13A	Lava tube					
	13B	Terrace					
50-10-27-18093	14	ahu	Marker	PH	D		NFR
	14A	ahu					
	14B	ahu					
50-10-27-18094	15	Lava tube-enclosure	Hab. (T)	PH	D		DR
50-10-27-18095	16	Mound	Ag.	PH?	D		NFR
50-10-27-18096	17	ahu	Marker	PH	D		NFR
50-10-27-18097	18	Pahoehoe excavations	Mining?	H?	D		NFR
50-10-27-18098	19	Complex	Hab. (P)	PH	C,D		DR
	19A	Enclosure, rectangular	Hab. (P)				
	19B	Pavement	Hab. (P)				
50-10-27-18099	20	Trail, kerbstone	Trail	PH/H	A,C,D		P
50-10-27-18100	21	ahu	Marker	PH	D		NFR
50-10-27-18101	22	Enclosure remnant	Hab. (T)	PH	D		NFR
50-10-27-18102	23	Lava tube	Hab. (T)	PH	D		DR
50-10-27-18103	24	Trail, stepping-stone	Trail	PH/H	D		DR
50-10-27-18104	25	Enclosure, irregular-shaped	Ag/animal pen	H	D		NFR
50-10-27-18105	27	Wall	Animal pen	PH/H	D		NFR
50-10-27-18106	28	Platform	Undetermined	PH	D		DR
50-10-27-18107	29	Enclosure , circular	Animal pen	PH	D		NFR
50-10-27-18108	30	Outcrop & bluff, modified	Ag.	PH	D		NFR
	30A	Outcrop, modified					
	30B	Bluff, modified					
50-10-27-18109	31	Enclosure remnant	Ag.	PH	D		NFR
50-10-27-18110	32	Enclosure circular	Ag.	PH	D		DR
50-10-27-18111	33	Complex	Hab. (T)/Ag.	PH	D		DR
	33A	Lava tube	Hab. (T)				
	33B	Platform	Ag.				
50-10-27-18112	34	Complex	Hab. (P)/Trail/marker	PH	C,D		DR
	34A	Pavement	Hab. (P)				
	34B	C-shaped enclosure	Hab. (P)				
	34C	Outcrop, modified	Hab. (P)				
	34D	Enclosure, U-shaped	Hab. (P)				
	34E	Pavement	Hab. (P)				
	34F	Pavement	Hab. (P)				
	34G	Pavement	Hab. (P)				
	34H	ahu	Marker				

Table 1 - Site Table Kaloko Honokōhau Business Park cont'

SHPD SITE #	CSH SITE #	FORMAL SITE FEATURE	FEATURE TYPE	INTERPRETIVE FUNCTION	PRIORITY	SIGNIFICANCE	RECOMMEND TREATMENT
	34I	Pavement	Hab. (P)				
	34J	Pavement	Hab. (P)				
	34K	Pavement	Hab. (P)				
	34L	ahu	Marker				
	34M	Trail, stepping-stone	Trail				
	34N	Enclosure rectangular	Hab. (P)				
	34-O	Enclosure, C-shaped	Hab. (P)				
50-10-27-18113	35	Platform	Ag., work area, storage	PH	D		NFR
50-10-27-18114	36	ahu	Marker	PH	D		NFR
50-10-27-18116	38	Complex	Hab. (P)/burial/symbolic	PH/H	D,E		P
	38A	Lava tube	Hab. (P)/burial				
	38B	papamu	Recreation				
	38C	Petroglyph	Symbolic				
50-10-27-18117	39	Lava tube	Hab. (T)/burial	PH	D,E		P
50-10-27-18118	40	Complex	Ag.	PH	D		NFR
	40A	Sink, modified					
	40B	Outcrop, modified					
50-10-27-18119	41	Enclosure rectangular	Hab. (R)	PH	D		NFR
50-10-27-18120	42	Lava blister	Hab. (R)	PH	D		DR
50-10-27-18121	43	Complex	Hab. (R)	PH	D		DR
	43A	Enclosure rectangular	Hab. (R)				
	43B	Enclosure C-shaped	Hab. (R)				
	43C	Platform	Marker				
50-10-27-18122	44	Trail, kerbstone	Trail	PH/H	D		DR
50-10-27-18123	45	Sink, modified	Ag.	PH	D		NFR
50-10-27-18124	46	Lava tube	Hab. (T)	PH	D		DR
50-10-27-18125	47	Lava tube	Hab. (T)	PH	D		DR
50-10-27-18126	48	Enclosure rectangular	Hab. (P)	PH	D		DR
50-10-27-18127	49	Complex	Hab. (R)	PH	D		NFR
	49A	Sink, modified					
	49B	Lava tube					
	49C	Platform					
50-10-27-18128	50	Rockshelter	Hab. (T)	PH	D		NFR
50-10-27-18130	52	Outcrop, modified	Ag.	PH	D		NFR
50-10-27-18131	54	Lava tube	Hab. (R)	PH	D		DR
50-10-27-18132	55	Lava tube	Hab. (T)	PH	D		DR
50-10-27-18133	56	Trail, stepping-stone	Trail	PH	C,D		DR
50-10-27-18134	57	Lava tube	Refuge Hab./burials	PH/H	A,C,D,E		P
50-10-27-18135	58	Mound	Marker?	PH	D		NFR
50-10-27-18136	59	Complex	Ag., work area, storage	PH	D		NFR
	59A	Platform	Ag., work area, storage				
	59B	Mounds	Ag.				
50-10-27-18137	60	Complex	Hab. (P)	PH	D		DR
	60A	Bluff, modified					
	60B	Wall					
	60C	Terrace					
	60D	Terrace					
	60E	Bluff, modified					
50-10-27-18138	61	Lava tube	Hab. (R)	PH	D		DR
50-10-27-18139	62	Pavement	Hab. (T)	PH	D		NFR
50-10-27-18140	63	Outcrop, modified	Ag.	PH	D		NFR
50-10-27-18142	65	Outcrop,modified	Ag.	PH	D		NFR
50-10-27-18143	66	Enclosure, L-shaped	Hab. (T)	PH	D		NFR
50-10-27-18186	114	Wall segment	Trail (possible)	PH?	D		NFR
50-10-27-18187	115	Lava tube	Hab. (T)	PH	D		DR
50-10-27-18188	116	Lava tube	Hab. (P)	PH	D		DR

Table 1 - Site Table Kaloko Honokōhau Business Park cont'

SHPD SITE #	CSH SITE FEATURE	FORMAL SITE FEATURE TYPE	INTERPRETIVE [illegible]	PROB. [illegible]	SIGNIFICANCE	RECOMMENDATION
50-10-27-18189	117	Complex	Hab. (P)	PH	D	DR
	117A	Terrace				
	117B	Terrace				
	117C	Terrace				
50-10-27-18190	118	Complex	Hab. (P)	PH	D	DR
	118A	Terrace				
	118B	Terraces				
	118C	Terrace				
	118D	Pavement				
	118E	Lava blister				
	118F	Alignment				
	118G	Terrace				
50-10-28-18192	120	Enclosure, C-shaped	Hab. (T)	PH	D	NFR
50-10-27-18193	121	Outcrop,modified	Undetermined	PH	D	NFR
50-10-28-18194	122	Complex	Ag.	PH	D	NFR
	122A	Outcrop,modified				
	122B	Enclosure, C-shaped				
	122C	Enclosure, rectangular				
50-10-28-18195	123	Terrace	Hab. (R)	PH	D	DR
50-10-27-18197	125	Lava tube	Burials	PH	D,E	P
50-10-28-18356	51,153,301	Wall segments	ahupua'a boundary	PH	D	NFR

KEY:
P Permanent
R Recurrent
T Temporary

PH Pre-historic
H Historic

A Site reflects major trends or events in the history of the state or nation.
B Site is associated with the lives of persons significant in the past.
C Site is an excellent example of a site type
D Site is likely to yield information important to prehistory and history
E Site has cultural or religious significance (including burials)

NFR No Further Research
DR Data Recovery
P Preservation

B. Site Descriptions

CSH Site #: 3

SHPD Site #: 50-10-27-02
Site Type: Kerbstone trail
Function: Trail
Features (#): 1
Dimension: Undetermined
Elevation: 55 ft. ft. a.m.s.l.

Description: Site 2 is the previously recorded Mamalahoa Trail. A portion of the trail extends in a southeast/northwest direction just inside the western boundary of the project area adjacent to the Queen Ka'ahumanu Highway. Vegetation consists of moderately dense *koa haole*.

The section of the trail running through this project area is a straight, cobble-lined pathway. The trail typically measures 3.2 m. (10.5 ft.) wide and is constructed of pahoehoe cobbles with large to medium boulder curbing. The trail is discontinuous and, in sections, is overgrown with grass.

No artifacts or midden were observed. Some modern trash, presumably from passing motorists, was observed. The site is in poor condition and no soil deposits are present.

CSH Site #: 37

SHPD Site #: 50-10-27-13031
Site Type: Wall segment
Function: Undetermined
Features (#): -
Dimension: 19.0 m.^{2} (204.5 ft.^{2})
Elevation: 85 ft. a.m.s.l.

Description: Site 13031 is a remnant wall section located on an undulating surface - comprising both a'a and pahoehoe lavas - with a gentle to moderate westerly slope. The area has pockets of soil supporting fountain grass and *koa haole*. The site was previously recorded by Paul H. Rosendahl, Inc. (PHRI).

The wall section measures 38.0 m. (124.7 ft.) long N/S by 0.5 m. (1.64 ft.) wide with a maximum height of 0.5 m. (1.64 ft.). It is constructed of angular, small boulder slabs one to two rows wide by 1 to 4 courses high. The wall is constructed along the upper edge of a moderately sloped outcrop ridge. It utilizes the height and width of some areas of uplifted pahoehoe.

The orientation and location of the wall indicate that it may be a *mauka* continuation of State site 50-10-27-18087 wall.

No midden or artifacts were observed.

Site 13021 has no soil deposits.

SHPD Site #: 50-10-27-18080 **CSH Site #: 1**
Site Type: Walls
Function: Undetermined
Features (#): 1
Dimension: 640.0 m.² (6,912.0 ft.²)
Elevation: 100 ft. a.m.s.l.

Description: Site 18080 consists of two wall segments located near the northwest corner of the project area. The site is located on rough, undulating a`a terrain which has been extensively bulldozed. Vegetation consists of *koa haole* and short grasses.

The main wall segment is oriented east/west and is constructed of small to medium a`a boulders. This segment measures approximately 32.0 m. (105.0 ft.) long E/W, 1.0 m. (3.3 ft.) thick and a maximum 1.1 m. (3.6 ft.) high. The other segment - aligned perpendicularly to the main segment at that segment's midpoint - is in poorer condition and is oriented north/south. This wall measures 14.0 m. (45.9 ft.) long, 0.8 m. (2.6 ft.) thick and 1.1 m. (3.6 ft.) high.

The wall segments may be elements of a more extensive enclosure wall. Bulldozing has disturbed most of the area, including at least part of this site.

No midden or artifacts were observed.

Site 18080 is in fair to poor condition with little likelihood of soil deposits.

SHPD Site #: 50-10-27-18081 **CSH Site #: 2**
Site Type: Petroglyphs
Function: Symbolism
Features (#): 1
Dimension: 350.9 m.² (3789.7 ft.²)
Elevation: 60 ft. a.m.s.l.

Description: Site 18081 (Figure 9) consists of a collection of petroglyphs located along the western boundary of the project area, immediately east of the Mamalahoa Trail (State site 50-10-27-2). Vegetation in the site area consists of moderately dense *koa haole* and grasses.

Overall the site area measures approximately 8.0 m. (26.2 ft.) N/S by 33.0 m.(108.9 ft.) E/W. The petroglyphs occur on two areas of raised pahoehoe outcrops, designated Areas A and B.

The area to the west - Area A - contains the most discernible petroglyphs. These include at least four human figures and a single pecked line; all of these are lightly pecked into a vertical outcrop surface on the south side of Area A. The human figures measure an average 0.4 m. (1.3 ft.) in diameter.

A small lava blister with a low ceiling lies beneath Area A's surface. Its entrance is located approximately 3.0 m. (9.9 ft.) north of the petroglyphs. No cultural material was identified within the lava blister.

Area B petroglyphs - beginning approximately 19.0 m. (62.7 ft.) east of Area A petroglyphs - are difficult to distinguish. One rough human form and a few areas of surface pecking were observed.

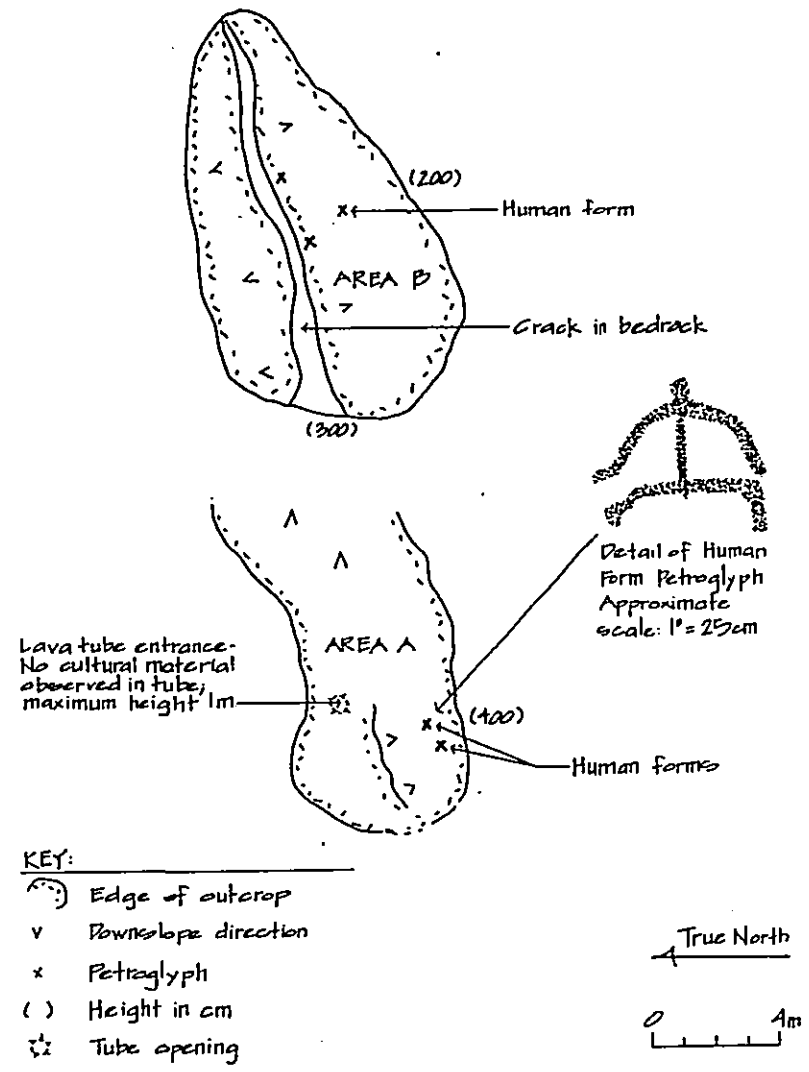


Figure 9 Site 50-10-27-18081, Plan View

No artifacts or midden were observed.

Site 18081 is in poor condition with some soil pockets adjacent to the raised outcrops.

SHPD Site #: 50-10-27-18083 **CSH Site #:** 4
Site Type: Modified outcrop
Function: Temporary habitation
Features (#): 1
Dimension: 14.0 m.^{2} (160.6 ft.^{2})
Elevation: 55 ft. a.m.s.l.

Description: Site 18083 (Figure 10) is two alignments of upright pahoehoe slabs located atop a pahoehoe outcrop bluff.

The main alignment is oriented northwest/southeast and measures 4.0 m. (13.1 ft.) long. At the southeast end of this alignment there are three additional upright slabs set perpendicular to the alignment, forming a small hearth-like rectangular enclosure.

A parallel alignment is located 1.0 m. (3.3 ft.) from the main alignment and measures 2.0 m. (6.6 ft.) long.

The upright slabs measure a maximum 0.25 m. (0.8 ft.) high.

No midden or artifacts were observed.

Site 18083 is in fair to poor condition with little soil deposition.

SHPD Site #: 50-10-27-18084 **CSH Site #:** 5
Site Type: Rockshelter
Function: Temporary habitation
Features (#): 1
Dimension: 6.0 m.^{2} (64.5 ft.^{2})
Elevation: 57 ft. a.m.s.l.

Description: Site 18084 (Figure 11) is a small modified rockshelter located on terrain of undulating pahoehoe outcrop and patchy soil areas.

The shelter utilizes natural outcropping and is partially enclosed by boulder and cobble stacking. The rockshelter is not formally modified; no facing was observed. The sheltered area is very small and measures only 6.0 m.^{2} (64.5 ft.^{2}). The ceiling height is 0.75 m. (2.5 ft.). The shelter floor consists of a shallow soil deposit.

No midden or artifacts were observed.

The site is in fair condition. There is only a shallow soil deposit.

SHPD Site #: 50-10-27-18085 **CSH Site #:** 6
Site Type: Lava tube
Function: Temporary habitation

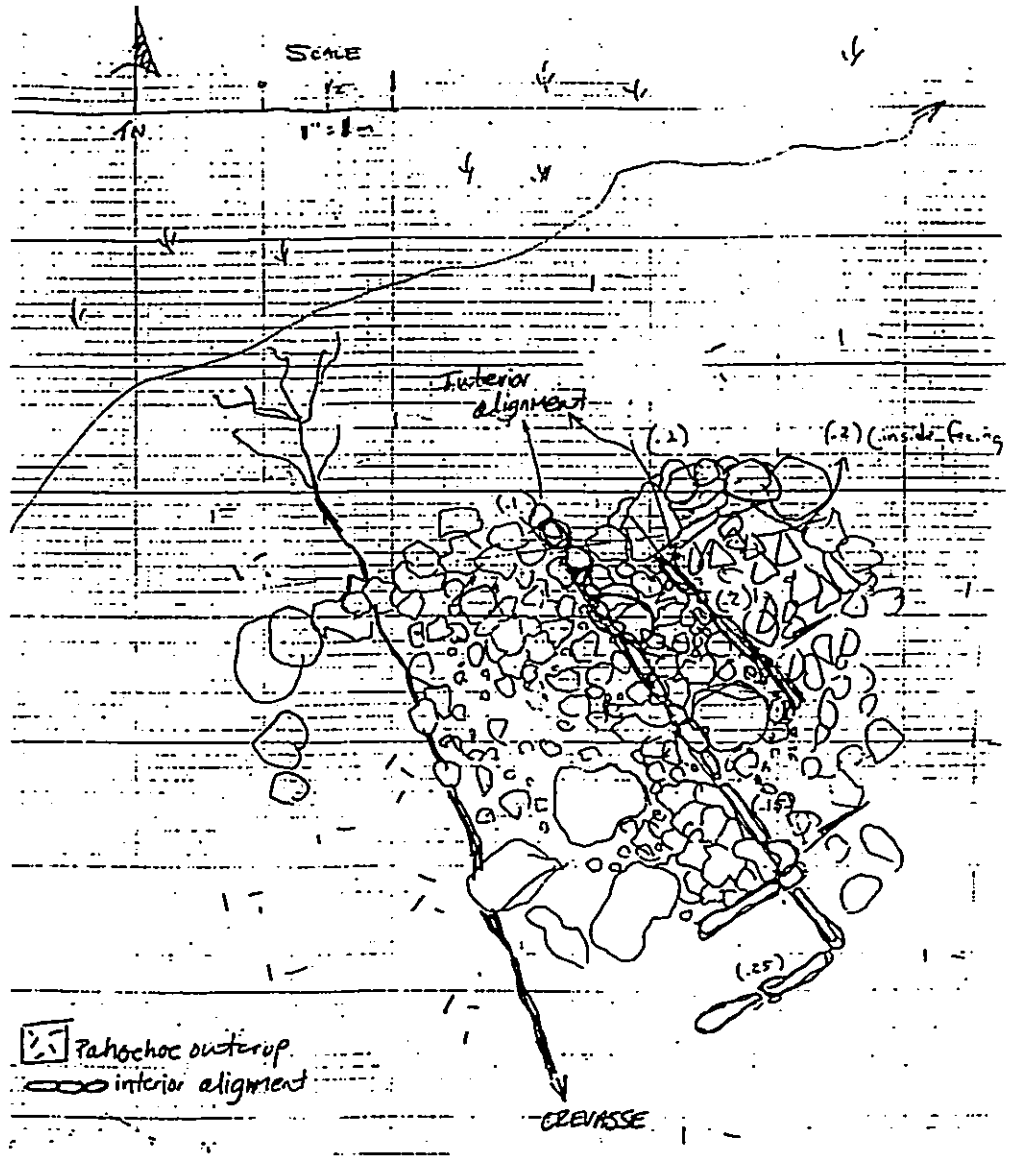


Figure 10 Site 50-10-27-18083, Plan View

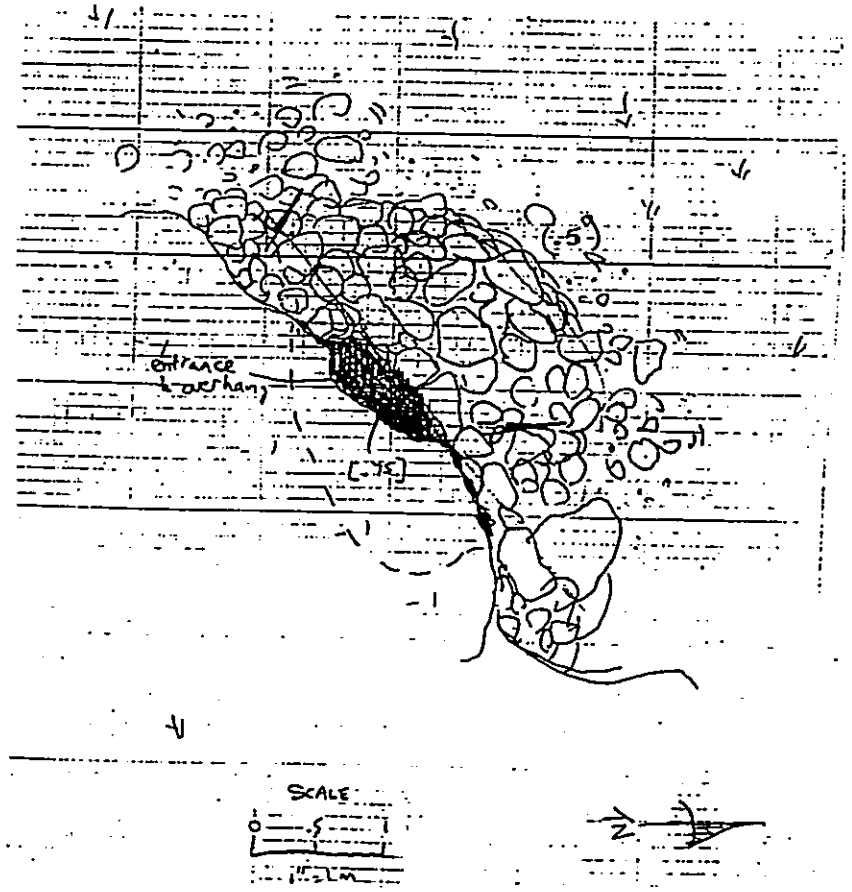


Figure 11 Site 50-10-27-18084, Plan View

Features (#): 1
Dimension: 45.0 m.² (486.0 ft.²)
Elevation: 55 ft. a.m.s.l.

Description: Site 18085 (Figure 12) is a small lava tube shelter located beneath a generally level pahoehoe lava surface. The surface vegetation consists of *koa haole* and grass.

The tube measures 7.5 m. (24.6 ft.) long from the entrance to the rear and 6.0 m. (19.7 ft.) wide, uniformly, from front to rear. The maximum ceiling height is 0.9 m. (3.0 ft.). A light zone below a crack in the ceiling is located at the rear of the tube. The floor is generally clear and level, with patches of shallow soil; marine shell and kukui nut midden were observed. Cobble and small boulder stacking was observed at the east side of the tube entrance.

Site -18085 is in fair condition with shallow soil deposits.

SHPD Site #: 50-10-27-18086 **CSH Site #:** 7
Site Type: Pecked pahoehoe basin
Function: Undetermined
Features (#): 1
Dimension: 96.0 m.² (1036.8 ft.²)
Elevation: 55 ft. a.m.s.l.

Description: Site 18086 (Figure 13) is a site remnant located along level pahoehoe outcrop near the southwest corner of the project area. The remnant consists of a pecked outcrop surface which forms a basin, and a concentration of boulders and cobbles.

The boulder and cobble concentration was likely disturbed by bulldozing. The pahoehoe basin measures approximately 0.3 m. (0.9 ft.) in diameter and has a maximum depth of 0.2 m. (0.6 ft.). The entire site area measures 12.0 m. (39.4 ft.) N/S by 8.0 m. (26.2 ft.) E/W. Two pieces of marine shell midden - but no artifacts - were observed.

The site and surrounding area has been disturbed extensively by modern bulldozing which apparently created pits in the surface of the pahoehoe. Similar pits - designated Site 50-10-27-18097 - in the general (*makai*) area disturb the historic kerbstone trail (State site 50-10-27-18099). These excavated pits may be associated with sub-surface exploration or mining of pahoehoe rubble with machinery.

Site 18086 is in remnant condition and lacks soil deposition.

SHPD Site #: 50-10-27-18087 **CSH Site #:** 8
Site Type: Wall
Function: Undetermined
Features (#): 1
Dimension: 182.0 m. (600 ft.) long
Elevation: 65 to 80 ft. a.m.s.l.

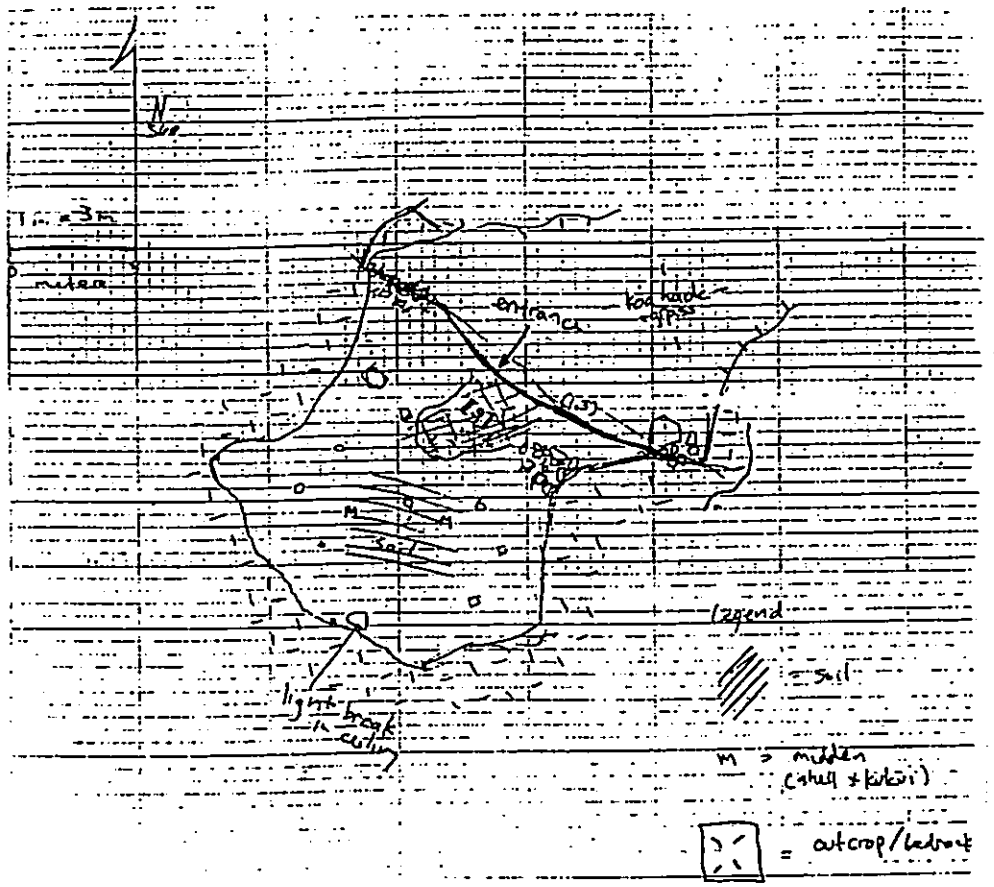


Figure 12 Site 50-10-27-18085, Plan View

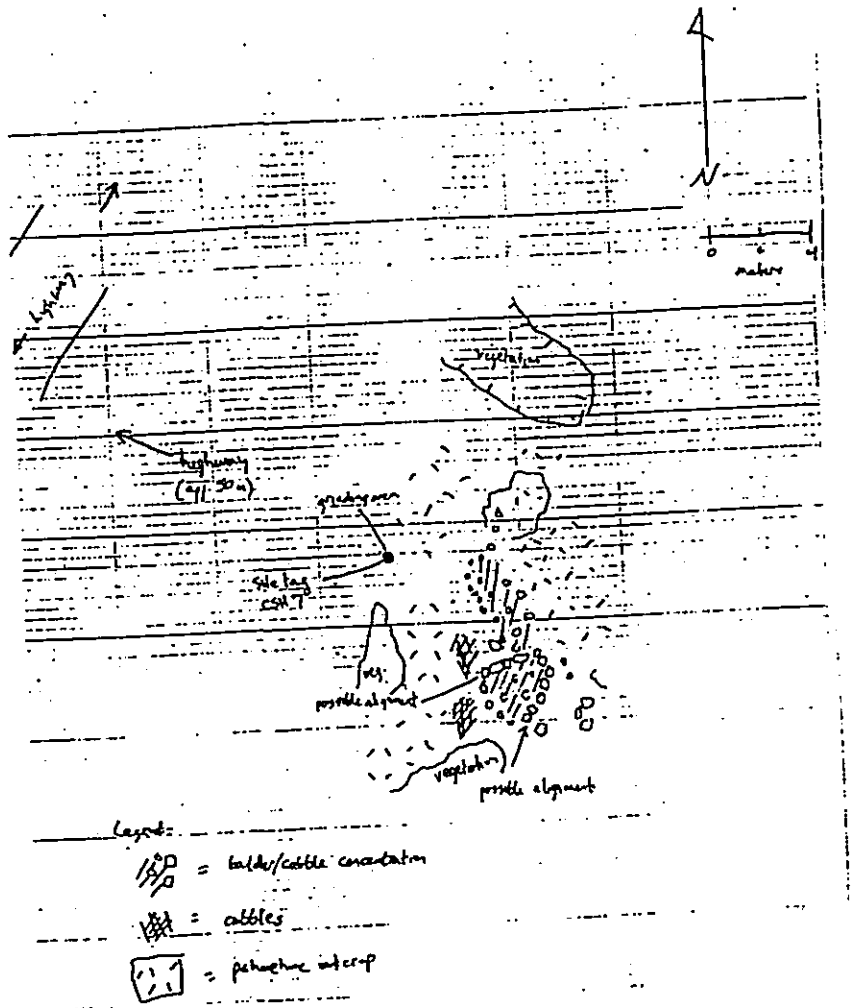


Figure 13 Site 50-10-27-18086, Plan View

RECEIVED AS FOLLOWS

Description: Site 18087 is a meandering wall section located near the south boundary of the project area, near Honokohau Boat Park. The terrain is generally flat pahoehoe lava with grass and *koa haole* vegetation.

The wall is in various degrees of preservation. Some sections are only a single course alignment and other sections are well-faced, standing 5 to 6 courses high. The wall is constructed of both a`a and pahoehoe cobbles and boulders. Some sections incorporate a pahoehoe outcrop ridge.

The wall is oriented generally northeast/southwest. The wall measures approximately 182.0 m. (600.0 ft.) long and no more than 1.0 m. (3.3 ft.) thick. The highest faced section, near the *mauka* terminus of the wall, measures 1.0 m. (3.3 ft.).

No artifacts or midden were observed.

Site 18087 is in fair to poor condition with little soil deposition.

SHPD Site #: 50-10-27-18088 **CSH Site #:** 9
Site Type: Lava tube
Function: Temporary habitation; burial
Features (#): 1
Dimension: 280 m.^{2} (3024 ft.^{2}) (minimum)
Elevation: 60 ft. a.m.s.l.

Description: Site 18088 (Figure 14) is a lava tube with an entrance in a small sink. The terrain is grass-covered undulating pahoehoe lava.

The lava tube is oriented northeast/southwest; the entrance is located approximately midway between the tube's northeast and southwest ends. The floor of the tube is generally very rough lava. The tube measures approximately 38.0 m. (124.6 ft.) long. Width ranges from 6.5 m. (21.3 ft.) near the entrance and at the northeast end, to 1.4 m. (4.6 ft.). Ceiling height does not exceed 0.9 m. (3.0 ft.) and averages 0.7 m. (2.3 ft.).

A coffin burial is located 12.0 m. (39.4 ft.) southwest of the entrance. Human bones - including a skull, ribs, and phalanges - were observed; no long bones were present. Dilapidated coffin wooden planks and two wooden poles of a *manele* used to transport the coffin burial (Bowen 1961:52) were observed with the human bones.

A concentration of pig bones and a pig skull are located 16.0 m. (52.5 ft.) northeast of the entrance. No other midden or artifacts were observed.

Site 18088 is in fair condition. The site has a historic burial component with previous use as a temporary habitation.

SHPD Site #: 50-10-27-18089 **CSH Site #:** 10
Site Type: Modified outcrop
Function: Agriculture
Features (#): 1
Dimension: 2.0 m.^{2} (21.6 ft.^{2})
Elevation: 75 ft. a.m.s.l.

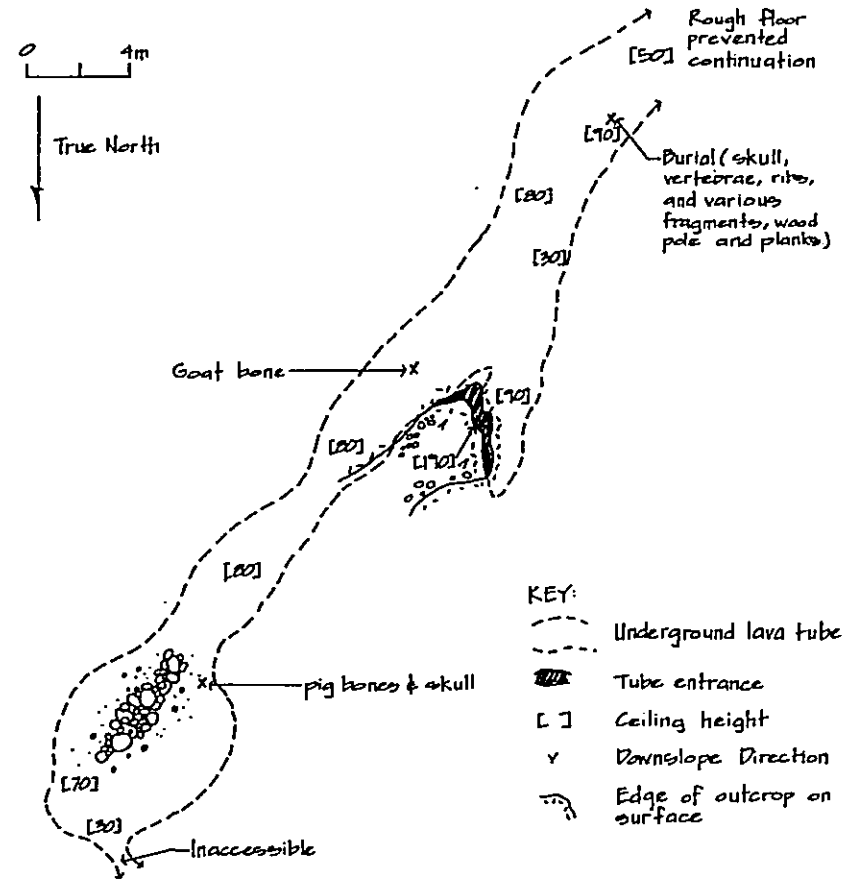


Figure 14 Site 50-10-27-18088, Plan View

RECEIVED AS FOLLOWS

Description: Site 18089 is a small modified outcrop located just inside the southern boundary of the project area near the Honokohau Boat Park road.

Modification consists of a small, faced stacking of pahoehoe boulders on the south side of a small bluff. The stacking measures 2.6 m. (8.5 ft.) long E/W by 0.6 m. (2.0 ft.) wide. The height of the stacking is 0.8 m. (2.6 ft.). The pahoehoe bluff measures approximately 6.0 m. (19.7 ft.) in diameter.

No midden or artifacts were observed. Site 18089 is in poor condition and no cultural deposits are believed present.

SHPD Site #: 50-10-27-18090 **CSH Site #: 11**
Site Type: Lava tube; modified sink
Function: Temporary habitation
Features (#): 2
Dimension: 400 m.² (1320 ft.²)
Elevation: 70 ft. a.m.s.l.

Description: Site 18090 (Figure 15) comprises a lava tube shelter and associated modified sink, designated Features A and B, respectively. The site is located among level pahoehoe lava terrain; *koa haole* trees fill the sink near the tube entrance.

Feature A is a shallow lava tube with an entrance located at the north end of an oval-shaped sink (Feature B). The tube extends northeast from the entrance for 28.0 m. (91.8 ft.); it measures a maximum 10.0 m. (32.8 ft.) wide. At the northeast end of the tube, the width narrows to 5.0 m. (16.4 ft.). Maximum ceiling height is 0.8 m. (2.6 ft.).

One coral abrader and some burnt wood and charcoal were observed at the tube entrance. A concentration of marine shell midden (especially *Nerita picea*) was also observed near the tube opening. A midden scatter, including some mammal bone, was observed at the rear of the tube. Soil was observed as far back as 20.0 m. (65.6 ft.) within the tube but may be the result of natural wash down through cracks in the ceiling.

Feature B is a slightly modified sink area in which the tube opening is located. The sink is oval shaped and measures 8.0 m. (26.2 ft.) long N/S by 5.0 m. (16.4 ft.) wide. An alignment of boulders edges the west and south sides of the sink. The depth of the sink, measured from the top of the alignment is 1.0 m. (3.3 ft.).

Site 18090 is in fair condition and has some soil deposition.

SHPD Site #: 50-10-27-18091 **CSH Site #: 12**
Site Type: Petroglyph
Function: Symbolism
Features (#): 1
Dimension: 18.2 m.² (196.6 ft.²)
Elevation: 57 ft. a.m.s.l.

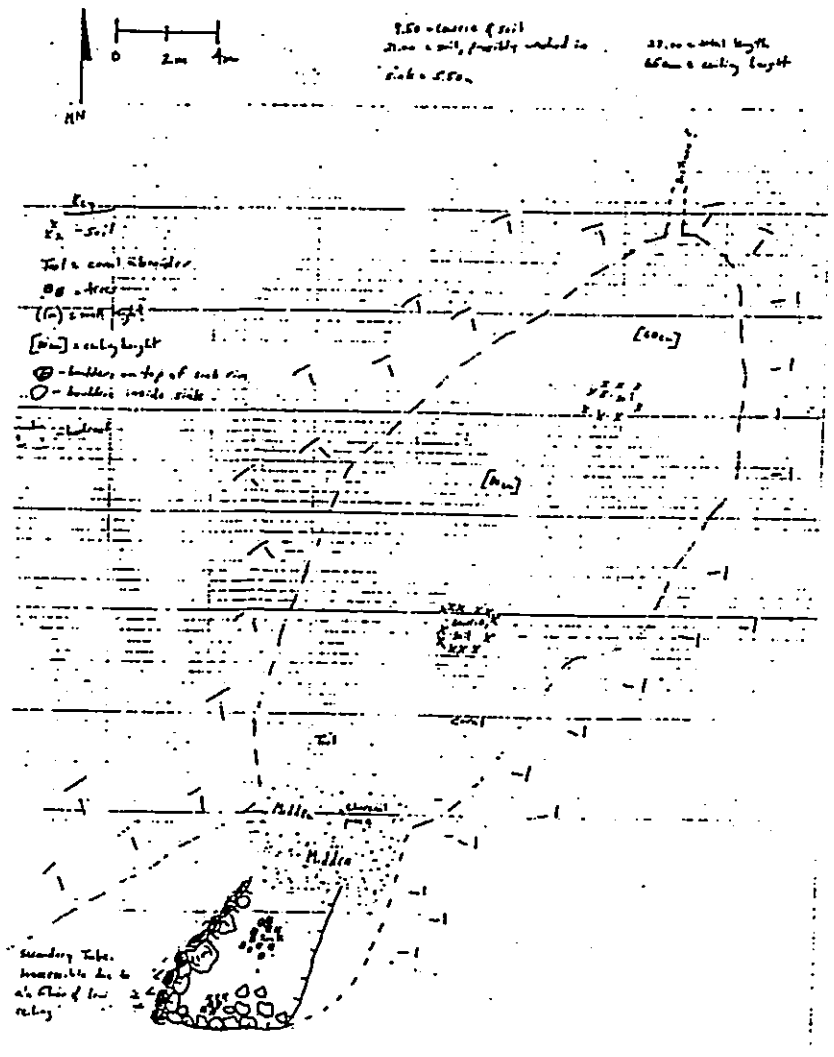


Figure 15 Site 50-10-27-18090, Plan View

Description: Site 18091 is an historic or modern petroglyph located immediately to the south of an excavated pahoehoe outcrop pit. The petroglyph appears to have been carved into the outcrop surface with a metal object. It reads: KEANINI.

The adjacent pahoehoe excavation is oval shaped and measures 8.0 m. (26.2 ft.) long E/W, 3.0 m. (9.8 ft.) wide and 0.7 m. (2.3 ft.) deep. Boulder and cobble rubble is scattered in the pit and on the nearby pahoehoe surface.

The excavation is probably late historic or modern and may be related to subsurface exploration or the mining of pahoehoe rubble through the use of machinery

No midden or artifacts were observed.

Site 18091 is in poor condition and there is no soil deposition.

CSH Site #: 13

SHPD Site #:	50-10-27-18092
Site Type:	Complex
Function:	Recurrent habitation
Features (#):	2
Dimension:	640.0 m.² (6,877.5 ft.²)
Elevation:	75 ft. a.m.s.l.

Description: Site 18092 (Figure 16) is located on an undulating pahoehoe outcrop that gently slopes *makai*. The area is covered with pockets of soil in which *koa haole* is plentiful.

The site is a complex consisting of a lava tube designated Feature A and a terrace with an associated paved area, designated Feature B. Overall, the site measures 9.0 m. (29.5 ft.) N/S by approximately 90.0 m. E/W (295.3 ft.).

Feature A is a lava tube measuring at least 90.0 m. (295.3 ft.) long; width ranges from 5.0 m. (16.4 ft.) to 10.0 m. (32.8 ft.); and ceiling heights range from 0.5 m. (1.64 ft.) to 1.6 m. (5.0 ft.). The entrance - 1.0 m. (3.3 ft.) in diameter - was created by ceiling collapse and the rubble allows easy access to the tube floor approximately 1.2 m. (3.9 ft.) below. The floor is rich with soil and decaying vegetation. From the entrance, the tube extends 40.0 m. (131.2 ft.) west where further access becomes impossible. East of the entrance, the tube extends 40.0 m. (131.2 ft.) where it curves to the north and the ceiling becomes low; the floor becomes rough a`a.

Midden was observed within the light zone and in the western portion of the tube. At least sixteen scatters of goat bones were observed throughout the tube.

A single coral abrader was observed 25.0 m. (82.0 ft.) west of the entrance.

A small ceiling hole - allowing light but not access - is located approximately 35.0 m. (114.8 ft.) east of the entrance.

A test unit measuring 1.0 m. (3.3 ft.) by 0.50 m. (1.64 ft.) was placed in a relatively undisturbed soil deposit within the light zone (see **Testing Results** below).

Feature B of Site 18092 is located atop Feature A lava tube, approximately 6.0 m. (19.7 ft.) northeast of the entrance to the tube. Feature B consists of a small terrace to the south and a paved area to the north. The terrace measures 2.1 m. (3.6 ft.) N/S by 3.2 m.

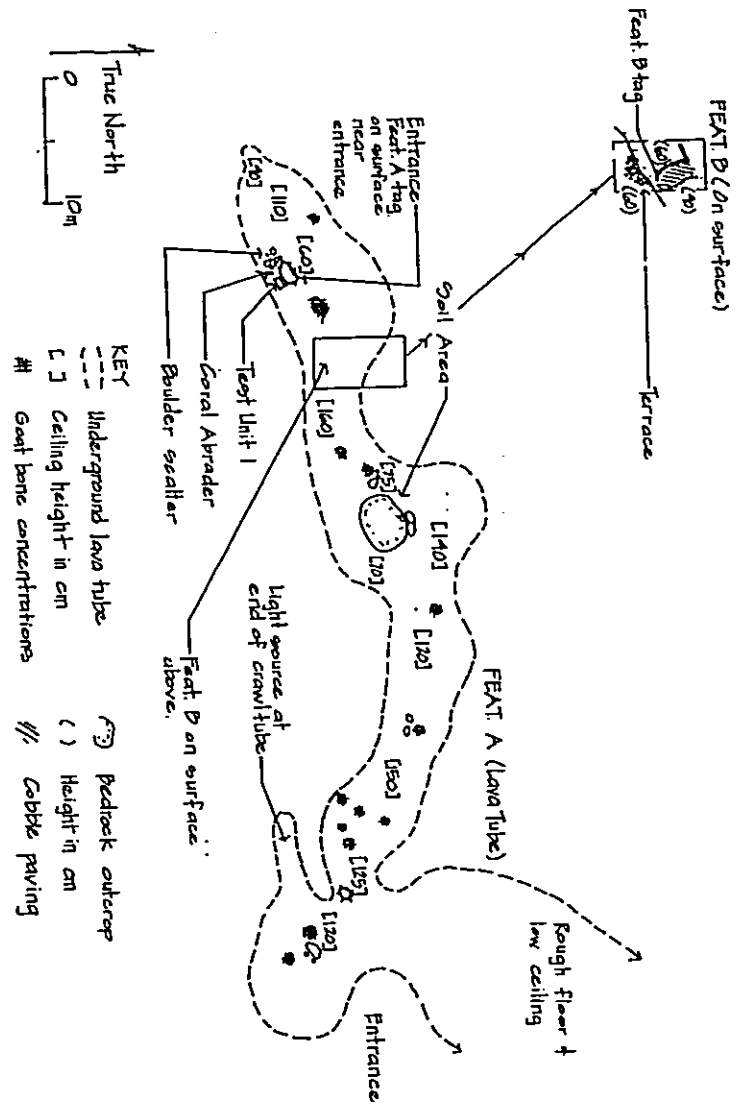


Figure 16 Site 50-10-27-18092, Plan View

(10.5 ft.) E/W with a maximum height of 0.6 m. (1.97 ft.). Its north side abuts the edge of the pahoehoe outcrop under which the lava tube lies. No midden or artifacts were observed.

The paved area measures 3.5 m. (11.5 ft.) N/S by 2.1 m. (6.9 ft.) E/W with a maximum height of 0.6 m. (1.97 ft.). Paving consists of pahoehoe cobbles. A wall segment measuring 1.5 m. (4.9 ft.) was observed extending to the west from the northwest corner of the paved area.

No artifacts or midden were observed at Feature B.

Site 18092 is in fair condition. Based on the limited testing described below, and has some soil deposits.

Testing Results

Limited testing was conducted at Site 18092 lava tube (Feature A) to determine the function of the site, examine subsurface deposits, and to collect charcoal for radiocarbon dating analysis. The testing consisted of excavating a 1.0 m. by 0.5 m. (3.3 ft. by 1.6 ft.) unit placed within a soil area beneath the lava tube's entrance. The surface of the unit was covered with scattered marine and terrestrial midden.

The unit was excavated to underlying bedrock to a maximum depth of 8 cm. One stratigraphic layer - Stratum I - was observed during the excavation. No profile was made due to the shallowness of the unit. Stratum I was a very dark grayish-brown (10 YR 3/2) silty loam. Coral and land snail shells were present.

Midden (marine and terrestrial) and charcoal were collected from Stratum I (0-8 cm.). The midden inventory includes the following: 54.0 gms. of cowrie (*Cypraea caputserpentis*); 0.3 gm. of periwinkle (*Littorina* sp.); 38.5 gms. of *Theodoxus cariosus*; 2.2 gms. *Thaididae* sp.; 45.6 gms. of pearl shell (*Isognomon* sp.); 31.5 gms. of unidentified marine shell; 78.0 gms. of sea urchin (Echinoderm); 0.1 gm. of squirrelfish (*Holocentrid*); and 0.5 gm. of unidentified fish bones and scales; 0.1 gm. of Polynesian rat (*Rattus exulans*); 0.1 gm. of small vertebrate; and 7.0 gms. of kukui-nut shell. A total of 0.6 gm. of charcoal was recovered from the excavation.

Interpretation: Based on the relative abundance of midden recovered from the lava tube interior and that the site contains associated surface pavements, it is interpreted as a recurrent habitation site. Given the lack of historic artifacts observed on the site's surface and recovered from the excavation, it is likely that Site 18092 was utilized primarily during the prehistoric era.

SHPD Site #: 50-10-27-18093 **CSH Site #: 14**
Site Type: *ahu*
Function: Marker
Features (#): 2
Dimension: 0.6 m.² (6.5 ft.²)
Elevation: 110 ft. a.m.s.l.

Description: Site 18093 consists of two *ahu*, Features A and B, located 17.0 m. (55.8 ft.) apart. The site is located on undulating pahoehoe which slopes gently *makai*. Sparse surrounding vegetation consists of *koa haole* and fountain grass.

Feature A *ahu* is constructed of eight pahoehoe boulders. It measures 0.70 m. (2.3 ft.) high and 0.50 m. (1.64 ft.) in diameter.

Feature B *ahu* is located to the northwest of Feature A and is constructed of eight pahoehoe boulders. It measures 0.50 m. (1.64 ft.) high and 0.50 m. (1.64 ft.) in diameter.

No midden or artifacts were observed.

Site 18093 is in fair condition with poor potential for cultural deposits.

SHPD Site #: 50-10-27-18094 **CSH Site #: 15**
Site Type: Lava tube-enclosure
Function: Temporary habitation
Features (#): -
Dimension: 35.0 m.² (378.0 ft.²)
Elevation: 90 ft. a.m.s.l.

Description: Site 18094 (Figure 17) is an unmodified lava tube and an adjacent enclosure oriented northeast/southwest. The site is located on uneven hillocks of pahoehoe with little soil visible. The terrain slopes gently *makai* and has sparse vegetation consisting of *kiawe* and fountain grass.

The lava tube entrance is 0.7 m. (2.39 ft.) wide and is located in the northeast corner of the enclosure. The lava tube measures approximately 5.0 m. (16.4 ft.) in diameter with an average height of 0.5 m. (1.64 ft.). The floor is uneven stalagmite lava. No artifacts or midden were observed.

The enclosure is roughly circular in shape. The walls are constructed of piled boulders with a few cobbles. No facing was discerned. The exterior wall portions merge into outcrop rubble. The enclosure measures 5.0 m. (16.4 ft.) N/S by 6.0 m. (19.7 ft.) E/W with a maximum height of 0.40 m. (1.31 ft.). The interior is uneven pahoehoe with scattered boulders.

Site 18094 is in fair condition with the possibility of some cultural deposits.

SHPD Site #: 50-10-27-18095 **CSH Site #: 16**
Site Type: Mound
Function: Agriculture
Features (#): 1
Dimension: 24.5 m.² (264.6 ft.²)
Elevation: 80 ft. a.m.s.l.

Description: Site 18095 is a roughly square mound constructed of pahoehoe boulders and cobbles on top of an exposed pahoehoe floor. The site is located on a gentle *makai* or southwest-trending slope. The vegetation around the site consists of *koa haole* and fountain grass.

The mound measures 4.9 m. (16.1 ft.) E/W by 5.0 m. (16.4 ft.) N/S with a maximum height of 0.95 m. (3.14 ft.). It is fairly tumbled, possibly impacted by the bulldozing activity which is evident in the area. Although presently in poor condition, the structure once may have been much more formally constructed.

No midden or artifacts were observed.

Site 18095 is in poor condition with some possibility of cultural deposits. Numerous pahoehoe excavations (State -18097) surround the site.

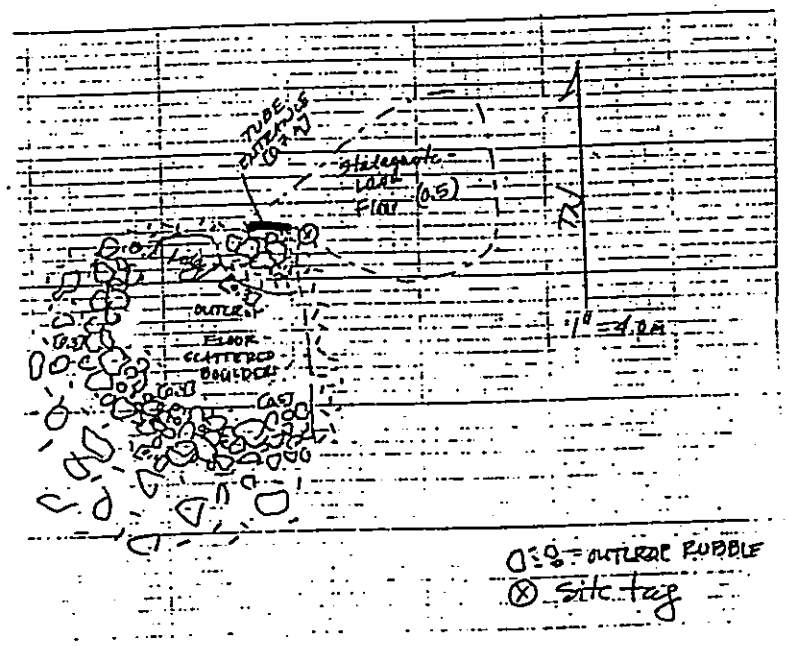


Figure 17 Site 50-10-27-18094, Plan View

CSH Site #: 17

SHPD Site #: 50-10-27-18096
Site Type: *ahu*
Function: Marker
Features (#): 1
Dimension: 0.81 m.² (8.75 ft.²)
Elevation: 95 ft. a.m.s.l.

Description: Site 18096 is an *ahu* which stands on a slightly raised pahoehoe outcrop. The *ahu* is located on undulating pahoehoe lava which gently slopes *makai* or southwest. The area has sparse vegetation consisting of *koa haole* and fountain grass.

The *ahu* is constructed of pahoehoe boulders and measures 0.9 m. (2.95 ft.) high and 0.9 m. (2.95 ft.) in diameter. Site 18096 *ahu* aligns in a northwest/southeast direction with two *ahu* (Site 18093) and one *ahu* (Site 18099). It is likely that these four *ahu* delineate a trail leading to Site 18099 kerbstone trail.

No midden or artifacts were observed.

Site 18096 is in good condition but has little likelihood for cultural deposits.

CSH Site #: 18

SHPD Site #: 50-10-27-18097
Site Type: Pahoehoe excavation
Function: Mining
Features (#): Multiple
Dimension: 463.0 m.² (5,000 ft.²)
Elevation: 65 to 100 ft. a.m.s.l.

Description: Site 18097 is a concentrated area of pahoehoe excavations. The excavations are located on a flat section of a gentle, *makai*-trending slope. The site area contains sparse vegetation consisting of *koa haole*, fountain grass and a few *kiawe*.

The pahoehoe excavations are visible within an area measuring approximately 100.0 m. (328.1 ft.) E/W by a maximum of 60.0 m. (200.0 ft.) E/W. The excavations are adjacent to and often times intrusive into the kerbstone trail (State site 50-10-27-18099) in the project area. The excavated pit areas are commonly filled with the cobble and boulder refuse. Excavated pits at this site are similar to and representative of other such pits located further *makai* in the project area. Although these excavations may represent agricultural activities, it is likely that they are associated with late historic or modern subsurface exploration or mining. This is mostly evidenced by the damage to the kerbstone trail by the pit excavations: the trail would have been spared harm if the pits were of a traditional Hawaiian function. (Subsurface exploration in the area may have been conducted during the early 1970s by the existing quarry operation located in the *makai* area of the project area.)

Site 18097 is in poor condition with little potential for remaining cultural deposits.

CSH Site #: 19

SHPD Site #: 50-10-27-18098
Site Type: Complex
Function: Permanent habitation
Features (#): 2
Dimension: 525.0 m.² (5,670.0 ft.²)
Elevation: 100 ft. a.m.s.l.

Description: Site 18098 (Figure 18) consists of two features designated A and B. Feature A is an enclosure with an interior hearth feature. Feature B is a level, paved area upon which marine shell midden was observed. The site is located on a rough a`a flow that slopes gently *makai*. There is no vegetation present on the a`a flow but on an adjacent pahoehoe flow *koa haole* and fountain grass were observed. The site is located immediately north of a major kerbstone trail (Site 50-10-27-18099) in the project area.

Feature A is a rectangular enclosure constructed of a`a boulders and cobbles. It measures 6.0 m. (19.7 ft.) NW/SE by 4.7 m. (15.4 ft.) NE/SW with a maximum wall height of 1.0 m. (3.3 ft.) and wall thickness of 1.0 m. (3.3 ft.). The enclosure is open to the south and a worn, paved pathway leads down-slope off of the a`a flow from this southern opening. The interior of the enclosure is level and paved with a`a pebbles and cobbles. A hearth ring of a`a cobbles is located directly in the center of the enclosure. The hearth measures 0.8 m. (2.62 ft.) in diameter. Marine shell midden is scattered within the enclosure and in the hearth. A test unit measuring 1.0 m. (3.3 ft.) by 1.0 m. (3.3 ft.) was excavated within the hearth feature (see **Testing Results** below).

Perpendicular to the east wall of the enclosure, a wall segment - averaging 0.7 m. (2.3 ft.) in height - extends 4.0 m (13.1 ft.). The segment ends abruptly at a very large a`a boulder.

Feature B of Site 18098 - located approximately 20.0 m. (65.6 ft.) east of Feature A - is a paved area intersected by Site 18099 trail. The paved area is rectangular and measures 13.0 m. (42.7 ft.) long NW/SE by 8.0 m. (26.2 ft.) wide NE/SW. The trail divides this area into two unequal parts, the smaller of which lies to the south of the trail. Marine midden and coral were observed.

No artifacts were observed at Feature B.

Because the kerbstone trail encroaches on the Feature B pavement, it is probable that this site was utilized prior to construction of the trail. However, it is likely that the kerbstone trail was superimposed on an original prehistoric trail and that the site was in some way associated with travel on this *ahupua`a mauka/makai* trail.

Site 18098 site is in good condition. Based on the testing results described below, Site 18098 probably has fair to good cultural deposits.

Testing Results

Limited testing was conducted at Feature A (Site 18098) to determine the site's function, examine subsurface deposits and to collect charcoal for radiocarbon dating (Figure 19). A 1.0 m. by 1.0 m. (3.3 ft. by 3.3 ft.) test unit was placed so that it overlapped the northern half of the hearth feature and a portion of the surrounding Feature A pavement. Marine shell midden was observed on the surface of the test unit within the hearth feature.

The hearth fill was removed from the test unit and bagged for laboratory analysis (1/16-inch mesh screening). The subsurface extent of the hearth extended to a maximum of 50 cm below the surface and consisted of a white (10 YR 8/1) silt or ash intermixed with a`a gravel and pebbles. The most concentrated ash content was observed at a depth of 30 cm. below the surface. An abundance of marine midden and scant terrestrial midden were recovered from the hearth portion of the test unit, including the following: 1.1 gms. of *Conus* sp.; 25.1 gms. of two species of cowrie (*Cypraea caputserpentis* and *Cypraea maculifera*); 0.2 gm. of *Pupu o Ha`upu* (*Trochus intextus*); 0.3 gm. of pearl shell *Isognomon* sp.); 0.5 gm. of unidentified shell; 41.5 gms. of sea urchin (Echinoderm); 0. 1 gm. of Polynesian rat (*Rattus exulans*); and 0.3 gm. of kukui nut shell.

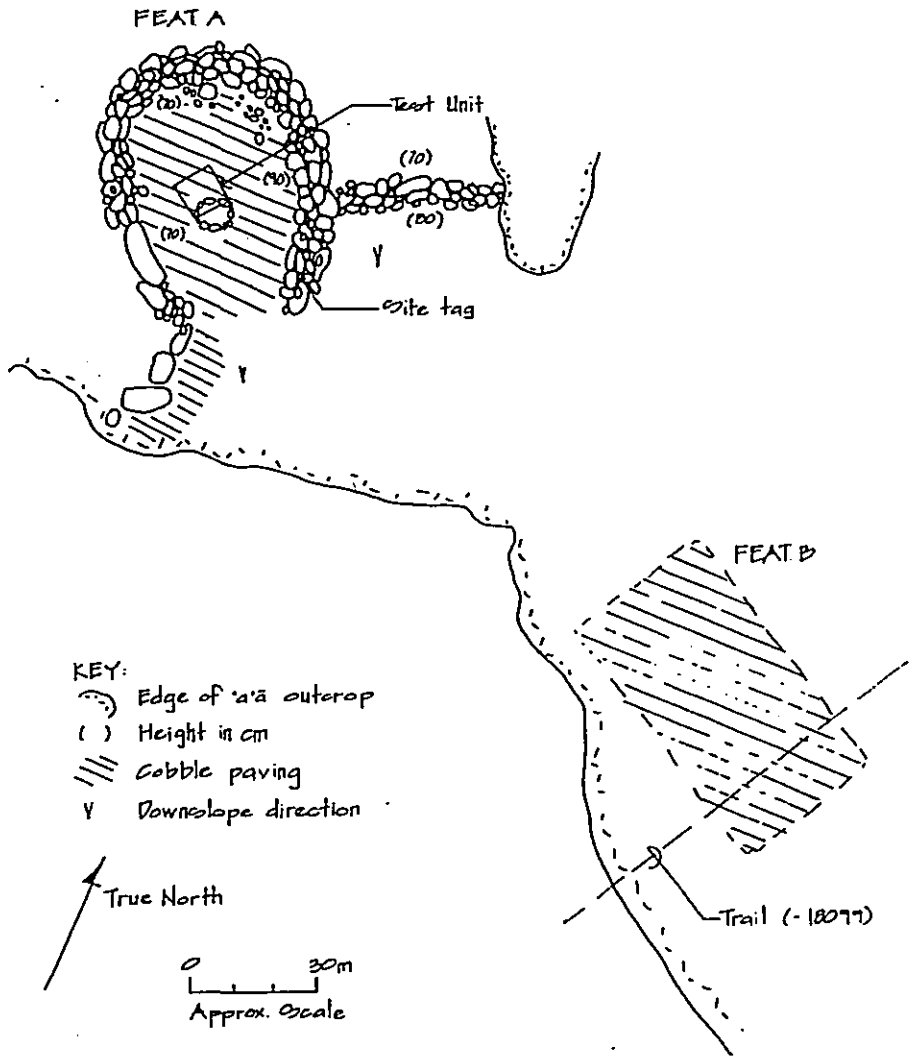


Figure 18 Site 50-10-27-18098, Plan View

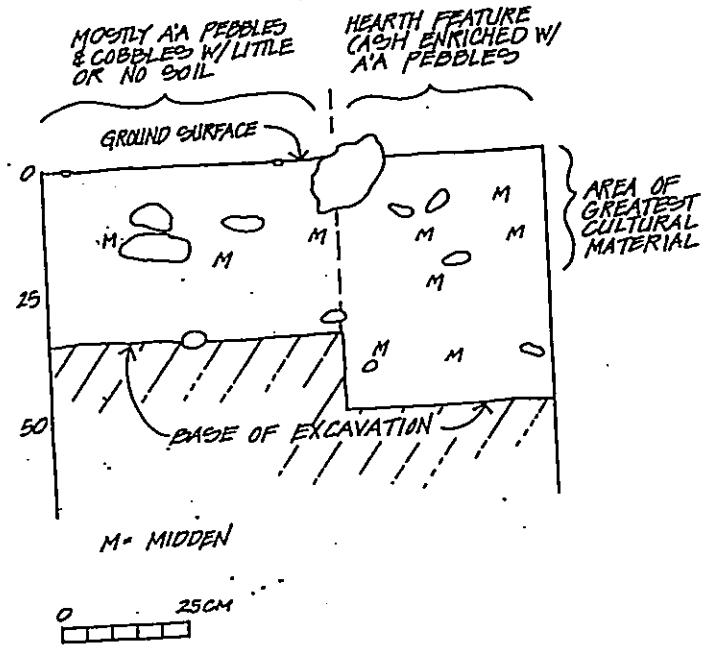


Figure 19 Site 50-10-27-18098 Feature A, Profile

The northern portion of the test unit - outside of the hearth feature - was excavated to a maximum depth of 35 cm. below the surface. The profile revealed a relatively homogenous a'a pebble and cobble matrix with intermittent soil pockets of brown (7.5 YR 5/2) sandy loam. Small pockets of marine midden were encountered during the excavation to the maximum depth of excavation. These items include 5.1 gms. of cowrie (*Cypraea caputserpentis*); 1.3 gms. of pearl shell (*Isognomon* sp.); 0.3 gm. of unidentified shell; 1.6 gms. of sea urchin (Echinoderm).

These sub-surface cultural deposits are believed to be the result of infiltration from the pavement surface above.

Interpretation: Based on the amount of midden recovered from Feature A and the presence of a primary hearth feature (but primarily the feature's architectural characteristics) the structure's likely use was for recurrent or permanent habitation. Given the lack of historic-era artifacts at the site, it was likely occupied primarily during the prehistoric period.

CSH Site #: 20

State site #:	50-10-27-18099
Site Type:	Kerbstone trail
Function:	Travel route
Features (#):	-
Dimension:	minimally 3,066 m. (10,120 ft.) long in project area
Elevation:	45 to 810 ft. a.m.s.l.

Description: Site 18099 is a *maukalmakai* trail which extends intermittently across the central portion and along the northern boundary of the project area. In accordance to Russell A. Apple's classifications of Hawaiian land routes (Apple 1973), this type of kerbstone trail is of the "AB" trail type. "AB" trails are generally defined as historic trails constructed for mule or horse travel over an existing prehistoric land route.

Where the trail crosses pahoehoe outcrop it is usually characterized by a pebble pavement bound by parallel cobble and boulder alignments. The trail has an average width of 3.3 m. (10.9 ft.) and, when traversing prominent depressions, is raised to a maximum height of 1.0 m. (3.3 ft.). Along a'a outcrop, the trail is distinguished by a trodden surface presently obscured by a dense grass growth and inset boulder kerbing.

As was identified during the survey and on aerial photos, the trail begins at the south side of Aimakapa Pond (fishpond) along the coast of Honokohau I *ahupua'a* and extends *mauka* across the *ahupua'a*, intersecting the Mamalahoa Trail (State site 50-10-27-2), and a running parallel to a trodden a'a trail (State site 50-10-27-18122). The most *mauka* portion of the trail, beginning at approximately the 690 ft. a.m.s.l, has evolved during the historic era into a road likely associated with ranching or historic agriculture activities in this region.

Midden was observed over portions of the trail.

CSH Site #: 21

SHPD Site #: 50-10-27-18100
Site Type: *ahu*
Function: Marker
Features (#): 1
Dimension: 1.44 m.² (15.6 ft.²)
Elevation: 110 ft. a.m.s.l.

Description: Site 18100 is a large *ahu* located 4.3 m. (14.1 ft.) to the south of the kerbstone trail (Site 18099). The *ahu* measures 1.2 m. (3.9 ft.) high and 1.2 m. (3.9 ft.) in diameter, and likely served as a marker for Site 18099 trail.

No midden or artifacts were observed.

Site 18100 is in fair condition but there is little likelihood of finding cultural deposits.

CSH Site #: 22

SHPD Site #: 50-10-27-18101
Site Type: Enclosure remnant
Function: Habitation, temporary
Features (#): 1
Dimension: 4.0 m.² (43.0 ft.²)
Elevation: 85 ft. a.m.s.l.

Description: Site 18101 (Figure 20) is a somewhat circular enclosure - constructed of pahoehoe boulders -located on undulating pahoehoe lava terrain. The enclosure measures 2.0 m. (6.6 ft.) in diameter; no facing was apparent.

No midden or artifacts were observed.

The site is in remnant condition and, given the lack of soil deposition, there is little likelihood of finding cultural deposits.

CSH Site #: 23

SHPD Site #: 50-10-27-18102
Site Type: Lava tube
Function: Temporary habitation
Features (#): 1
Dimension: 48.0 m.² (516.4 ft.²)
Elevation: 177 ft. a.m.s.l.

Description: Site 18102 (Figure 21) is a small, low and narrow lava tube located beneath a moderately sloping pahoehoe lava surface. Vegetation on the surface is primarily *koa haole* and grasses.

The tube measures approximately 26.0 m. (85.3 ft.) long NE/SW and averages 2.0 m. (6.6 ft.) in width. Maximum ceiling height is 0.8 m. (2.6 ft.).

There are four separate light zones - created by collapsed ceiling areas - within the tube. The light zones are distributed at fairly equal intervals along the length of the tube.

One large, fragmented water-rounded stone was observed near the *mauka*-most light zone. No other artifacts or midden were observed.

No cultural deposits are believed present.

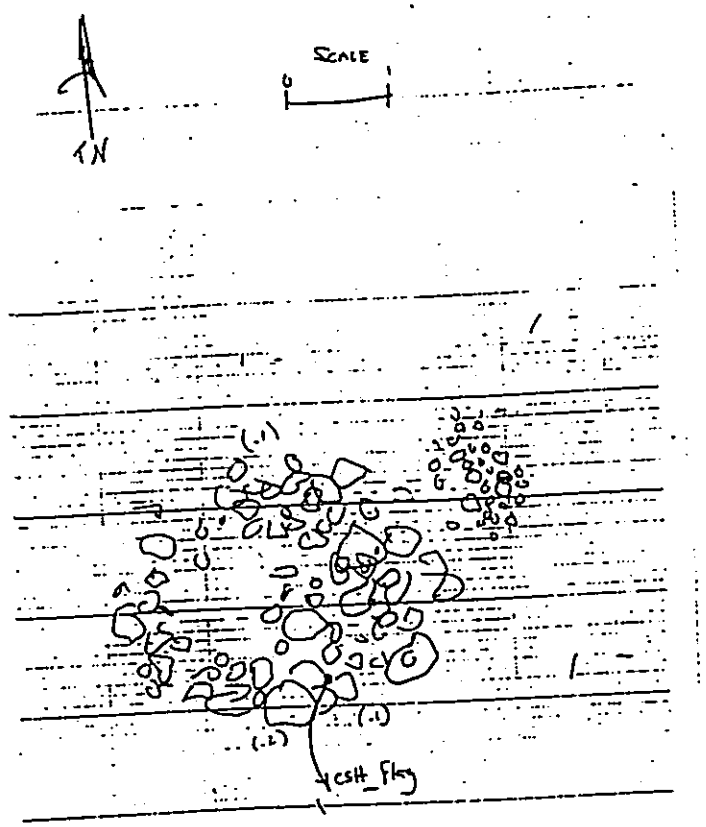


Figure 20 Site 50-10-27-18101, Plan View

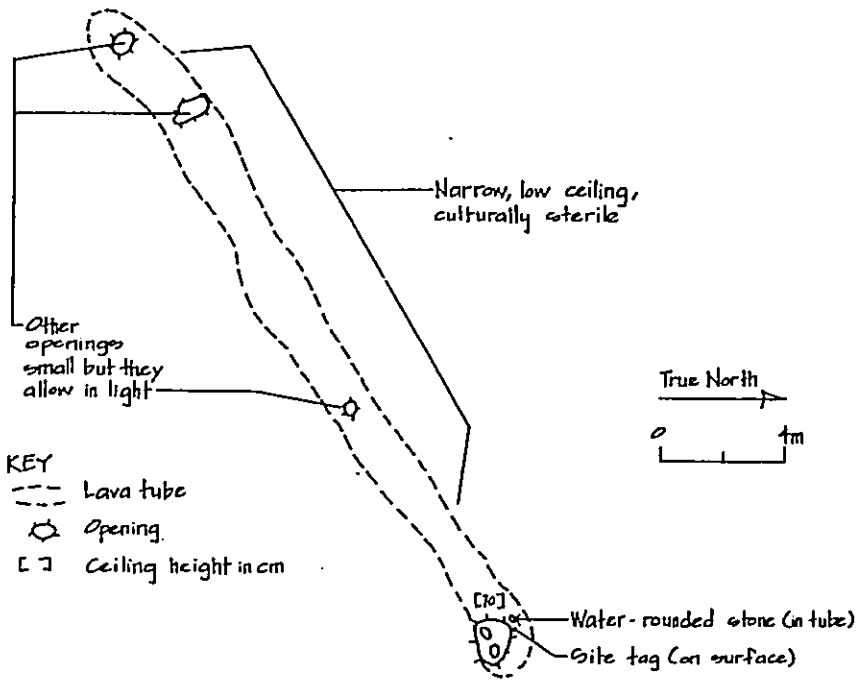


Figure 21 Site 50-10-27-18102, Plan View

SHPD Site #: 50-10-27-18103 **CSH Site #:** 24
Site Type: Stepping-stone trail
Function: Trail
Features (#): -
Dimension: 15.0 m.² (161.4 ft.²)
Elevation: 150 to 175 ft. a.m.s.l.

Description: Site 18103 is a stepping-stone trail remnant located on an undulating, gentle *makai*-trending a`a flow. No soil is present and the area is barren of all vegetation.

The trail crosses a`a outcrop in a east/west direction and measures 30.0 m. (98.4 ft.) long by 0.5 m. (1.64 ft.) wide. It crosses the *makai* toe of the a`a flow, extending *mauka* of Site 18104 enclosure (possibly an animal pen or a garden to keep animals out) to the other side of the a`a field to the southwest. An historic-era square bucket - hanging on a knob of a`a - is present at the northeast end of the trail where it crosses onto pahoehoe. The trail likely functioned in association with Site 18104 and probably connected to Site 18099 trail.

No midden or artifacts were observed.

Site 18103 is in remnant condition with no soil present.

SHPD Site #: 50-10-27-18104 **CSH Site #:** 25
Site Type: Irregular enclosure
Function: Agriculture/Animal pen
Features (#): 1
Dimension: 3,600.0 m.² (38,880.0 ft.²)
Elevation: 60 to 110 ft. a.m.s.l.

Description: Site 18104 is a long, meandering bifaced wall situated on undulating to flat a`a and pahoehoe lava. The area has pockets of soil visible which allows for growth of *koa haole* and grasses and a stepping stone trail (Site 18103) appears to connect this site with a historic *mauka/makai* trail.

The wall extends along the edge of a prominent a`a flow and along a level area of pahoehoe. It is irregularly configured, forming a few enclosed areas in conjunction with the outcrop edges. The northern portion of the wall, running roughly *mauka/makai*, is the longest continuous segment. Facing was observed in several sections and the highest vertical facing measured 1.4 m. (4.7 ft.). Average width of the wall is 0.8 m.

Overall, the enclosure wall network encloses a depressed area in the *makai* portion of the project area, and extends on and below the higher a`a lava flow with a gully along the *makai* side of the site. The areal extent covered by this site is approximately 3600 m.² (38,880.0 ft.²). The height of the wall (1+ m.) and width (.8 m.) suggested a structure of historic age and that it was an area either to keep animals out or in however, a local part-Hawaiian man of late middle age, who was unwilling to give his name and gave no other information about himself, said he remembered many years ago a field of small sweet pineapples planted in that area. The wall presently is full of gaps but was probably formerly continuous. See the site configuration on the lower part of the project plan map

No midden or artifacts were observed.

Site 18104 is in fair to poor condition with possibility of some cultural deposits.

SHPD Site #: 50-10-27-18105 **CSH Site #: 27**
Site Type: Wall
Function: Animal pen
Features (#): 1
Dimension: 28.0 m. (92.4 ft.) long
Elevation: 65 ft. a.m.s.l.

Description: Site 18105 is a long meandering wall located on mixed a`a and pahoehoe lava terrain near at the edge of extensive bulldozed land in the northwest section of the project area. Vegetation is primarily *koa haole* and grasses.

The wall connects two high points along a steep a`a ridge. The wall is oriented NW/SE and measures approximately 28.0 m. (91.8 ft.) long. The southeast end of the wall terminates at a massive a`a boulder and the northwest end terminates at a pahoehoe ridge. The wall is bifaced along most of its length, with a maximum height of 1.1 m. (3.6 ft.).

An enclosed area appears to be defined by the wall to the east and by steep a`a and pahoehoe outcrop and bulldozer push to the north, west and south. This enclosed area is generally level. A mound is located within it.

No midden or artifacts were observed.

Site 18105 is in fair condition and no cultural deposits are believed present. The site is probably an animal pen associated with State site 50-10-27-18104 enclosure.

SHPD Site #: 50-10-27-18106 **CSH Site #: 28**
Site Type: Platform
Function: Undetermined
Features (#): 1
Dimension: 8.5 m.^{2} (91.4 ft.^{2})
Elevation: 95 ft. a.m.s.l.

Description: Site 18106 (Figure 22) is a platform located along an a`a outcrop bounded by pahoehoe immediately north of the site. Scattered grasses cover the surrounding area.

The platform measures approximately 4.0 m. (13.2 ft.) NE/SW by 3.0 m. (9.9 ft.) NW/SE and rises a maximum of 0.7 m. (2.3 ft.). It constructed of an a`a boulder facing and roughly paved with a`a cobbles.

No midden or artifacts were observed.

Site 18106 is in good condition and cultural deposits may be present.

SHPD Site #: 50-10-27-18107 **CSH Site #: 29**
Site Type: Circular enclosure
Function: Animal pen
Features (#): 1
Dimension: 200.0 m.^{2} (2,151.7 ft.^{2})
Elevation: 75 ft. a.m.s.l.

Description: Site 18107 (Figure 23) is a large, oval enclosure located in mixed terrain of pahoehoe and some a`a. Vegetation is primarily klu, *koa haole* and grasses.

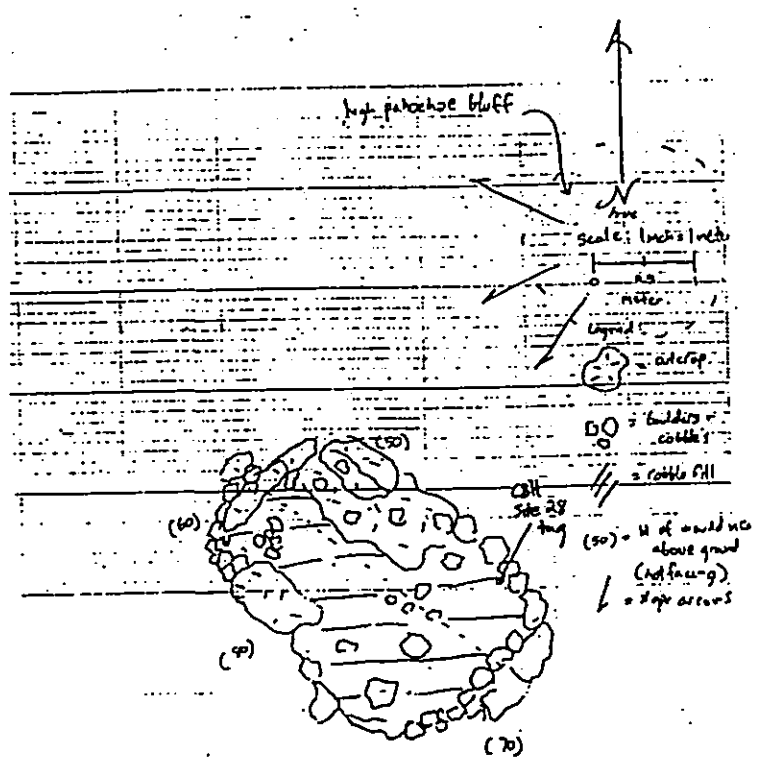


Figure 22 Site 50-10-27-18106, Plan View

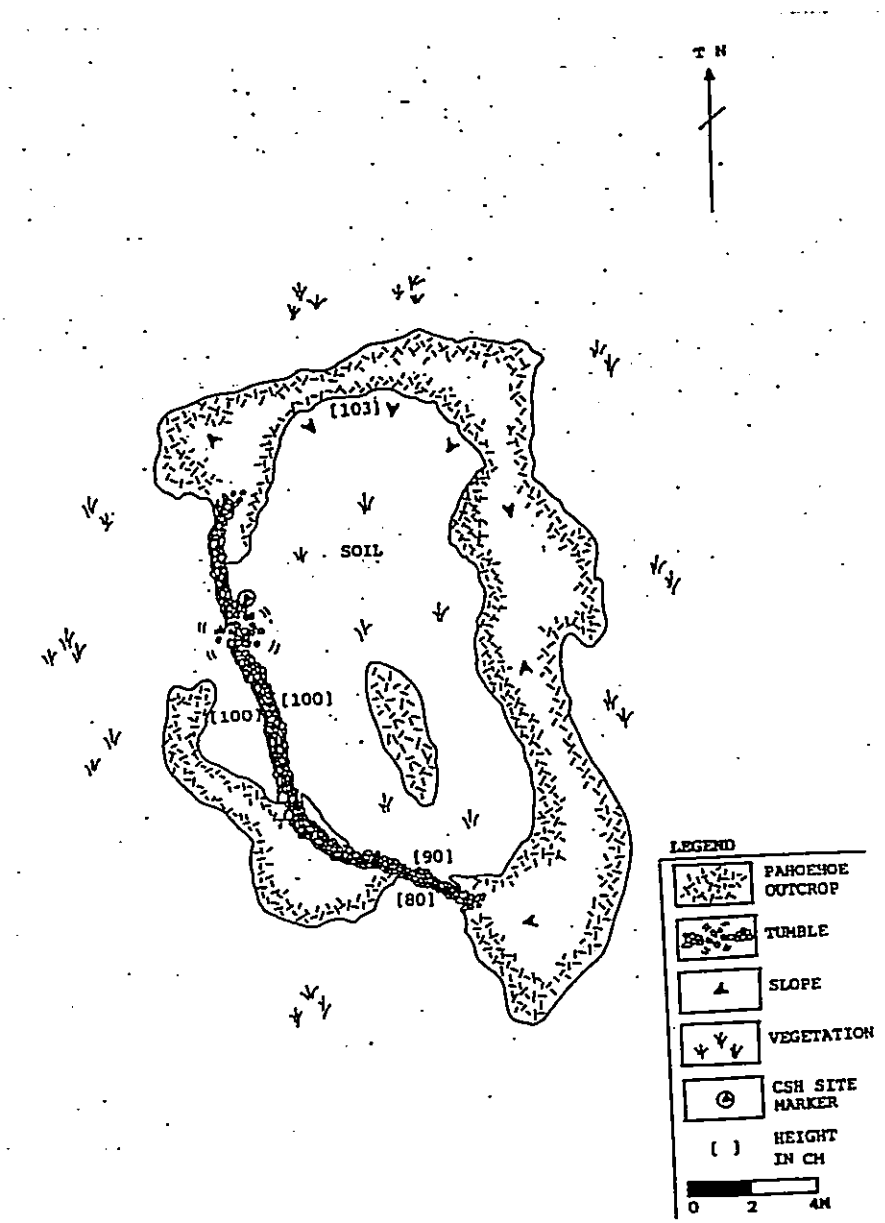


Figure 23 Site 50-10-27-18107, Plan View

The enclosed area is defined by both wall segments and steep-sided pahoehoe outcropping. The wall is bifaced and is constructed of pahoehoe boulders and cobbles. It defines the west (*makai*) side of the enclosure. From the northwest corner of the enclosure, the wall runs south for 10.0 m. (32.8 ft.) and then curves gently to the southeast for 6.0 m. (19.7 ft.). The wall is generally uniform in height, measuring 1.0 m. (3.3 ft.) high.

Steep outcrop, up to 1.3 m. (4.3 ft.) high, defines the enclosure to the east and north.

The enclosed area measures approximately 16.0 m. (52.5 ft.) long N/S by 8.0 m. (26.2 ft.) wide. The interior is primarily soil and is densely vegetated with klu.

No artifacts or midden were observed.

Site 18107 is in fair to poor condition. Cultural deposits may be present.

CSH Site #: 30

SHPD Site #: 50-10-27-18108
Site Type: Modified bluff
Function: Agriculture
Features (#): 2
Dimension: 680.0 m.^{2} (7,344.0 ft.^{2})
Elevation: 110 ft. a.m.s.l.

Description: Site 18108 (Figure 24) consists of, to the north, a variety of outcrop modifications - designated A - and, to the south, bluff modifications and a distinct bluff-enclosure - designated Feature B.

Feature A contains outcrop modifications including pebble and cobble filled crevasses, rock piles and a terrace structure, all situated along fairly level pahoehoe outcrop. Overall, Feature A measures 10.75 m. (35.5 ft.) by 14.0 m. (45.9 ft.). The average wall height for the terrace portion of Feature A is 0.5 m. (1.64 ft.).

Feature B of Site 18108 is a modified bluff. It measures 17.0 m. (55.8 ft.) by 3.75 m. (12.3 ft.). Modifications include a rough piling and terracing along the edge of the bluff. The average wall height for these modifications is 0.3 m. (0.98 ft.).

The bluff enclosure is formed at the south end of the feature by two wall sections abutting the edge of the bluff. The walls define an irregularly-shaped enclosure which is open to the west. The interior is level and soil covered.

No artifacts or midden were observed.

Site 18108 is in fair condition and cultural deposits may be present.

CSH Site #: 31

SHPD Site #: 50-10-27-18109
Site Type: Enclosure remnant
Function: Agriculture
Features (#): -
Dimension: 10.5 m.^{2} (113.4 ft.^{2})
Elevation: 110 ft. a.m.s.l.

Description: Site 18109 is two roughly constructed, contiguous enclosures located on a moderate southwesterly slope. The area is characterized by scattered rubble over soil. The only vegetation present is fountain grass and *koa haole*.

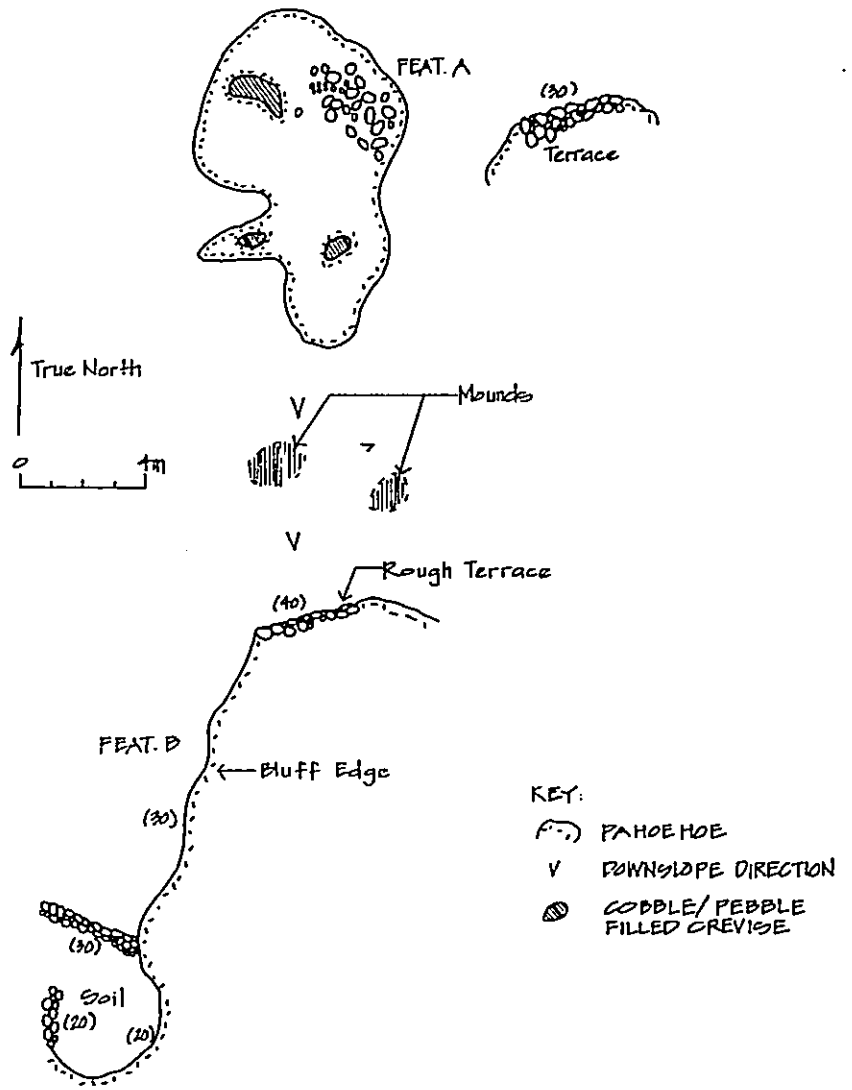


Figure 24 Site 50-10-27-18108, Plan View

The western enclosure measures 2.5 m. (8.2 ft.) N/S by 3.0 m. (9.8 ft.) E/W. The maximum wall width is 2.0 m. (6.6 ft.); maximum height is 0.7 m. (2.3 ft.). The eastern enclosure measures 2.0 m. (6.6 ft.) N/S by 1.5 m. (4.9 ft.) E/W. The maximum wall width is 0.5 m. (1.64 ft.); maximum wall height is 0.6 m. (1.97 ft.). Both enclosures are constructed of large and medium boulders, roughly piled with no facing. The interiors of the enclosures are grass with scattered boulders.

The site is located roughly 40.0 m. (131.2 ft.) from the quarry access road and may have been disturbed by bulldozing.

No artifacts or midden were observed.

Site 18109 is in poor condition and no cultural deposits are believed to be present.

SHPD Site #: 50-10-27-18110 **CSH Site #:** 32
Site Type: Circular enclosure
Function: Agriculture
Features (#): -
Dimension: 84.0 m.^{2} (907.2 ft.^{2})
Elevation: 140 ft. a.m.s.l.

Description: Site 18110 (Figure 25) is an enclosure located on a level to gentle *makai*-trending slope. Vegetation is comprised of *koa haole* and grass.

The enclosure utilizes a pahoehoe sink and is defined by boulders -2 to 6 courses at the sinks edge. Some boulders are randomly scattered along the northeastern section of the sink.

The size and thickness of the walls, along with the lack of an entry, suggest that the enclosure is an animal pen, perhaps for pigs.

No artifacts or midden were observed.

Site 18110 is in good to fair condition and cultural deposits may be present.

SHPD Site #: 50-10-27-18111 **CSH Site #:** 33
Site Type: Complex
Function: Temporary habitation; agriculture
Features (#): 2
Dimension: 156.9 m.^{2} (1,691.3 ft.^{2})
Elevation: 125 ft. a.m.s.l.

Description: Site 18111 (Figure 26) is located on a gentle *makai*-trending pahoehoe lava slope. Scattered areas of soil on the pahoehoe support *koa haole* and grasses. The site is a complex consisting of a lava blister designated Feature A - and a small platform - designated Feature B. Overall, the site measures 10.6 m. (34.8 ft.) N/S by 14.8 m. (48.6 ft.) E/W.

Feature A lava blister has a main chamber measuring 5.0 m. (16.5 ft.) N/S by 2.0 m. (6.6 ft.) E/W. The entrance into the blister measures 1.0 m. (3.3 ft.) wide with a height of 0.5 m. (1.6 ft.). A few piled boulders constrict the entrance. The main chamber has a

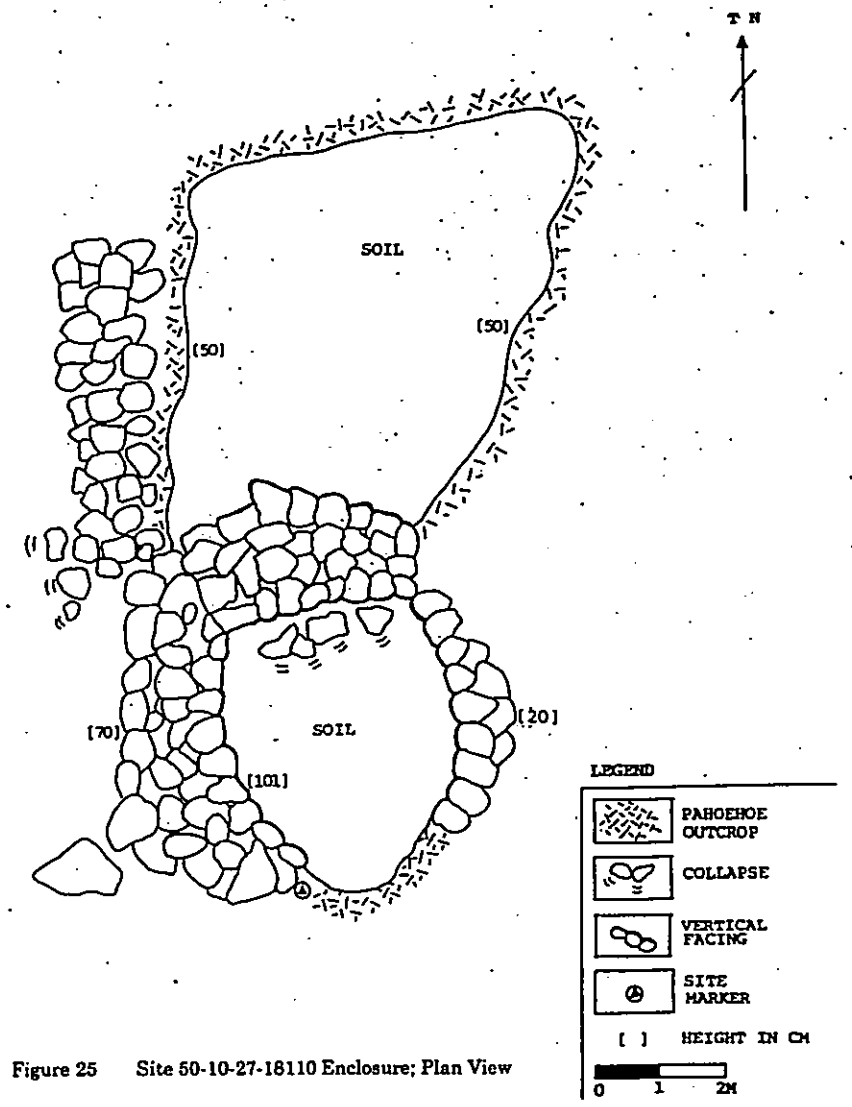


Figure 25 Site 50-10-27-18110 Enclosure; Plan View

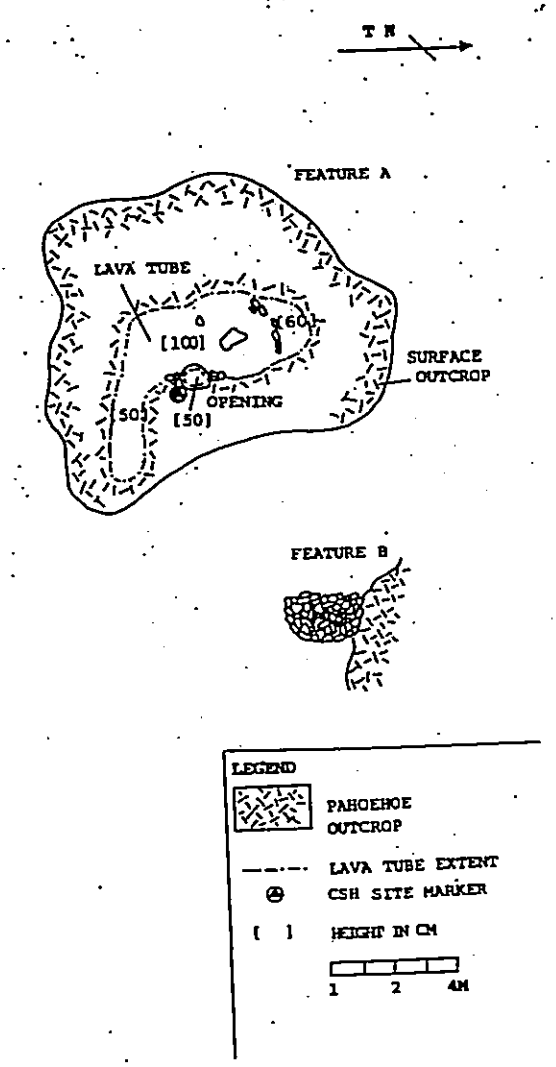


Figure 26 Site 50-10-27-18111 Site Complex, Features A and B; Plan View

maximum height of 1.0 m. (3.3 ft.) and its floor is a ropey and rough lava. An alignment of small boulders extends across the north portion of the chamber for approximately 2.0 m. (6.6 ft.) E/W.

A small and narrow passage extends to the east of the main chamber's southern end; it measures 3.0 m. (9.9 ft.) E/W by 1.0 m. (3.3 ft.) wide with a maximum height of 0.5 m. (1.6 ft.).

No cultural materials were observed within Feature A lava blister. It is in good condition and cultural deposits may be present.

Feature B of Site 18111 is a small platform measuring 2.5 m. (8.2 ft.) N/S by 1.5 m. (4.9 ft.) E/W. The platform is constructed of pahoehoe cobbles with no clear facing visible. It is located approximately 8.0 m. (26.4 ft.) northeast of the lava blister entrance.

No artifacts or midden were observed.

Feature B is in fair condition and cultural deposits may be present.

CSH Site #: 34

SHPD Site #:	50-10-27-18112
Site Type:	Complex
Function:	Permanent habitation; trail; marker
Features (#):	15
Dimension:	10,923 m.^{2} (117,968.4 ft.^{2})
Elevation:	150 to 155 ft. a.m.s.l.

Description: Site 18112 (Figure 27) is a complex consisting of 15 features designated Features A to O. The features are believed associated because of similar construction style, proximity and similar states of preservation. The site is located on the edge of a barren a`a field. Only sparse grasses occur in the site area.

The site includes a series of pavements, *ahu*, enclosures and trail segments occurring primarily to the south of State site 50-10-27-18099 kerbstone trail. The complex is focused along the southwest outer edge of the a`a flow which forms a natural C-shape configuration around the underlying State site 50-10-27-18117 lava tube to the southwest.

The features range in size from 4.0 m.^{2} (13.1 ft.2) to 75.0 m.^{2} (246.1 ft.2) and typically consist of a cleared, cobble paved surface of a`a. The paved areas are all very close to the edge of the a`a flow, providing easy access to the pahoehoe surface and Site 18117 below.

Feature A is a flat paved area occurring on the southern tip of the a`a flow. It measures 4.75 m. (15.7 ft.) N/S by 2.0 m. (6.6 ft.) E/W. The pavement consists of a`a cobbles and pebbles. A small amount of midden was observed.
February 2, 1998

Feature B of Site 18112 is located 5.0 m. (16.4 ft.) north of Feature A and is a rough C-shape constructed of a`a boulders. The interior is paved with a`a cobbles and pebbles. The east wall of the C-shape is the tallest, reaching a maximum height of 0.85 m. (2.81 ft.).

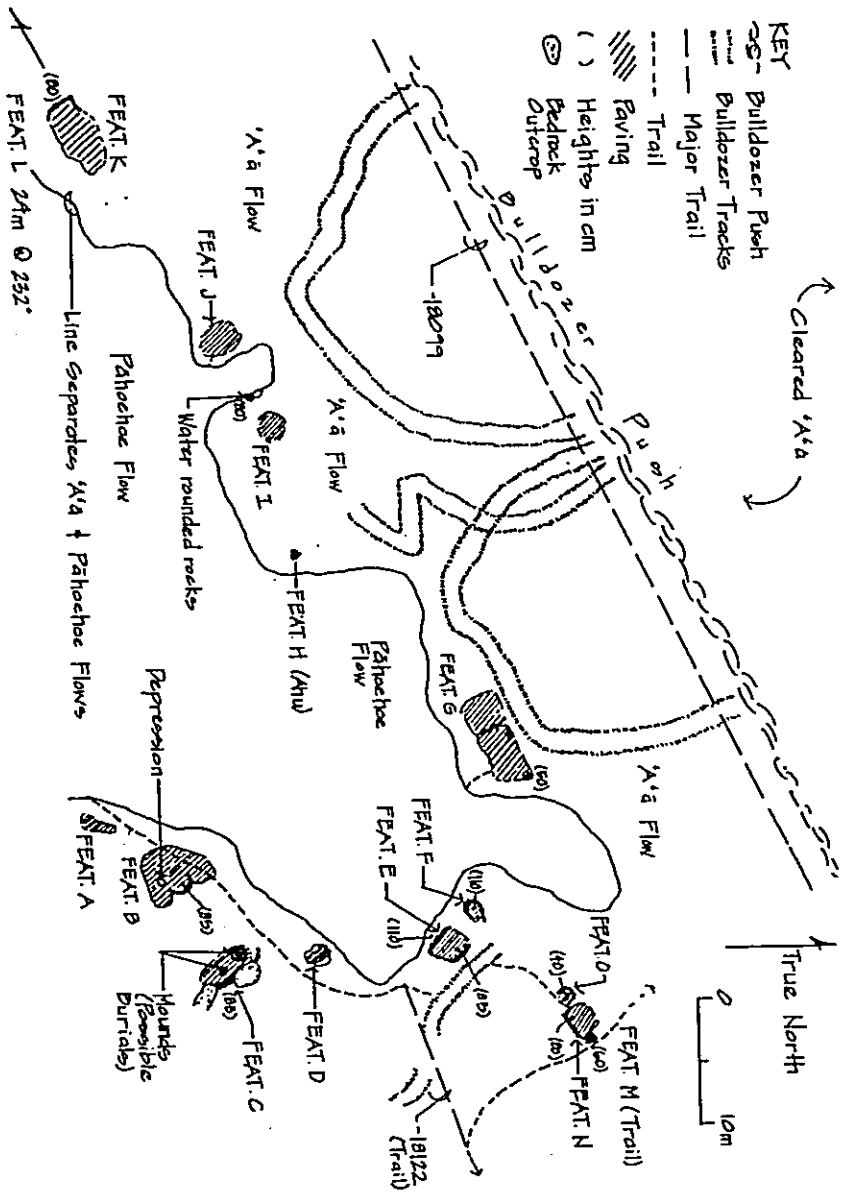


Figure 27 Site 50-10-27-18112, Plan View

A paved area extends from the C-shape to the north, south and west. A circular depression in the paved area is located approximately 2.0 m. to the southwest of the C-shape. It measures approximately 1.0 m. (3.3 ft.) in diameter.

A trail was observed approximately 2.0 m. (6.6 ft.) to the west of the C-shape and is oriented northeast/southwest, following the edge of the a`a flow. It terminates near Feature E. Its total length is approximately 54.0 m. (177.2 ft.).

Feature C is a modified outcrop located 9.5 m. (31.2 ft.) northeast of Feature B. The feature measures 5.5 m. (18.0 ft.) N/S by 11.0 m. (36.1 ft.) E/W. The southeast wall of this feature is constructed between two large a`a outcrops. It reaches a maximum height of 0.85 m. (2.81 ft.).

To the northwest of the wall is an a`a cobble and pebble paved area. Two small mounds are located on this paved area.

Feature D of Site 18112 is a U-shaped enclosure - measuring 3.0 m. (9.8 ft.) N/S by 3.75 m. (12.4 ft.) E/W - located approximately 7.0 m. (23.0 ft.) to the northwest of Feature C. The enclosure consists of a partially stacked wall to the northwest constructed between two large a`a outcrops. The southwest is open. The interior is a depression that has been partially filled with a paving of a`a cobbles and pebbles. The paved interior is approximately 0.50 m. (1.64 ft.) to 0.70 m. (2.30 ft.) below the surrounding area. One pahoehoe slab was observed. No midden was observed.

Occurring between Features D and E is State site 50-10-28-18122 trail. The trail is visible on the a`a, oriented east/west (*mauka/makai*).

Feature E is a pavement bounded by wall segments on its northeast and south west sides, located approximately 10.3 m. (33.8 ft.) north of Feature D. The pavement measures approximately 4.0 m. (13.1 ft.) in diameter. A wall on the southwest is only one course high but rises 1.10 m. (3.6 ft.) above the adjacent pahoehoe flow. The northeast wall is constructed of several courses of cobbles, rising a maximum 0.85 m. (2.81 ft.) high.

Feature F of Site 18112 is a low, paved a`a surface with a wall along a portion of its perimeter. It is located approximately 2.75 m. (9.1 ft.) to the northwest of Feature E. The feature measures 4.0 m. (13.1 ft.) N/S by 2.25 m. (7.43 ft.) E/W. The walls stand approximately 1.10 m. (3.6 ft.) high. The interior is paved with a`a cobbles and pebbles.

No midden was observed.

Feature G is a two-tiered paved area located approximately 16.0 m. (52.5 ft.) to the west of Feature F. The entire feature measures 6.0 m. (19.7 ft.) N/S by 13.0 m. (42.7 ft.) E/W. The eastern paved area (upper tier) measures 6.0 m. (19.7 ft.) N/S by 8.25 m. (27.23 ft.) E/W. The western paved area (lower tier) measures 5.75 m. (18.9 ft.) N/S by 4.75 m. (15.68 ft.) E/W. Both areas are paved with a`a cobbles and pebbles. One pahoehoe slab was observed.

The upper tier has a wall segment at its northern edge where a small depression was observed. The depression is 0.50 m. (1.64 ft.) deep. A second small depression was observed in the northeast corner of the upper tier. No internal features were observed on the lower tier. There is also a pathway leading to Site 18117 lava tube.

Midden is scattered over the surface of the feature.

Feature H of Site 18112 is an *ahu* - measuring 0.50 m. (1.64 ft.) in height and 1.0 m. (3.3 ft.) in diameter - located approximately 30.0 m. (98.4 ft.) southwest of Feature G.

Feature I - located 15.0 m. (49.2 ft.) west of Feature H - is a circular paved area near the edge of the a`a flow. It measures 3.75 m. (12.38 ft.) N/S by 3.25 m. (10.73 ft.) E/W. The southeast, southwest and northwest sides rise only slightly above the level of the surrounding flow. The pavement comprises a`a cobbles and pebbles.

No midden or artifacts were observed.

To the west of Feature I is a small depression with a wall built on its western side. To the north is a small cache of waterworn stones.

Feature J of Site 18112 - located 9.0 m. to the southwest of Feature I - is a paved area on the edge of the a`a flow. The pavement measures 4.0 m. (13.1 ft.) N/S by 5.75 m. (18.9 ft.) E/W and rises approximately 0.80 m. (2.62 ft.) above the surrounding terrain.

No midden or artifacts were observed.

A small trail segment nearby leads off the a`a flow to the surrounding pahoehoe flow below. The trail is a worn depression on the a`a and has a measured length of 1.50 m. (4.9 ft.).

Feature K is an L-shaped wall and an adjacent a`a cobble and pebble paved area located 25.5 m. (83.7 ft.) to the southwest of Feature J. Feature K measures 6.0 m. (19.7 ft.) N/S by 11.0 m. (36.1 ft.) E/W. The wall borders the southwest edge of the paved area. The longer northwest/southeast-oriented leg of the wall is well faced. It has a maximum wall height of 0.80 m. (2.62 ft.). The shorter southwest/northeast-oriented leg of the wall is not faced.

No midden or artifacts were observed.

Feature L of Site 18112 - located approximately 24.0 m. (78.7 ft.) to the southwest from Feature K - consists of two square *ahu* located on the toe of the a`a flow. Both *ahu* are well stacked. The first *ahu* measures 1.80 m. (5.9 ft.) by 2.30 m. (7.5 ft.) by 0.80 m. (2.62 ft.) high; the second measures 1.30 m. (4.3 ft.) by 1.40 m. (4.6 ft.) by 1.15 m. (3.8 ft.) high.

Located 10.0 m. (32.8 ft.) to 15.0 m. (49.2 ft.) to the southwest of Feature L is another *ahu* (State site 50-10-27-18096).

A large waterworn stone was observed between Features K and L but was not collected. No midden was observed.

Feature M is a stepping-stone trail delineated by an alignment of pahoehoe slabs along a linear trodden a`a surface. The trail measures 56.0 m. (183.7 ft.) long. It connects to two other trails: State sites 50-10-27-18099 and 50-10-28-18122).

Feature N of Site 18112 is a rectangular enclosure located 1.0 m. (3.3 ft.) west of Feature M trail and measures 3.50 m. (11.5 ft.) N/S by 4.25 m. (14.0 ft.) E/W. (The trail parallels the enclosure's east wall. The walls measure approximately 0.6 m. (2.0 ft.) thick and 0.8 m. (2.6 ft.) high, maximum. There is another trail segment leading from the enclosure southwest towards Feature E but the southernmost portion of the trail was destroyed by bulldozing activity.) The north, south and east walls of the enclosure are roughly constructed but intact. The west wall is collapsed.

No midden or artifacts were observed.

Feature O is a C-shaped enclosure located immediately west of Feature N; it is open to the south and is roughly constructed. It measures 2.5 m. (8.2 ft.) N/S by 2.25 m. (7.43 ft.) E/W and is .8 m. (2.6 ft.) high, maximum.

No midden or artifacts were observed.

Site 18112 is in fair condition and cultural deposits may be present based on the presence of midden.

SHPD Site #: 50-10-28-18113 **CSH Site #: 35**
Site Type: Platform
Function: Agriculture
Features (#): 1
Dimension: 5.5 m.^{2} (59.4 ft.^{2})
Elevation: 95 ft. a.m.s.l.

Description: Site 18113 (Figure 28) is a rectangular platform located on a pahoehoe outcrop. The terrain consists of uneven pahoehoe outcrops and small soil pockets in an area which slopes gently southwest. Vegetation at the site consists of *kiawe, koa haole* and fountain grass.

The platform measures 2.5 m. (8.2 ft.) NE/SW by 2.2 m. (7.2 ft.) NW/SE and is constructed of pahoehoe cobbles and boulders. Facing is intact along its southwest side as well as on portions of its southeast and northwest sides. The surface is rough. A circular depression at the center measures 1.0 m. (3.3 ft.) in diameter by 0.20 m. (0.66 ft.) deep. A test unit measuring 1.0 m. (3.3 ft.) by 1.0 m. (3.3 ft.) was excavated within the depression (see Testing Results below).

No artifacts or midden were observed.

Site 18113 is in fair condition. Based on the results of testing, the site is interpreted as a traditional agricultural field *hale*. No cultural deposits are believed to be present.

Testing Results

Limited testing was conducted at Site 18113 to determine the presence or absence of human burial. A 1.0 m. by 1.0 m. (3.3 ft. by 3.3 ft.) test unit was excavated in a depression of the platform surface. The platform fill extended to a maximum depth of 60 cm. Below the platform an intermittent soil deposit - Stratum I - was present.

Stratum I was excavated to a maximum depth of 5 cm. where bedrock was encountered. A small amount of marine midden was recovered from Stratum I, including two horn shell fragments (*Cerithium* sp.) weighing 0.9 gms. and one 0.5 gm. sea urchin fragment (Echinoderm). No human skeletal remains were encountered during the excavation.

Stratum I consisted of a dark brown (10 YR 3/3) silt loam.

The testing results indicate that no burial is present within or below the platform.

Interpretation: Based on the scant midden recovered from the site along with its platform construction (raised surface), it is interpreted as an traditional agricultural field *hale* used for processing crop goods, providing a shelter for a short nap, and perhaps served also as a storage house and it may have been constructed as a result of ground clearance.

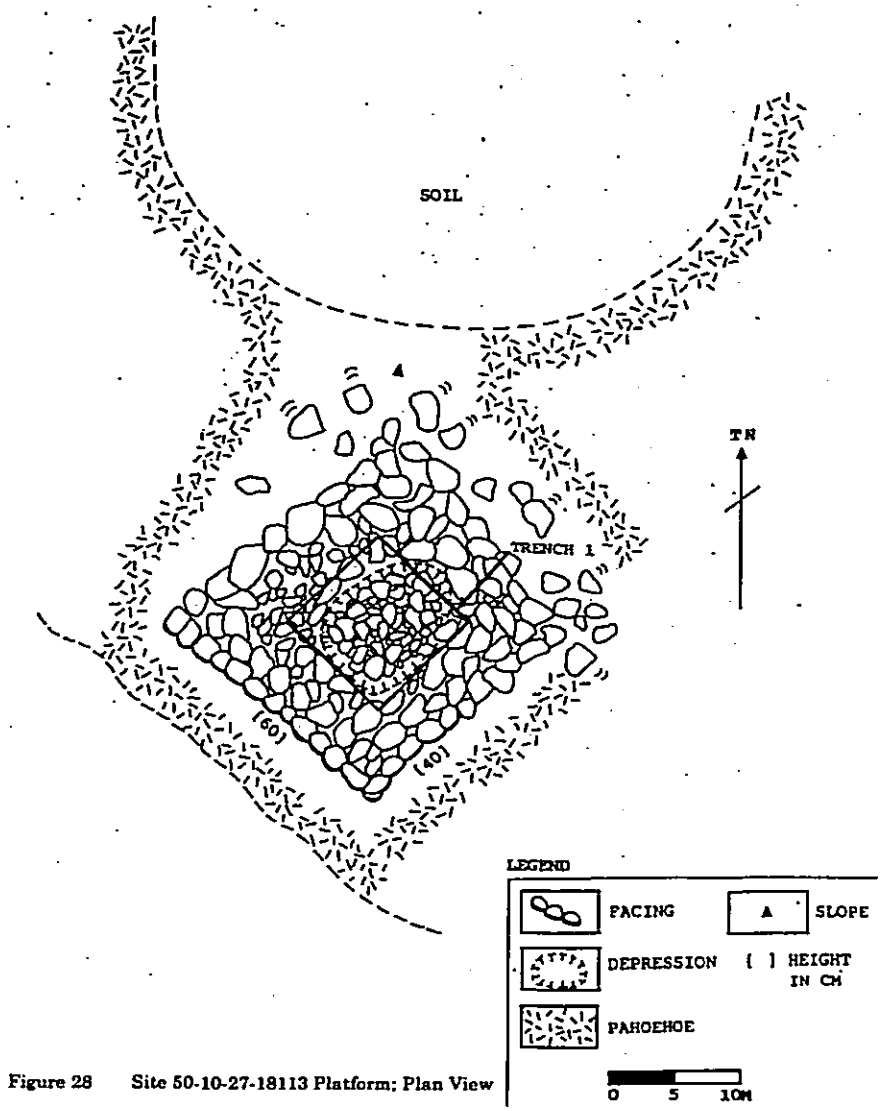


Figure 28 Site 50-10-27-18113 Platform; Plan View

SHPD Site #: 50-10-27-18114 **CSH Site #: 36**
Site Type: *ahu*
Function: Marker
Features (#): -
Dimension: 0.28 m.² (3.01 ft.²)
Elevation: 80 ft. a.m.s.l.

Description: Site 18114 is an *ahu* located on an undulating, gently *makai*-sloping pahoehoe lava. Small pockets of soil in the surrounding terrain support *koa haole* and grasses.

The *ahu* is located approximately 15.0 m. (49.2 ft.) southeast of the east end of State site 50-10-27-18087 wall. It consists of 2 courses and 2 rows of stacked small boulders and measures 0.7 m. (2.30 ft.) N/S by 0.4 m. (1.31 ft.) E/W with a maximum height of 0.8 m. (2.62 ft.).

No midden or artifacts were observed. Site 18114 is not believed to contain any cultural deposit.

SHPD Site #: 50-10-27-18116 **CSH Site #: 38**
Site Type: Complex
Function: Permanent habitation; burial; symbolism
Features (#): 3
Dimension: 339.3 m.² (3,650.51 ft.²)
Elevation: 140 ft. a.m.s.l.

Description: Site 18116 (Figure 29) consists of a lava tube - Feature A - and petroglyphs - Features B and C - located on and beneath a gentle *makai*-trending surface of pahoehoe lava. The terrain above the lava tube is predominantly pahoehoe outcrop with small soil areas. Vegetation includes *koa haole*, *alahe'e* and grasses.

Feature A lava tube is entered through a sink formed by ceiling collapse. The sink measures 7.3 m. (24.0 ft.) long by 5.0 m. (16.4 ft.) wide with a maximum depth of 3.0 m. (9.8 ft.). Large pahoehoe boulders and several *koa haole* trees are present in the bottom of the sink.

The lava tube extends to the southwest and to the northeast from its entrance. Inside the dripline, a thick covering of midden extends throughout the floor of the tube, especially in its northeast portion. An abundance of rat and mice bones litter the tube floor - refuse of the tube's owl inhabitants. Several goat skeletons are also present - from animals that had fallen into the sink.

The southwest portion extends approximately 26.0 m. (85.3 ft.). Six internal features are present within the southwest portion and are designated **Subfeatures 1** through 6 and two are within the northeast section (designated **Subfeatures 7** and 8).

Subfeature 1 is a terrace located 1.0 m. (3.3 ft.) southwest of the dripline. The terrace spans the width of the tube and rises 0.7 m. (2.3 ft.) above the tube floor.

Subfeature 2 is a circular alignment of large cobbles located 4.0 m. (13.1 ft.) from the entrance. The alignment rests below an overhang and abuts the west wall of the tube.

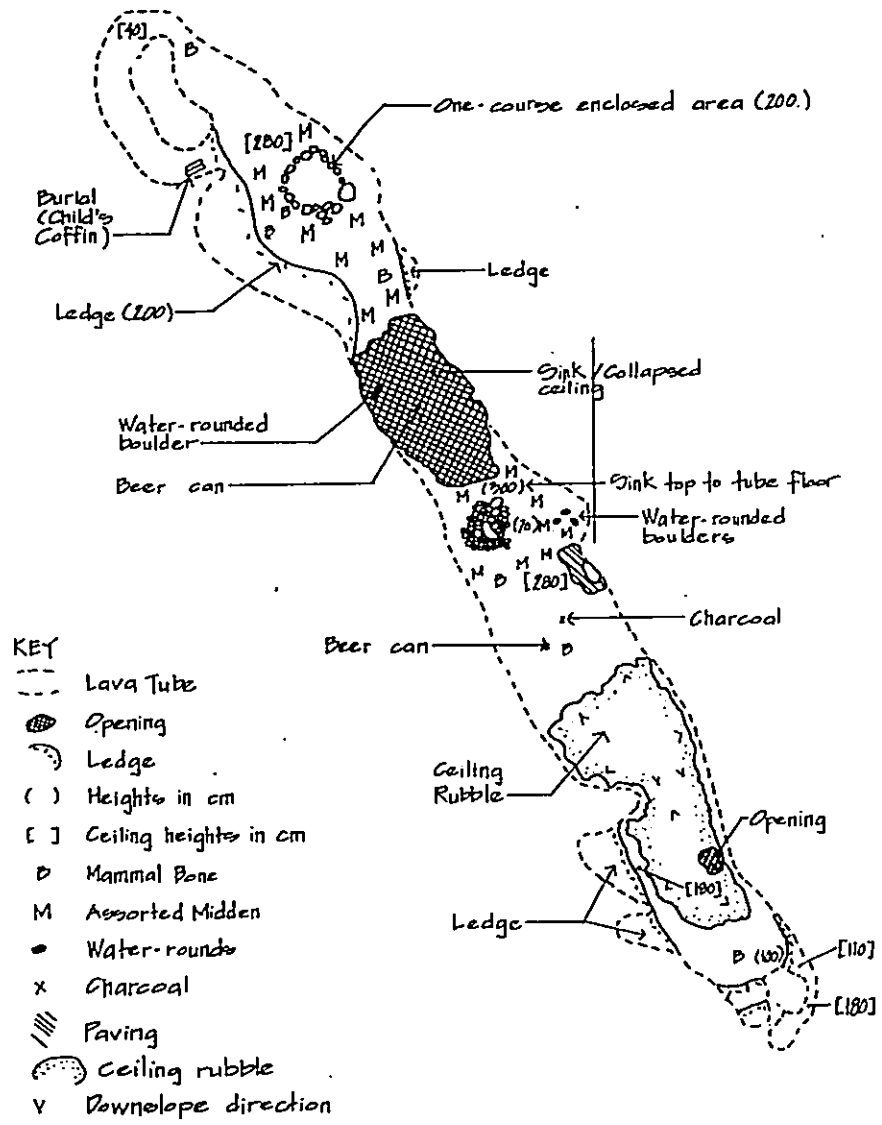


Figure 29 Site 50-10-27-18116 Feature A, Lava Tube; Plan View

It measures 2.4 m. (7.9 ft.) E/W by 1.6 m. (5.2 ft.) N/S. Large sea urchin fragments and a coconut shell were observed at this subfeature.

Subfeature 3 is a clustering of midden and artifacts located between 10.3 m. (33.8 ft.) and 11.0 m. (36.1 ft.) from the entrance. At 10.3 m. (33.8 ft.) there is a concentration of *kukui* shells. At 10.5 m. (34.4 ft.) a handful of *'ili'ili* stones was observed. These stones may be associated with a *papamū* (Feature B) located on the surface. At approximately 10.8 m. (35.4 ft.) a pile of cobble-sized, waterworn stones was observed. At 11.0 m. (36.1 ft.) a discoidal piece of coral with rounded edges was observed. It may be an abrader.

Subfeature 4 is a small terrace abutting the south wall of the tube at 13.0 m. (42.7 ft.) from the entrance. The terrace measures 0.5 m. (1.6 ft.) N/S by 1.0 m. (3.33 ft.) E/W.

Subfeature 5 is a semi-circular alignment of cobbles located against the north wall of the tube at approximately 15.0 m. (49.2 ft.) from the entrance. The alignment encloses an area 0.5 m. (1.6 ft.) in diameter. This area lies below the level of the surrounding tube floor which has been built up with a rough cobble and boulder surface. (This cobble and boulder surface has many excavated depressions which may evidence prior looting.)

From 16.0 m. (52.5 ft.) to 27.0 m. (88.6 ft.) into the southwest portion of the tube, there is massive roof fall. The area of the tube behind this roof fall was culturally barren. Only three goat skeletons were observed.

Approximately 18.0 m. (59.1 ft.) from the entrance, a second roof collapse has created another light zone. No access is gained by this light zone.

Against the back wall of the southwest portion of the main tube, an opening to a smaller tube was observed at 22.8 m. (74.8 ft.). It continues in the same direction as the main tube, but is much smaller.

Subfeature 6 is a small mound of cobbles and small boulders located against the south wall of the smaller tube at approximately 24.2 m. (79.4 ft.) southwest of the main tube entrance.

Extending along the north wall of the smaller tube is a ledge containing many rodent bones, egg shells and *kukui* shells - refuse from owls inhabiting the tube. A low ceiling height prevented further exploration of the ledge area.

The northeast section of the lava tube is smaller compared to the southwest section and extends 16.2 m. (53.1 ft.) from the main entrance. Roof collapse forming the vertical opening into the lava tube has blocked part of the northeast section's entrance making the level of the sink floor about 1.0 m. (3.3 ft.) above the level of the tube floor. A test unit measuring 1.0 m. (3.3 ft.) by 0.50 m. (1.64 ft.) was excavated on a soil area within the light zone (see **Testing Results** below).

Two internal features - Subfeatures 7 and 8 - are present within the northeast section of the tube.

Subfeature 7 is a square enclosure located 5.0 m. (16.4 ft.) from the main entrance to the tube. It measures 2.0 m. (6.6 ft) in diameter and is constructed of a single course and row of cobbles.

A thick layer of marine midden was observed throughout the light zone of this portion of the lava tube. Historic goat and rodent bones were also observed.

Subfeature 8 is a coffin burial located within a subsidiary tube at 10.0 m. (33.0 ft.) from the main entrance to the tube, 3.0 m. (9.8 ft.) above the floor. The subsidiary tube extends back about 7.0 m. (23.0 ft.). The coffin burial is located at the entrance of the subsidiary tube against its west wall. The wood is well preserved but the coffin has

collapsed. Bones are visible between the planks. The size of the coffin indicates that it contains the remains of a sub-adult.

Along the northwest section of the main chamber is a ledge that is 2.0 m. (6.6 ft.) above the floor. It extends towards the back of the tube where roof collapse has closed off the tube.

Feature B of Site 18116 is a *papamū* located approximately 2.0 m. (6.6 ft.) northwest from the northwest corner of the sink and main entrance to the lava tube. It has a grid of 12 by 10 pecked depressions.

Feature C (Figure 30) is a petroglyph of a human form located approximately 2.0 m. (6.6 ft.) west of the *papamū*. It measures 0.56 m. (1.9 ft.) E/W by 0.45 m. (1.5 ft.) N/S.

Site 18116 is in fair condition and appears to have been previously excavated or looted.

Testing Results

Limited testing (Figure 31) was conducted within the lava tube of Site 18116 to determine the site's function and to collect charcoal for radiocarbon analysis. A 1.0 m. (3.3 ft.) by 1.5 m. (4.9 ft.) unit was excavated in the southwest portion of the lava tube, approximately 4.0 m. (13.2 ft.) beyond the tube's entrance. The test unit was placed on a soil surface covered with a concentration of marine midden.

The test unit was excavated to underlying bedrock, to a maximum depth of 5 cm. in the northern portion of the test unit and at 7 cm. in the southern part of the test unit. Two stratigraphic layers - Stratum I and II - were revealed during the excavation.

Stratum I consisted of a very dark gray (10 YR 3/1) loose silt intermixed with a'a pebbles. A large amount of both midden (predominately marine) and charcoal were recovered from throughout Stratum I (0-7 cm.). The complete midden inventory follows: 22.5 gms. of *puu'ala* (*Conus* sp.; 0.2 gm. of horn shell (*Cerithium* sp.); 263.9 gms. of two species of cowrie (*Cypraea caputserpentis* and *Cypraea maculifera*); 0.9 gm. of *pipipi'akolea* (*Littorina* sp.); 122.2 gms. of *pipipi* (*Nerita picea*); 10.6 gms. of *Theodoxus cariosus*; 0.7 gm. of *pupumamaiki* (*Strombus maculatus*); 3.1 gms. of *papua* (*Thaididae sp.*); 4.9 gms. of *ha'upu* (*Trochus intextus*); 356.2 gms. of pearl shell (*Isognomon* sp.); 35.9 gms. of unidentified shell; 599.6 gms. of sea urchin (Echinoderm); 1.4 gms. of Crustacean sp.; 0.1 gm. of moray eel (Muraenid); 0.1 gm of jack fish (Carangid); 0.3 gm. of bigeye emperor (Sparid); 0.1 gm. of wrasse (Labrid); 0.4 gm. of surgeon fish (Acanthurid); 5.5 gms. of unidentified fish bone and scales; 0.1 gm. of hoary bat (*Lasiurus cingreus*); 0.2 gm. of medium bird; 0.1 gm. of small lizard; 0.3 gm. of Norway or roof rat (*Rattus norvegicus* or *R. rattus*); 0.2 gm. of Polynesian rat (*Rattus exulans*); 0.2 gm. of domestic dog (*Canis familiaris*); 7.8 gms. of domestic pig or goat or sheep (*Sus scrofa* or *Capra hircus* or *Ovis* sp.); 12.9 gms. of small to medium mammal; 7.6 gms. of medium mammal; 0.9 gm. of small to medium vertebrate; 115.3 gms. of kukui nut shell; and 1.6 gms. of land snail. In addition, a total of 611.0 gms. of charcoal was recovered from throughtout Stratum I.. A single indigenous artifact, a sea urchin file (Acc. #46), was also recovered from Stratum I.

Stratum II consisted of a 1 cm. thick, loose, dark gray (10 YR 4/1) silt overlying bedrock. No cultural material was recovered from this stratum.

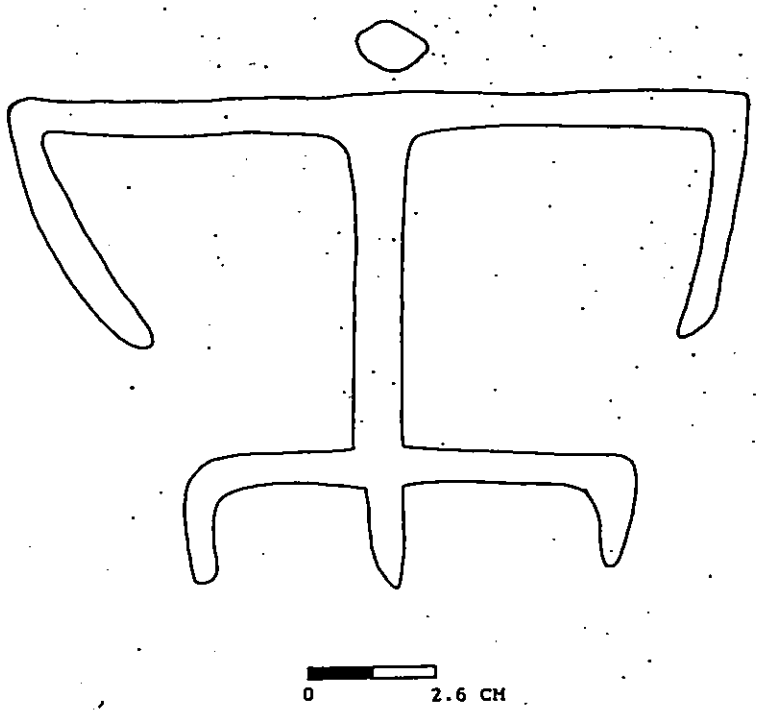


Figure 30 Site 50-10-27-18116 Feature C, Petroglyph

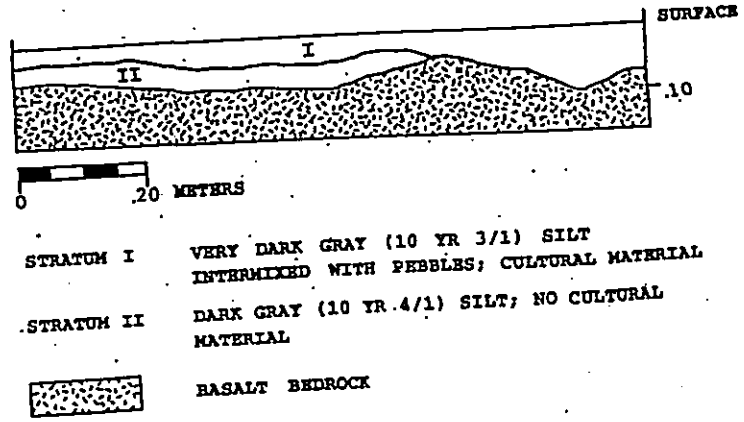


Figure 31 Site 50-10-27-18116 Feature A, Test Unit 1; Profile

Interpretation: Based on the abundance and variety of cultural materials recovered, the lava tube was likely utilized for recurrent or permanent habitation. Because of the predominance of marine midden, shell fish preparation and consumption was a dominant activity at the site. Some of the introduced vertebrate species are likely non-cultural and related with owl consumption (two owls presently inhabit the cave) or deaths not related to human consumption. Hawaiian bat remains were also recovered from the site excavation.

SHPD Site #: 50-10-27-18117 **CSH Site #:** 39
Site Type: Lava tube
Function: Temporary habitation; burials
Features (#): 1
Dimension: 204.0 m.² (2,203.2 ft.²)
Elevation: 145 ft. a.m.s.l.

Description: Site 18117 (Figure 32) is a lava tube located at the base of the terminus of an a`a flow, within pahoehoe lava. The terrain slopes gently southwest. Vegetation at the site consists of grass and *koa haole*.

The lava tube consists of a main tube with three small chambers along its edges. These side chambers were explored and did not contain cultural material.

Two entrances provide access into the main tube. These are on the east and west sides of a lava arch which measures 3.0 m. (9.8 ft.) wide E/W by 0.9 m. (3.0 ft.) high. The entrance on the east side is a ledge entrance which measures 5.0 m. NW/SE long. The entrance on the west side of the lava arch measures 2.7 m. (8.9 ft.) NE/SW by 1.0 m. (3.3 ft.) NW/SE. The floor of the tube lies 0.9 m. (3.0 ft.) beneath this entrance.

The main chamber extends primarily east and west from the lava arch and measures 15.0 m. (49.2 ft) E/W by 8.2 m. (26.9 ft.) N/S and 1 m. (3.3 ft.) high. A great deal of midden was observed in the light zone. A coral abrader was also observed in this area.

Two burials were encountered in the main chamber. One burial, consisting primarily of long bones, was observed among piled boulders near the east end of the main chamber. The small entrance, which serves as a light source, is located 3.5 m. (11.5 ft.) east of this burial. The other burial, a fairly complete human skeleton, was observed among piled boulders 2.0 m. (6.6 ft.) west of the tube's main entrance. The skeletal remains are large and may have belonged to a large male. Interestingly, all the tooth sockets in both the maxillae and mandible are completely worn or ground down. A coconut shell and husk were observed 1.0 m. (3.3 ft.) north of this burial.

The site was utilized prehistorically for temporary habitation, likely associated with State site 50-10-27-18112. It was subsequently used for burial placement. The lack of coffin associations suggests the burials are prehistoric.

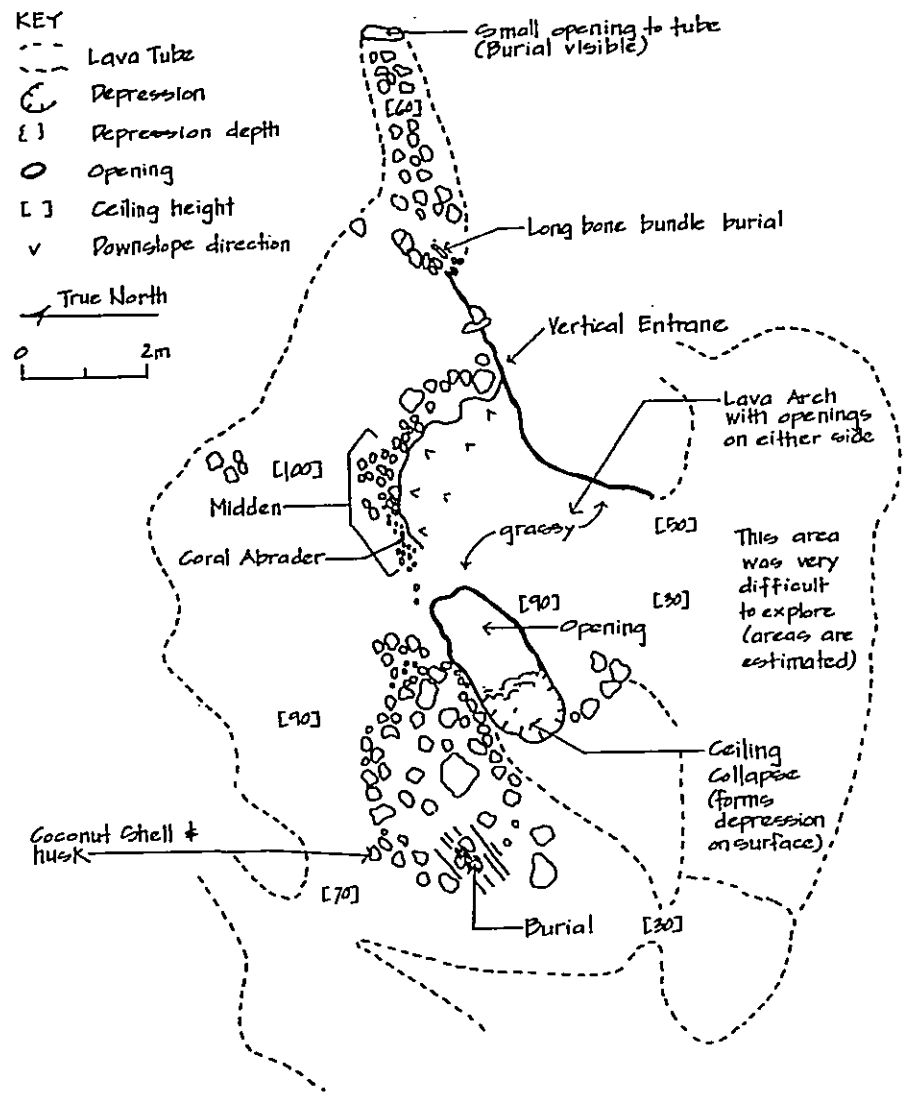


Figure 33 Site 50-10-27-18117, Plan View

CSH Site #: 40

SHPD Site #: 50-10-27-18118
Site Type: Modified outcrop
Function: Agriculture
Features (#): 2
Dimension: 486.0 m.² (5,248.8 ft.²)
Elevation: 160-165 ft. a.m.s.l.

Description: Site 18118 (Figure 33) is a complex consisting of two agricultural features, designated A and B. These features are deemed associated because of proximity. The terrain consists of a relatively level pahoehoe bluff partially covered with soil. Vegetation at the site consists of *koa haole* and grass.

Feature A is a modified sink. The sink lies at the southern side of the northeastern end of a raised pahoehoe finger. Modification consists of piling - 1 to 2 rows wide - large pahoehoe boulders around the circumference of the sink which contains a soil area measuring 2.0 m. (6.6 ft.) N/S by 1.0 m. (3.3 ft.) E/W.

The feature is in poor condition.

Feature B of Site 18118 is a modified outcrop located 17.5 m. (57.4 ft.) east of Feature A. The modified outcrop measures 2.0 to 4.5 m. (6.6 to 14.8 ft.) wide NE/SW by 16.0 (52.5 ft.) long NW/SE. The modification consists of pahoehoe boulders piled around four adjacent soil pockets which are situated along the southwestern edge of a pahoehoe bluff. The two northwest pockets are no larger than 1.2 m. (3.9 ft.) in diameter. Facing measuring 0.40 m. (1.31 ft.) high remains along the southeastern edge of the pocket on the southeast end of the group.

Feature B is considered to be in fair condition.

No artifacts or midden were observed at this site.

Site 18118 is not believed to contain any cultural deposit.

CSH Site #: 41

SHPD Site #: 50-10-27-18119
Site Type: Rectangular enclosure
Function: Recurrent habitation
Features (#): 1
Dimension: 16.5 m.² (178.2 ft.²)
Elevation: 170 ft. a.m.s.l.

Description: Site 18119 (Figure 34) is a rectangular enclosure located on a pahoehoe bluff. The surrounding terrain consists of uneven pahoehoe outcrops, limited soil areas and many lava blisters and tubes. The area slopes gently towards the southwest. Vegetation at the site consists of *koa haole*, wild *`ilima* and fountain grass.

The enclosure measures 5.0 m. (16.4 ft.) NE/SW by 3.3 m. (10.8 ft.) NW/SE. Wall construction consists of large cobble-small boulder facings with an indistinct fill of small cobbles. Maximum height along the facings of both the northwest and southwest walls is 0.40 m. (1.31 ft.). Most of the enclosure is collapsed. The interior of the enclosure is filled

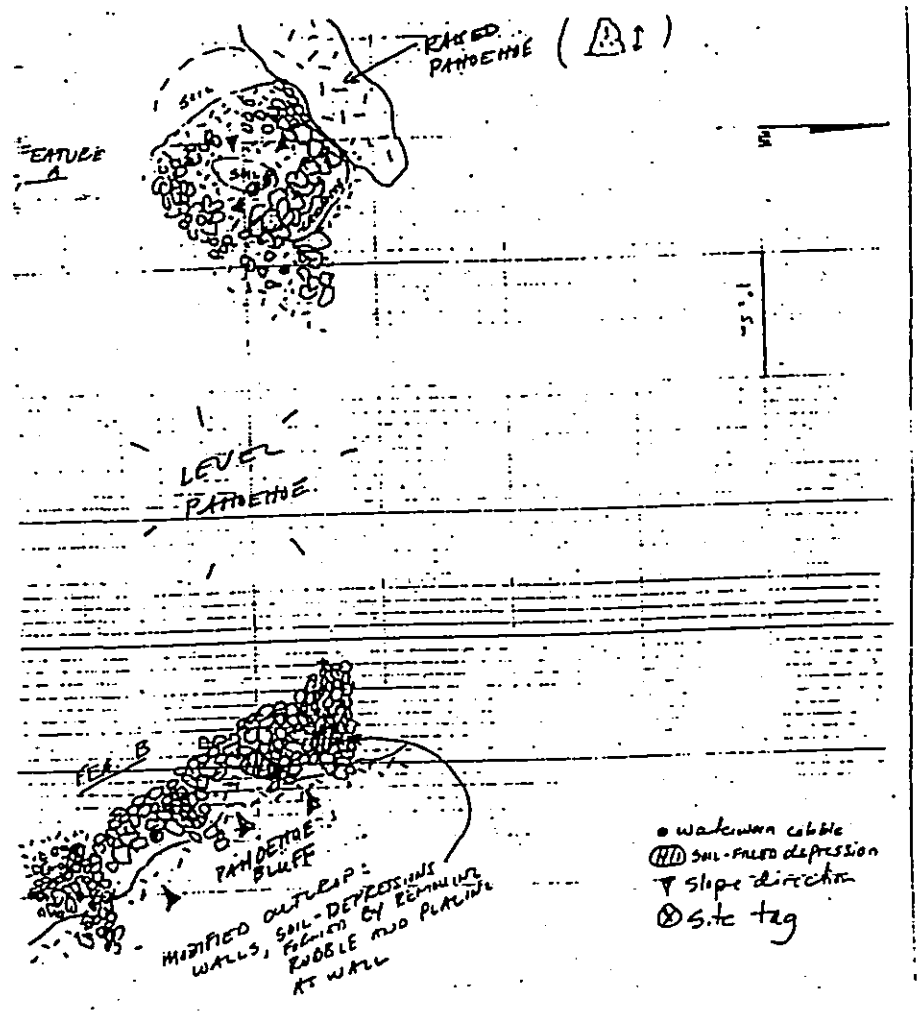


Figure 33 Site 50-10-27-18118, Plan View

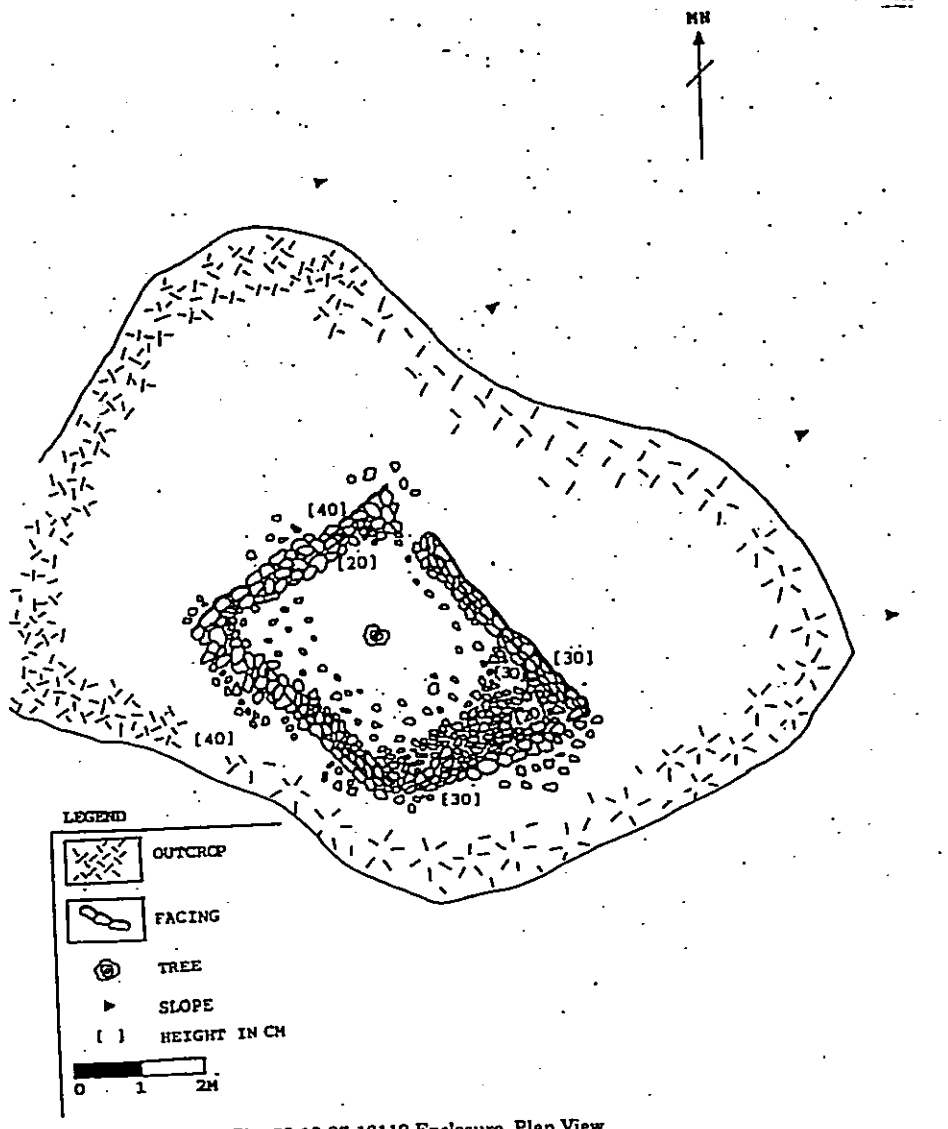


Figure 34 Site 50-10-27-18119 Enclosure, Plan View

with cobble collapse on a pahoehoe bedrock floor. A clear breach at the southern end of the southwest wall measures 0.70 m. (2.3 ft.) wide and may have been used as an entry to the interior space.

A waterworn cobble was observed 2.0 m. (6.6 ft.) south from the southern corner of the enclosure.

No midden was observed.

Site 18119 is deemed a recurrent habitation unit based on its formal construction in conjunction with its small size. The site is in fair condition and a cultural deposit may be present.

CSH Site #: 42

SHPD Site #: 50-10-27-18120
Site Type: Lava blister
Function: Recurrent habitation
Features (#): 1
Dimension: 301.6 m.^{2} (3,257.3 ft.^{2})
Elevation: 165 ft. a.m.s.l.

Description: Site 18120 (Figure 35) is a lava blister with a large entrance along the western edge of a large sink in the pahoehoe outcrop. Much soil and many pahoehoe outcrops are present in the surrounding area. Vegetation at the site consists of grass and *koa haole*.

The lava blister extends 14.0 m. (45.9 ft.) or more west of the sink opening but modifications and midden are limited to an area within 2.0 m. (6.6 ft.) west of the entrance dripline. Along the south half of the dripline is a piled wall. West of this wall are two main habitation areas designated Chambers A and B. The north half of the dripline is partially occupied

by an internal lava outcrop. Two modifications, one faced, extend from this outcrop edge into the open soil-covered sink area.

Chamber A is located at the southern end of the lava blister opening. The maximum ceiling height is 1.0 m. (3.3 ft.). The piled dripline wall and ledges along the chamber walls enclose a soil area which measures 1.8 m. (5.9 ft.) NE/SW by 1.9 m. (6.2 ft.) NW/SE. A ledge rises 0.4 m. (1.31 ft.) from the blister floor and ranges in width from 0.9 m. (2.95 ft.) along the southeast blister wall to 0.3 m. (0.98 ft.) along the southwest blister wall. Midden - including *kukui* shells and coconut shell - was observed on the southwest ledge. Rocks piled from the dripline wall to the west end of the southwest ledge separate Chambers A and B.

Chamber B contains a square pavement and a midden covered floor which are surrounded by the dripline wall on the northeast and blister ledges on the northwest and southwest. The ledges rise 0.6 m. (1.97 ft.) from the blister floor. The cobble and pebble pavement measures 1.0 m. (3.3 ft.) square. Between it and the separating wall segment to the southeast is a blister floor area - roughly the same size as the pavement - which is covered with sea urchin midden. A break in the dripline wall at the point where the

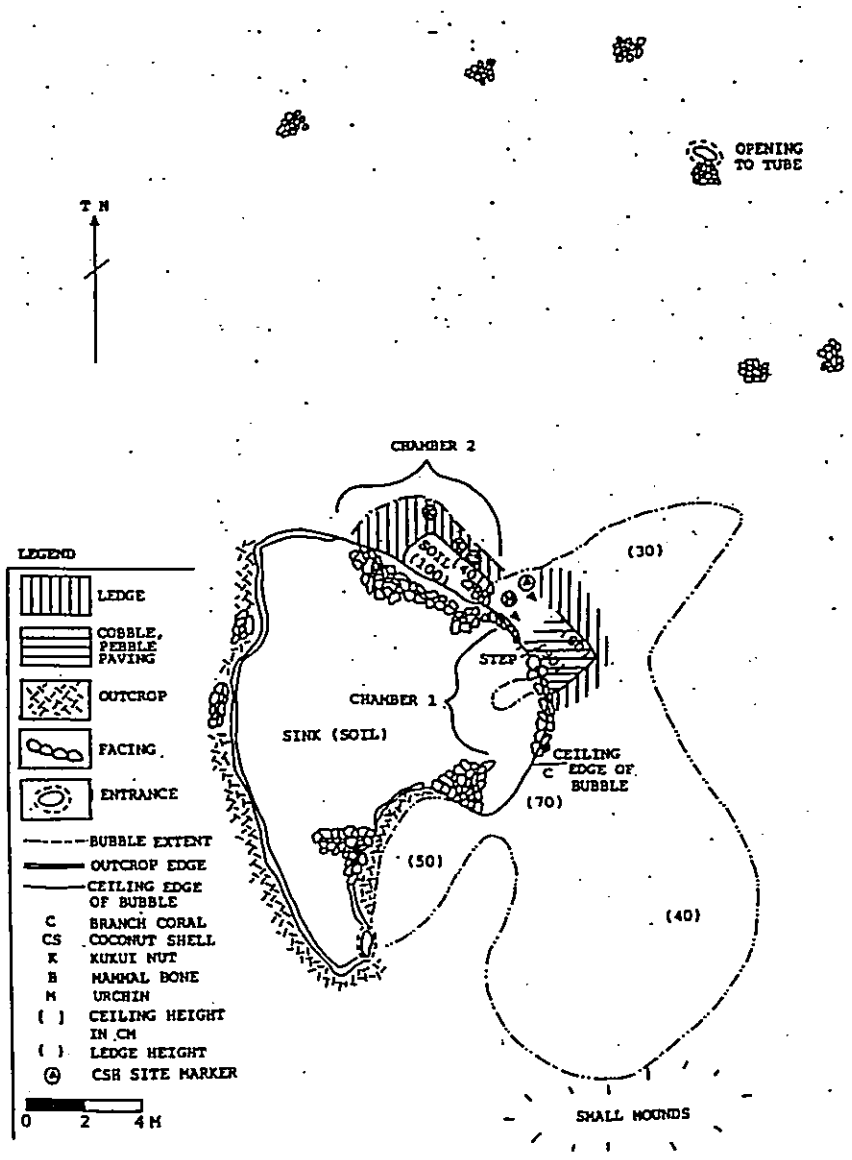


Figure 35 Site 50-10-27-18120 Lava Blister; Plan View

pavement and midden areas meet serves as a stepped entrance to the chamber. The ceiling height at this point measures 0.9 m. (2.95 ft.). Outside the dripline wall just north of the stepped entrance is a small area covered with mammal bones.

A piece of branch coral was observed at the northern end of the dripline wall about half-way along the blister opening. Here, the ceiling reaches a maximum height of 0.7 m. (2.3 ft.).

Two modifications extend from an outcrop located within the northern half of the blister. A pile of pahoehoe boulders 1.0 m. (3.3 ft.) in diameter is constructed against the south side of the outcrop. Another pile of boulders - 1.0 m. (3.3 ft.) long E/W and faced on its south side - partially encloses a rectangular soil area in the north corner of the sink outside the blister. This soil area measures 2.0 m. (6.6 ft.) N/S by 1.0 m. (3.3 ft.) E/W.

No artifacts were observed.

Site 18120 is in fair condition and a cultural deposit may be present.

SHPD Site #: 50-10-27-18121 **CSH Site #:** 43
Site Type: Complex
Function: Recurrent habitation
Features (#): 3
Dimension: 154.0 m.^{2} (1,663.2 ft.^{2})
Elevation: 180 ft. a.m.s.l.

Description: Site 18121 (Figure 36) is a complex consisting of three features, designated A to C. These features include two C-shaped enclosures and a small circular platform. The complex is located on fairly level pahoehoe outcrops approximately 11.0 m. (36.1 ft.) east of a north/south-running access road. Vegetation at the site consists of *koa haole* and grass.

Feature A is a square enclosure open on its eastern side. The enclosed area measures 2.8 m. (9.2 ft.) NE/SW by 2.4 m. (7.9 ft.) NW/SE. Maximum height on the exterior is 0.80 m. (2.62 ft.). The enclosure is constructed of pahoehoe boulders - 3 rows wide - and remains well-faced on the exterior, 2 to 3 courses high. The surface of the enclosed area is pahoehoe outcrop. Feature A is in good condition.

Feature B of Site 18121 is a C-shaped enclosure located 3.4 m. (11.2 ft.) north of Feature A. The enclosed area measures 3.0 m. (9.8 ft.) NE/SW by 1.5 m. (4.9 ft.) NW/SE. The southwestern side of the enclosure is open. The enclosure is constructed of pahoehoe boulders. Facings remain on both sides of the northern wall segment and reach a maximum height of 0.80 m. (2.62 ft.). The surface of the enclosed area is pahoehoe outcrop. Feature B is in fair condition.

Feature C is a small circular platform located 5.0 m. (16.4 ft.) west of Feature A and 7.2 m. (23.6 ft) southwest of Feature B. It measures 1.0 m. (3.3 ft.) in diameter and is composed of pahoehoe cobbles and boulders. The structure is faced, 2 courses high and reaches 0.5 m. (1.64 ft.) high on its south side. It is in good to fair condition.

No midden or artifacts were observed.

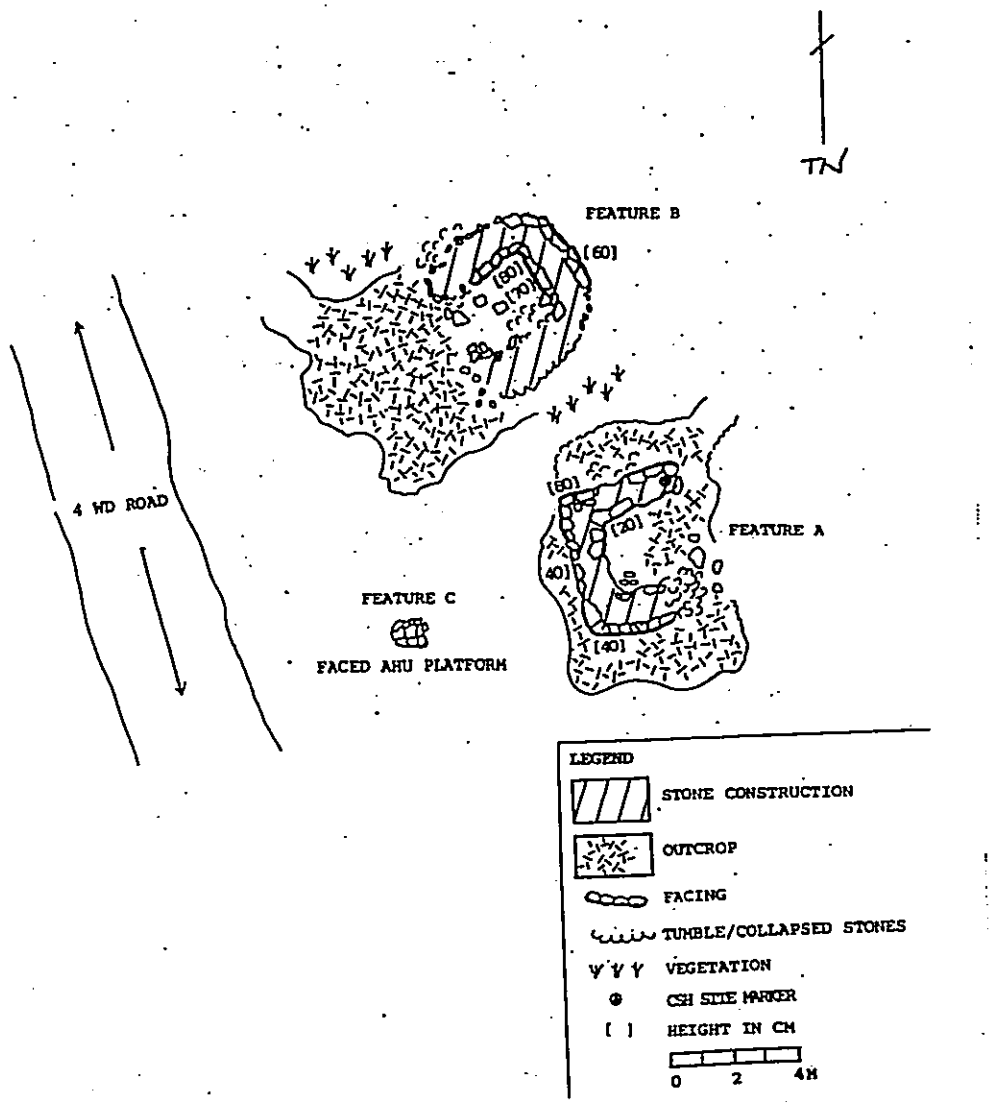


Figure 36 Site 50-10-27-18121 Site Complex, Features A to C; Plan View

Site 18121 may contain a cultural deposit.

SHPD Site #: 50-10-28-18122 **CSH Site #:** 44
Site Type: Trodden a'a-kerbstone trail
Function: Trail
Features (#): -
Dimension: 33.3 m.² (360.0 ft.²)
Elevation: 150-160 ft. a.m.s.l.

Description: Site 18122 is a trail consisting of a linear trodden a'a surface extending *maukalmakai* across an a'a field. The a'a flow is fairly level but slopes gently southwest in some places. The only vegetation is fountain grass growing along the trail surface.

The trail is visible only when crossing the a'a flow. It extends from State site 50-10-27-18112 to the east for approximately 120.0 m. (400.0 ft.) roughly parallel with State site 50-10-27-18099 trail approximately 10.0 m. (32.8 ft.) to the south. This trail diminishes as it intersects pahoehoe outcrop at its eastern end. At this point it may merge with Site 18099 trail.

Numerous stepping stone trails branch off from the trail and extend generally to the south. Intermittent bulldozing disturbances have occurred throughout the area.

Scattered midden was observed along the trail.

Site 18122 is in fair condition and a cultural deposit may be present.

SHPD Site #: 50-10-27-18123 **CSH Site #:** 45
Site Type: Modified sink
Function: Agriculture
Features (#): 1
Dimension: 30.0 m.² (324.0 ft.²)
Elevation: 230 ft. a.m.s.l.

Description: Site 18123 is a small modified sink located on an undulating pahoehoe outcrop which slopes gently southwest. It is located approximately 80.0 m. (262.5 ft.) southeast of State site 50-10-27-18125. Vegetation at the site consists of *koa haole* and grass.

Modification consists of a piling - a maximum 0.70 m. (2.3 ft.) high -of large pahoehoe boulders which enclose a roughly circular area measuring 1.5 m. (4.9 ft.) in diameter. The boulders fill the southern half of the sink which measures 5.0 m. (16.4 ft.) N/S by 6.0 m. (19.7 ft.) E/W.

No midden or artifacts were observed.

Site 18123 is in remnant condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18124 **CSH Site #: 46**
Site Type: Lava tube
Function: Temporary habitation
Features (#): 2
Dimension: 152.0 m.^{2} (1,641.6 ft.^{2})
Elevation: 233 ft. a.m.s.l.

Description: Site 18124 (Figure 37) is a lava tube located among undulating pahoehoe outcrops gently sloping southwest. Vegetation consists of *koa haole*, air plants and grass.

Adjacent to the entrance of the tube is an irregularly-shaped platform faced on all of its three sides. It is constructed with pahoehoe boulders and large cobbles, and measures 3.6 m. (11.8 ft.) NE/SW by 1.7 m. (5.6 ft.) NW/SE. The surface is roughly paved with boulders and cobbles. The sides are faced, 4 to 6 courses high, and rise to a maximum height of 1.3 m. (4.3 ft.). The platform is in fair condition.

The entrance to the tube is adjacent to the western edge of the platform and accesses the tube's southern portion. The tube is oval and measures 7.5 m. (24.6 ft.) N/S by 10.5 m. (34.4 ft.) E/W, but only a small area at the entrance has sufficient ceiling height - a maximum 1.0 m. (3.3 ft.) - to allow access: this area measures 4.0 m. (13.1 ft.) NE/SW by 2.0 to 3.5 m. (6.6 to 11.5 ft.) NW/SE and is bounded on its northwestern and southwestern sides by pahoehoe boulders in a rough alignment. Charcoal and midden - including *kukui*, sea urchin and sea shell - were observed scattered in this area which is also strewn with pahoehoe boulders and cobbles. Approximately 2.5 m. (8.2 ft.) beyond the northwestern alignment, small, non-human mammal bones - including a small mandible - were observed. The tube is in poor condition.

No artifacts were observed.

Site 18124 is unlikely to contain any cultural deposit.

SHPD Site #: 50-10-27-18125 **CSH Site #: 47**
Site Type: Lava tube
Function: Temporary habitation
Features (#): -
Dimension: 9672 m.^{2} (104,100.12 ft.^{2})
Elevation: 225 ft. a.m.s.l.

Description: Site 18125 (Figure 38) is a lava tube located on a gentle *makai*-trending slope. The surrounding terrain contains pockets of soil that support *koa haole* and grass.

The lava tube contains one entrance leading into a main chamber or activity area. Beyond the main chamber the lava tube emanates into three separate lateral tubes: two tubes to the southeast (Lateral tubes 1 and 2) and one tube (Lateral tube 3) to the west.

The entrance into the main chamber measures 2.7 m. (8.9 ft.) wide and 1.0 m. (3,28 ft.) high. The floor of the tube extending into the main chamber is a stone rubble surface which slopes downward.

The main chamber measures 6.7 m. (22.0 ft.) N/S by 15.0 m. (49.2 ft.) E/W and it has a range of ceiling heights from 0.5 m. (1.64 ft.) to 2.00 m. (6.6 ft.). The main chamber is

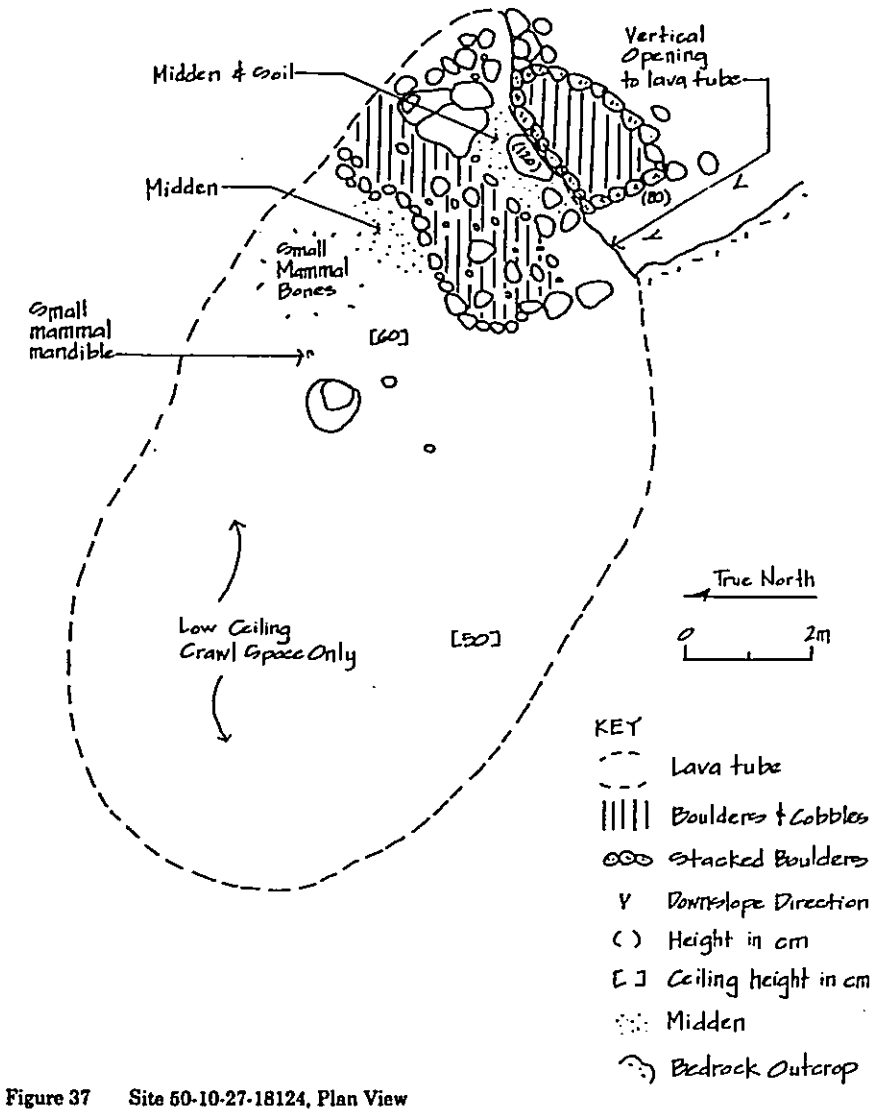


Figure 37 Site 50-10-27-18124, Plan View

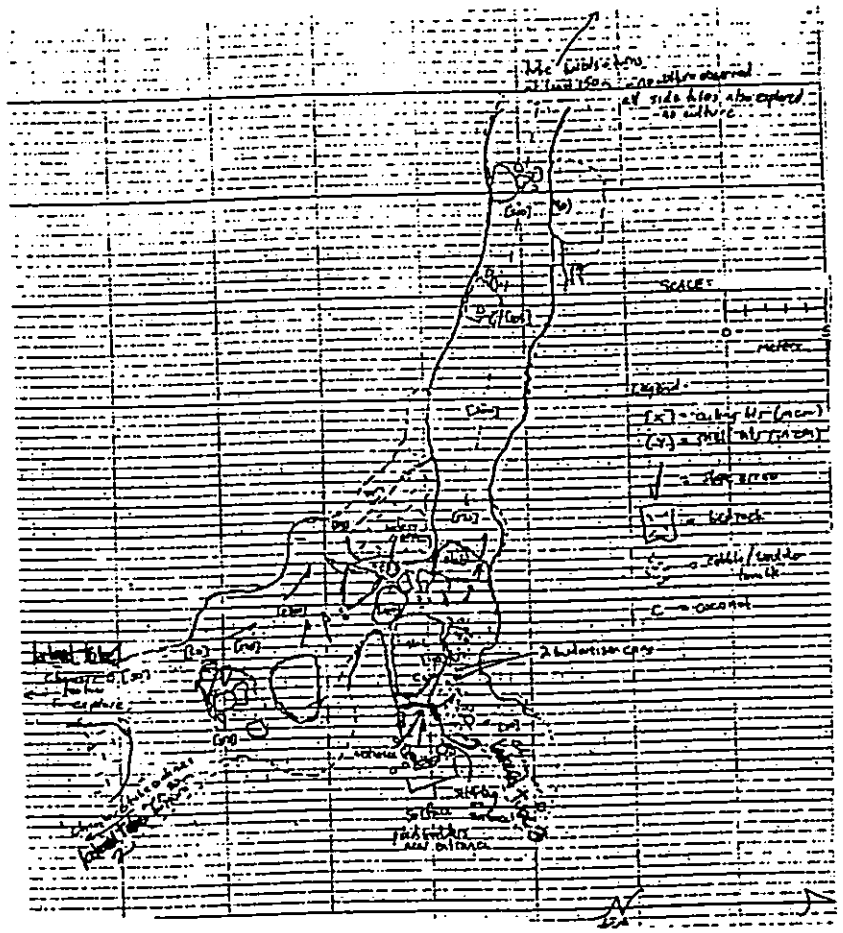


Figure 38 Site 50-10-27-18125, Plan View

partially separated from the adjoining lateral tubes with boulders and mounded piles of ceiling collapse. A coconut husk was observed within the main chamber beneath a boulder slab, approximately 1.0 m. (3.28 ft.) from the lava tube entrance.

Lateral tube 1 extends approximately 170.0 m. (557.6 ft.) to the west of the main chamber. No culture was observed within this portion of the tube except a single crab claw. The western terminus of the tube was determined by a low ceiling height of 0.5 m. (1.64 ft.).

Lateral tubes 2 and 3 extend to the southeast of the main chamber. Lateral tube 2 runs parallel to Lateral tube 3. Lateral tube 2 is not accessible for inspection due to its low ceiling height. Lateral tube 3 -with its entrance to the east of Lateral tube 2's entrance - extends for approximately 30.0 m. (98.4 ft.) southeast. No cultural material was observed in either Lateral tube 2 or 3.

Other than the coconut husk, no midden or artifacts were observed at the site.

The site is in poor condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18126 **CSH Site #:** 48
Site Type: Rectangular enclosure
Function: Permanent habitation
Features (#): 1
Dimension: 275.0 m.^{2} (2,970.0 ft.^{2})
Elevation: 240 ft. a.m.s.l.

Description: Site 18126 (Figure 39) is a rectangular enclosure located at the juncture of an a`a flow and a field of undulating pahoehoe. Approximately 1.0 m. (3.3 ft.) to the north is the edge of a bulldozer push in the a`a field. State site 50-10-27-18099 trail is located 6.0 m. (19.7 ft.) to the south. Vegetation at the site consists of *koa haole* and grass.

The enclosed area measures 8.5 m. (27.9 ft.) N/W by 10.0 m. (32.8 ft.)E/W. The walls stand to a maximum interior height of 1.8 m. (5.9 ft.). The north, east and west walls are integrated within the edges of a small inlet in the a`a flow ledge. These walls are constructed with a`a boulders, filled with an a`a cobble core and are faced on interior and exterior sides. The south wall consists of a low stacking of pahoehoe slabs across the pahoehoe outcrop adjacent to the a'a flow. This wall reaches a maximum height of 0.25 m. (0.82 ft.). The enclosed area contains enough soil for *koa haole* and grass to thrive.

Adjoining the northweatern corner of the enclosure and extending west, a paved area of a`a stretches 4.2 m. (13.8 ft.) N/S by 6.0 m. (19.7 ft.) E/W.

No midden or artifacts were observed at this site.

The enclosure is in good condition. No cultural deposit is believed to be present based on the lack of sufficient soil for testing.

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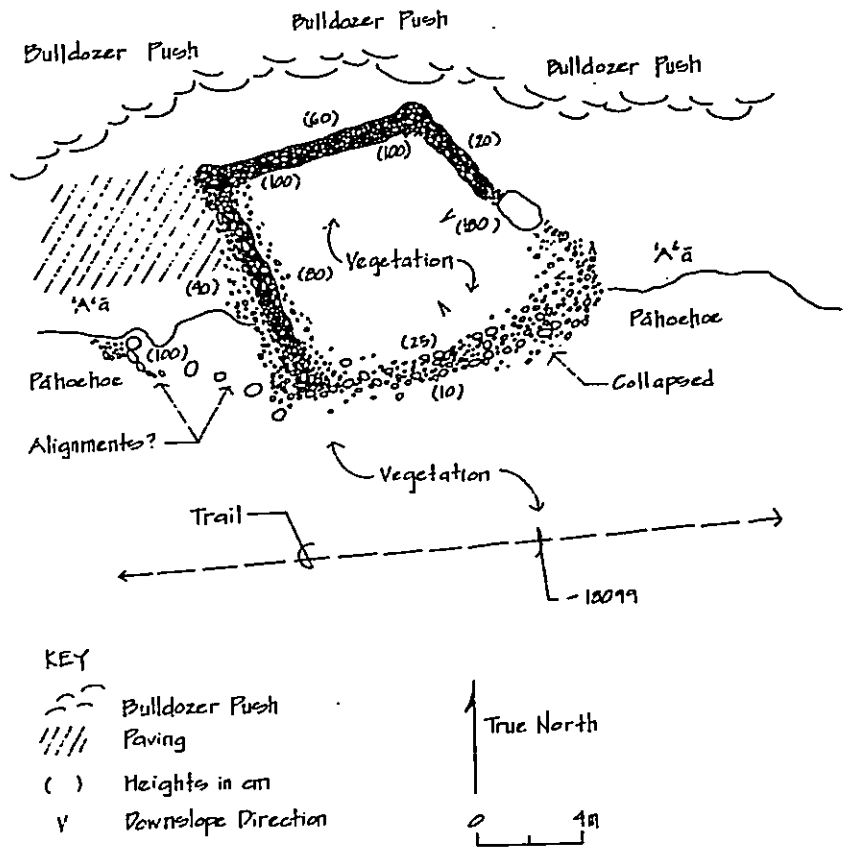


Figure 39 Site 50-10-27-18126, Plan View

CSH Site #: 49

SHPD Site #: 50-10-27-18127
Site Type: Complex
Function: Recurrent habitation
Features (#): 3
Dimension: 475.0 m.² (5,130.0 ft.²)
Elevation: 240 ft. a.m.s.l.

Description: Site 18127 (Figure 40) is a complex consisting of three features, designated A to C, located within and near a sink. The features are considered associated because of their proximity. The terrain consists of a pahoehoe ridge and pahoehoe outcrops which slope gently southwest. Vegetation at the site consists of *koa haole*, morning glory and fountain grass.

Feature A is a C-shaped enclosure constructed against the sink's edge; this forms a circular enclosure. The enclosed area measures 1.0 m. (3.3 ft.) NE/SW by 2.0 m. (6.6 ft.) NW/SE and the enclosure wall is constructed of small and medium pahoehoe boulders, 2 courses high and 2 rows wide. A few small cobbles serve as fill in the center of the wall. The interior of the enclosure is level and covered with cobbles. A 1.0 m. by 0.5 m. unit was excavated within the interior Feature A enclosure (see **Testing Results** below).

Feature A is in fair condition. No artifacts or midden were observed on the surface of Feature A.

Feature B of Site 18127 is a lava tube. Its entrance is located 1.0 m. (3.3 ft.) northwest of Feature A. The activity area within the light zone of the entrance is marked by a cleared soil area measuring 3.0 m. (9.8 ft.) N/S by 1.5 m. (4.9 ft.) E/W. Scant traces of midden including marine shell were observed in the soil area (See volume I, Midden table). Roughly piled boulders encircle the soil area.

No modifications or cultural remains were observed in the rest of the tube which measures 10.0 m. (32.8 ft.) long NE/SW by 5.0 to 1.5 m. (16.4 to 4.9 ft.) wide NW/SE. A 1.0 m. by 1.0 m. unit was excavated within the light zone of the lava tube (see **Testing Results** below).

Feature B is in fair condition.

Feature C - located 36.5 m. (119.8 ft.) east of Feature A - is a rectangular platform built along the edge of the sink. The platform measures 1.3 m. (4.3 ft.) N/S by 2.0 m. (6.6 ft.) E/W with a maximum height of 0.6 m. (1.97 ft.). It is constructed of pahoehoe cobbles and small boulders. It is faced on its north and east sides with upright slabs of pahoehoe; the other sides are collapsed. A 1.0 m. by 1.0 m. unit was excavated in the center of Feature C platform. Feature C is in fair condition. A cultural deposit may be present.

Testing Results

Subsurface testing was conducted at Features A (Figure 40), B (Figure 41) and C (Figure 42) of Site 18127. Features A and B were tested to determine site function, examine natural and cultural deposits and to collect datable charcoal for radiocarbon analysis. Feature C was tested to determine the presence or absence of human remains.

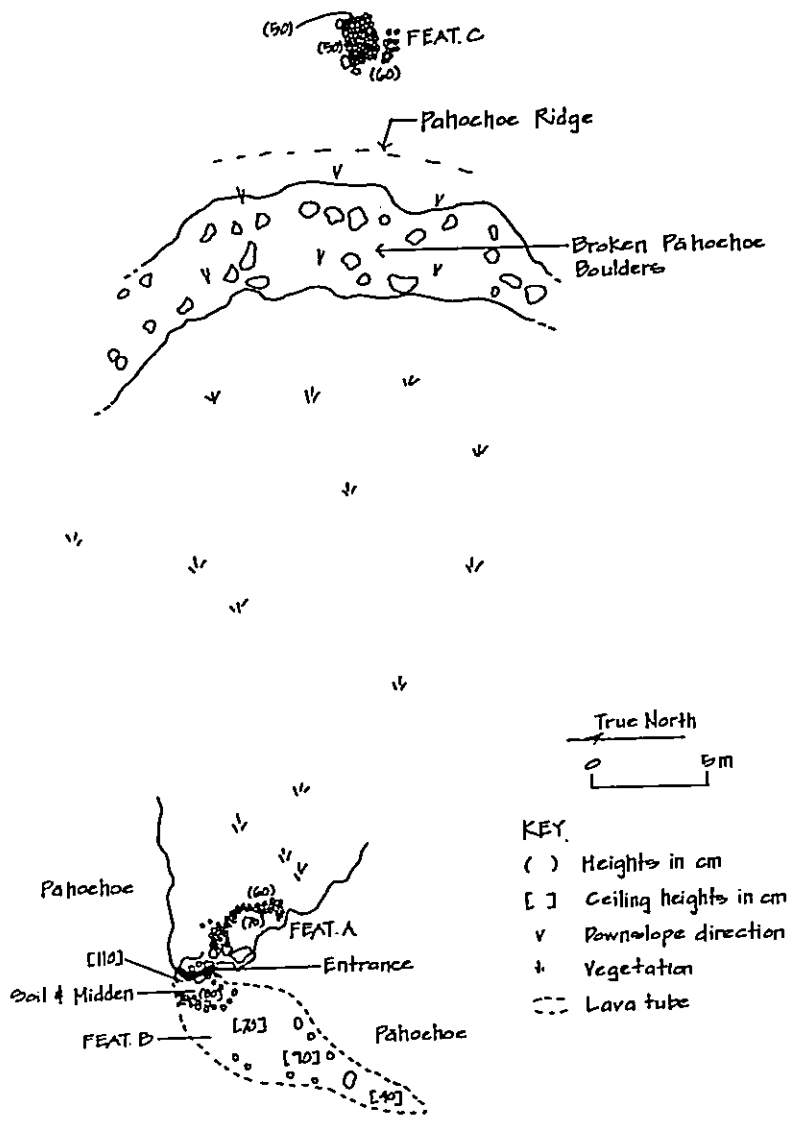
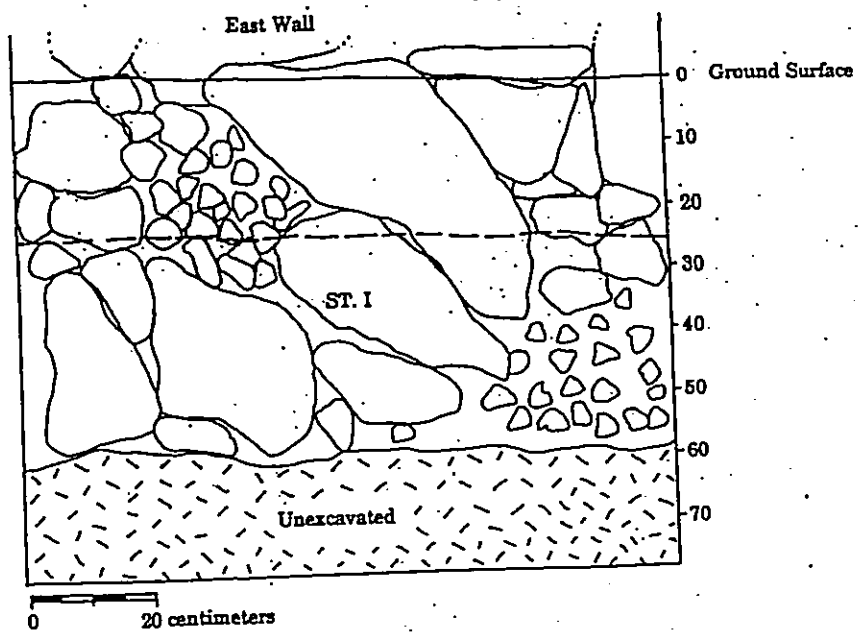


Figure 40 Site 50-10-27-18127 Site Complex, Features A to C; Plan View



Stratum I- Dark brown (10 YR 3/2) Silt loam with roots and 10% gravel; contains cultural materials.

Figure 41 Site 50-10-27-18127 Feature A, Test Unit 1 Profile

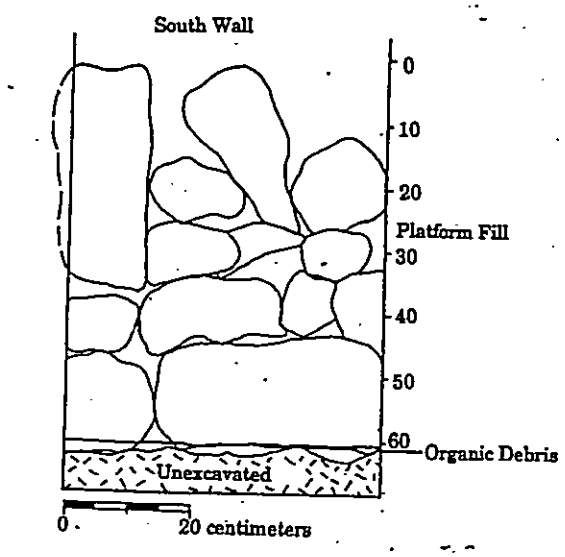


Figure 42 Site 50-10-27-18127 Feature B, Test Unit 2 Profile

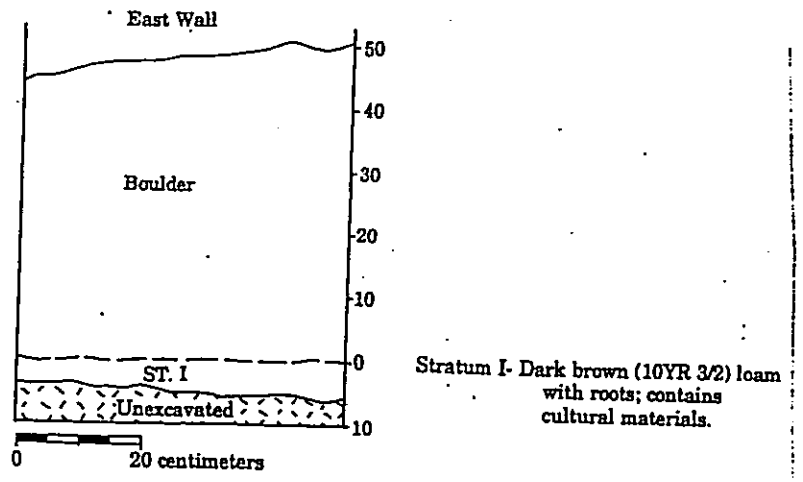


Figure 43 Site 50-10-27-18127 Feature C, Test Unit 3 Profile

A 1.0 m. by 1.0 m. unit - Test unit 3 - was placed at the center of Feature A enclosure over a boulder-cobble floor. The unit was excavated to a maximum depth of 60 cm. below surface and terminated upon reaching bedrock. The boulder-cobble fill of the enclosure floor extended to bedrock; a soil layer, designated Stratum I, was present at the base of the rock fill between 25 cm. below surface and the underlying bedrock.

Stratum I - 25 cm thick - consisted of a loosely compacted, dark brown (10 YR-3/2) silt loam with a 10% gravel content. Marine midden was recovered from Stratum I and includes the following: 1.2 gms. cowrie (*Cypraea caputserpentis*); 11.1 gms. unidentified shell; 4.4 gms. urchin (Echinoderm); 0.9 gms. Crustacean (total midden 17.8 gms); and 8 gms of charcoal.

Based on the presence and relatively sparse amount of midden recovered from Feature A, in conjunction with the size and construction of Feature A enclosure, it likely functioned as a shelter for recurrent habitation.

Similar to Feature A - in its amount of recovered midden (17.6 gm) and small space - Feature B was likely used for recurrent habitation. Stratum I had 6.1 gms. of charcoal.

A 0.5 m. by 0.5 m. unit - Test unit 1 - was placed within the center of Feature C platform and excavated to bedrock at a maximum depth of 60 cm. below the platform surface. A thin layer of organic material was encountered at the base of the platform. No cultural material was recovered from the Feature C excavation.

Interpretation: Based on the amount of midden and association with Feature A, Feature B lava tube was utilized as a component feature for recurrent habitation. Because of the lack of cultural materials recovered at Feature C and its apparently non-functional, relatively high surface positioned on an elevated spot of the terrain, it is interpreted as a marker. It likely demarcates the location of Feature A and B habitation features. Site 18127 is located adjacent to State site 18099 trail and thus, its usage may be associated with coastal-inland (*mauka-makai*) travel or more directly with agricultural activities occurring in this marginal agricultural area of Honokohau. There was sparse cultural material here and the majority of excavatable areas have already been tested during the inventory survey phase, thus, no further work appears warranted at this site.

SHPD Site #: 50-10-27-18128 **CSH Site #: 50**
Site Type: Rockshelter
Function: Temporary habitation
Features (#): -
Dimension: 8.1 m.^{2} (86.73 ft.^{2})
Elevation: 245 ft. a.m.s.l.

Description: Site 18128 (Figure 44) is a small crescent-shaped rock shelter located on the south side of an oval sink in the pahoehoe outcrop. The terrain, which slopes *makai*, consists of undulating pahoehoe with scattered shallow pockets of soil. The edge of an a`a flow stands nearby. Vegetation at the site consists of dense *koa haole*, air plants and grass.

The rock shelter measures 1.5 m. (4.9 ft.) N/S by 5.4 m. (17.7 ft.) E/W. The ceiling is low, averaging 0.6 m. (1.97 ft.) in height. The shelter entrance measures 3.5 m. (11.5 ft.)

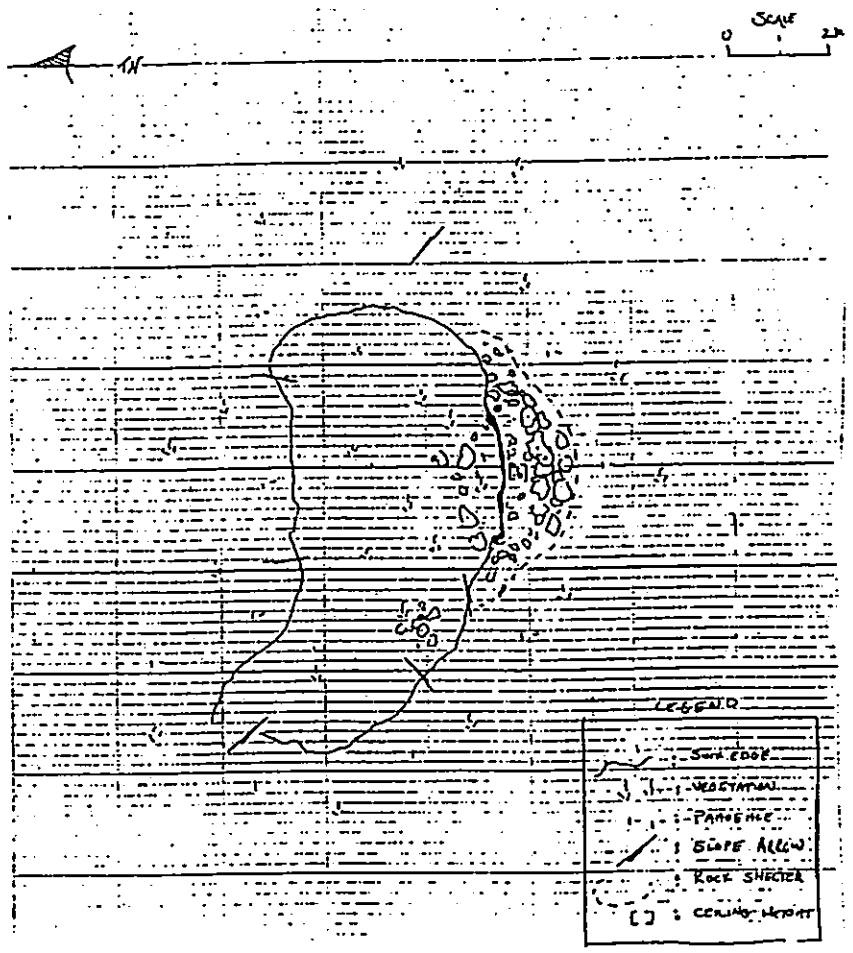


Figure 44 Site 50-10-27-18128, Plan View

wide E/W. The interior surface of the shelter is exposed bedrock partially covered with a soil-and-cobble mixture. An abundance of *kukui* nut fragments is the only evidence of culture at this site. No artifacts were observed.

The sink measures 9.0 m. (29.5 ft.) E/W by 4.0 m. (13.1 ft.) N/S. No modification of the sink was observed.

The site is in poor condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18130 **CSH Site #: 52**
Site Type: Modified outcrop
Function: Agriculture
Features (#): 1
Dimension: 22.6 m.^{2} (243.7 ft.^{2})
Elevation: 260 ft. a.m.s.l.

Description: Site 18130 is a modified outcrop located on pahoehoe lava terrain. The terrain slopes moderately to the southwest or *makai*. Vegetation consists of *koa haole* and grass.

The modified outcrop is defined by a small L-shaped wall abutting an outcrop edge. The resulting enclosed area measures 2.5 m. (8.3 ft.) NE/SW by 3.5 m. (11.6 ft.) NW/SE. The modification is constructed of stacked large boulders. The enclosed area is a depression filled with large to small pahoehoe boulders. There is little soil within the enclosure. Two upright boulders are positioned on the south side of the modified outcrop.

No artifacts of midden were observed.

The site is in poor condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18131 **CSH Site #: 54**
Site Type: Lava tube
Function: Recurrent habitation
Features (#): 1
Dimension: 450.0 m.^{2} (4,841.3 ft.^{2})
Elevation: 270 ft. a.m.s.l.

Description: Site 18131 (Figure 45) is a lava tube situated beneath an undulating, *makai*-trending pahoehoe surface. The terrain holds pockets of soil which supports *koa haole* and grass.

The lava tube consists of a main tube which runs east-west; near the center of the tube the ceiling has collapsed. This collapsed material is reconstructed as a platform with faced sides and a cobble-paved surface which is visible from outside the lava tube. The platform surface measures 3.7 m. (12.1 ft.) N/S by 5.3 m. (17.4 ft.) E/W.

The overall extent of the lava tube roughly measures 24.0 m. (78.7 ft.) E/W by 7.0 m. (23.0 ft.) N/S. The tube contains four openings. One, located at the *makai* end of the tube,

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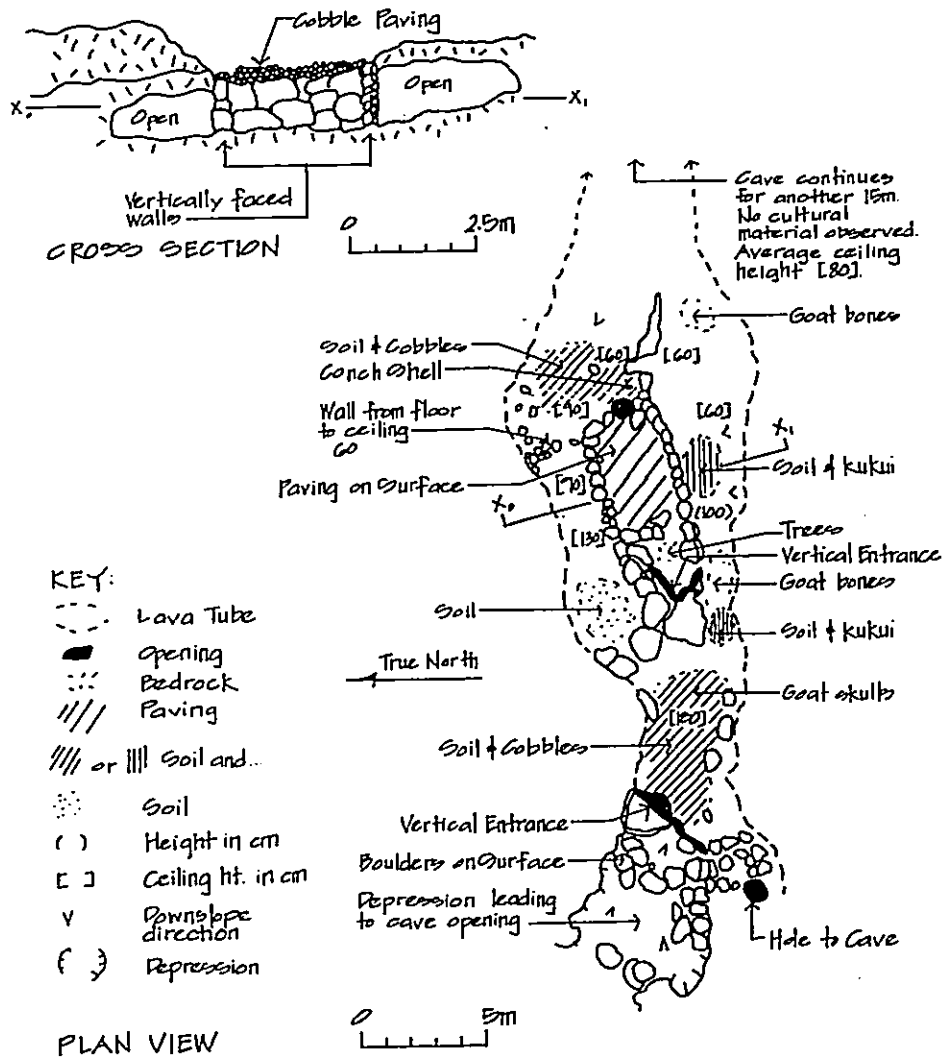


Figure 45 Site 50-10-27-18131, Plan View

measures 0.8 m. (2.62 ft.) in diameter and serves only as a light source. The three remaining openings are large enough to allow access. The largest entrance occurs at the west end of the tube; two others are situated in the collapse area around the platform. The tube is described from west to east (*makai* to *mauka*) below.

The entrance at the west end of the tube measures 3.9 m. (12.8 ft.) wide. From this entrance the tube extends 10.5 m. (34.5 ft.) east to another large entrance at the ceiling collapse and platform. This section of the tube ranges in width from 4.0 to 7.0 m. (13.1 to 23.1 ft.) N/S and has a maximum ceiling height of 1.8 m. (5.9 ft.). The large collapse entrance measures approximately 3.0 m. (9.8 ft.) wide N/S. These entrances at either end of this section of the tube provide much light to the interior. An area of cobbles and soil measuring 3.0 m. square (9.8 ft. square) is located near the center of this section of tube. Midden observed in the soil area includes *opihi*, coral, *kukui*, cowrie and pearl shells. Historic artifacts present include goat bones and a newspaper page dated November 20, 1991. External vegetation debris is also present in large quantities. A coral pounding tool is present approximately 9.5 m. (31.2 ft.) east of the tube's west entrance.

The tube continues at least 16.0 m. (52.8 ft.) east beyond and around the large collapse entrance where the platform lies. Overall width of this section ranges from 7.0 to 10.0 m. (23.0 to 32.8 ft.) with a maximum height of 1.3 m. (3.9 ft.). The third entrance occurs at the east end of the platform and measures 0.9 m. (2.95 ft.) in diameter. Near the northeast tube edge from the floor to the ceiling. It measures 1.5 m. (4.5 ft.) N/S by 0.6 m. (1.97 ft.) high and is constructed of medium boulders.

The tube floor contains several areas with shallow layers of soil where midden was observed. A soil area to the north of the large collapse entrance contains shell midden and coral. One small soil area to the south of this entrance and another soil area south of the platform contain only *kukui* midden. Northeast of the platform, a soil-and-cobble area measuring 1.0 m. (3.3 ft.) E/W by 3.0 m. (9.8 ft.) N/S contains a small amount of shell midden.

A large conch shell fragment was observed approximately 0.5 m. (1.64 ft.) east of the east entrance. Goat bones were observed throughout the tube.

Site 18131 is in fair condition and a cultural deposit may be present.

SHPD Site #: 50-10-27-18132 **CSH Site #: 55**
Site Type: Lava tube
Function: Temporary habitation
Features (#): 1
Dimension: 143.52 m.² (1,544.73 ft.²)
Elevation: 255 ft. a.m.s.l.

Description: Site 18132 (Figure 45) is a small single-chambered lava tube situated within pahoehoe lava which slopes gently *makai*. The terrain holds scattered shallow pockets of soil. Vegetation includes *koa haole* and grass.

The lava tube measures 13.8 m. (45.3 ft.) NE/SW by 7.2 m. (29.6 ft.) NW/SE. Its only entrance, situated near the center of the north tube wall, is horizontal and measures 0.7 m. (2.3 ft.) in diameter. The tube floor lies from 0.7 to 1.4 m. (2.3 to 4.6 ft.) below the entrance. Scattered pockets of soil are present over much of the lava tube floor.

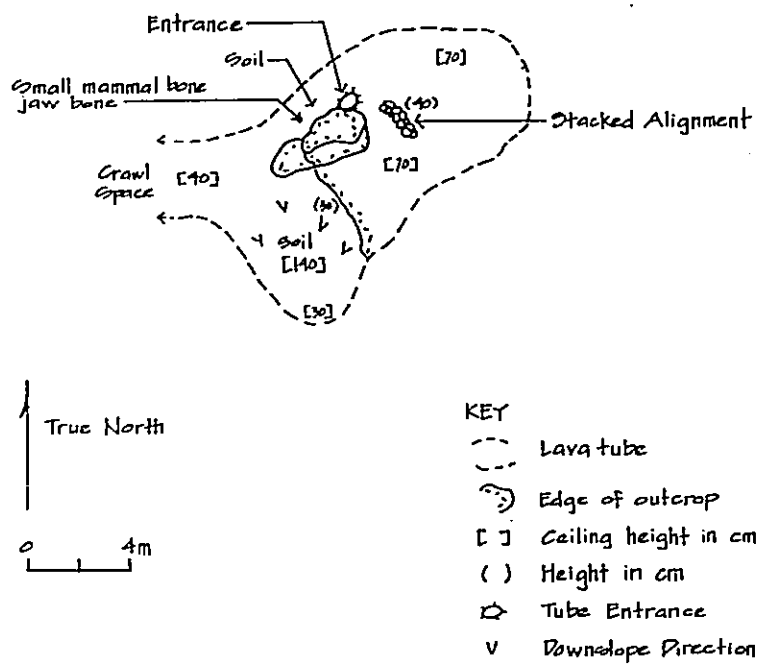


Figure 45 Site 50-10-27-18132, Plan View

The only modification within the lava tube is a wall located 0.9 m. (2.95 ft.) south of the tube entrance. The wall measures 1.4 m. (4.6 ft.) long NW/SE, 0.4 m. (1.31 ft.) high, and 0.4 m. (1.31 ft.) thick.

No midden or artifacts were observed.

The site is in poor condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18133 **CSH Site #: 56**
Site Type: Stepping-stone trail
Function: Trail
Features (#): 1
Dimension: 57.0 m. (181.1 ft.) long
Elevation: 255 ft. a.m.s.l.

Description: Site 18133 is a stepping-stone trail located along the outer edge of a bulldozed a'a flow. The southeastern end of the site crosses pahoehoe outcrop, which is covered with dense *koa haole* and grasses. No vegetation exists along the a'a portion of the site.

The trail consists of small to medium-sized pahoehoe boulder slabs set into a minimally cleared path through an a'a flow. The two remaining, but separate segments of the trail have a total extent of approximately 30.0 m. (98.4 ft.).

The northwest portion of the trail appears to have been disturbed by bulldozing. From the bulldozed edge, the trail extends 7.0 m. (23.0 ft.) southeast, off the a'a flow and onto a grassy pahoehoe flow.

A separate segment of the trail, 30.0 m. (98.4 ft.) to the south, stretches roughly 20.0 m. (65.6 ft.) NW/SE. This segment of the trail leads off the a'a to a small lava tube opening, Site 18197 burial lava tube.

It is probable that the two segments were once connected but have since been disturbed by bulldozing. This trail may be a spur trail to Site 18099 *maukalmakai* trail.

No artifacts or midden were observed.

The site is in fair condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18134 **CSH Site #: 57**
Site Type: Lava tube
Function: Refuge habitation; burials
Features (#): 2
Dimension: 8,265.0 m.^{2} (89,262.0 ft.^{2})
Elevation: 265 ft. a.m.s.l.

Description: Site 18134 (Figures 46 and 47) is a lava tube network and associated surface features. The lava tube occurs within pahoehoe lava with its entrance bound to the west by an a'a berm demarcating the eastern edge of a major a'a flow, in the northern *makai* portion of the project area. Extensive bulldozing associated with quarry activities in the project area has occurred along most of the a'a flow's surface in close proximity to the site area. The external surface entrance area of the lava tube is modified with a rough surface of cobbles and boulders; outside the entrance are three mounds and a large, faced

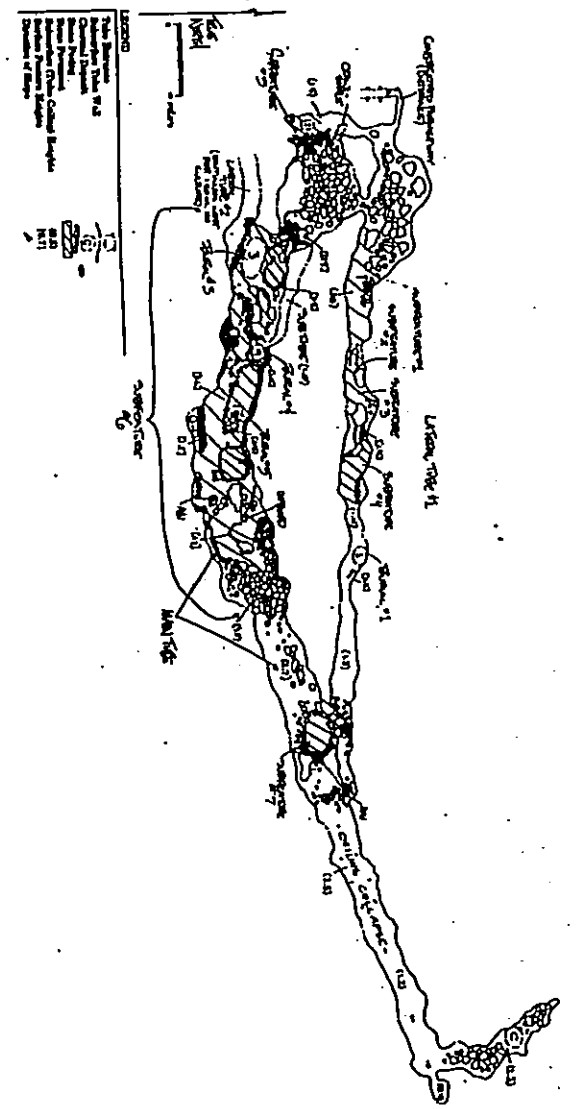


Figure 46 Site 50-10-27-18134 Feature A Lava Tube; Plan View

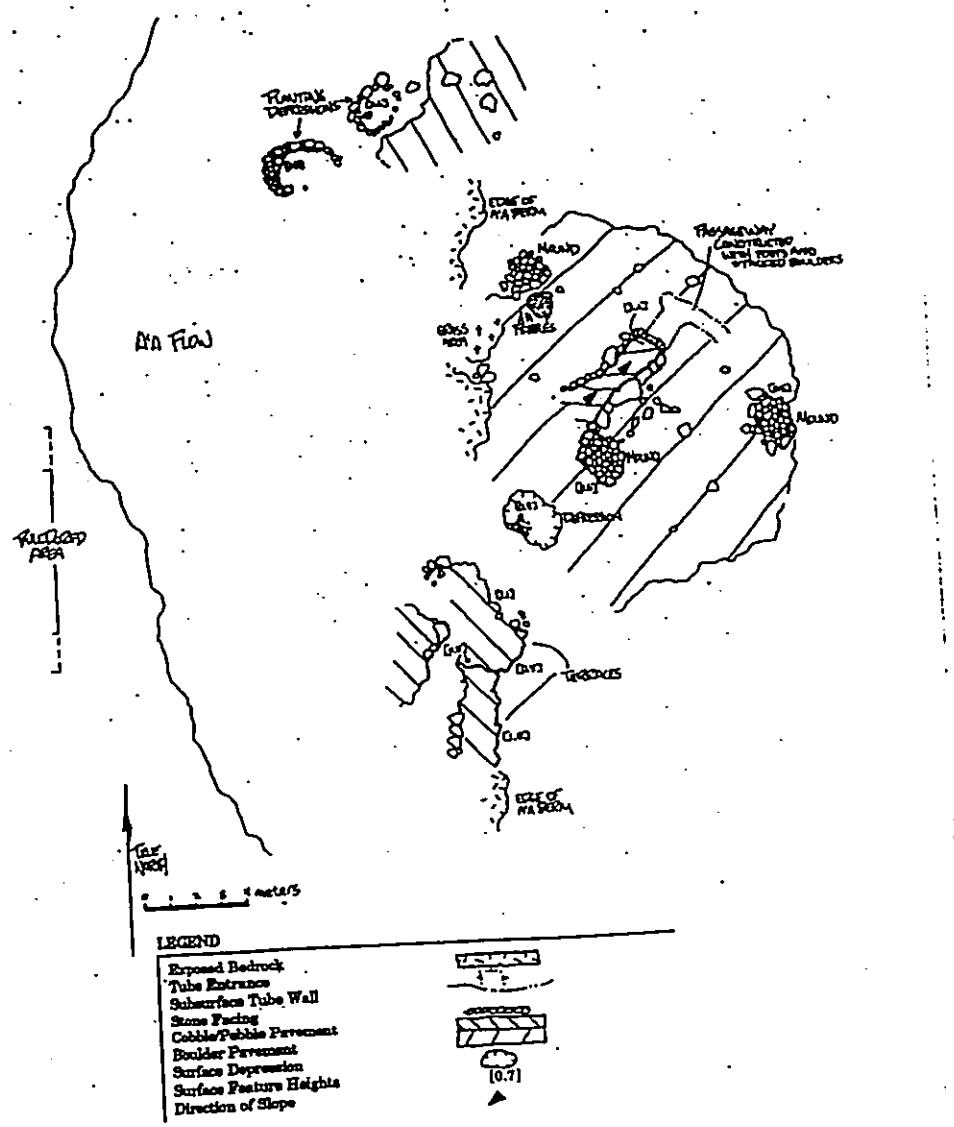


Figure 47 Site 50-10-27-18134 Feature B Surface Structures, Plan View

depression. For the sake of description the lava tube is designated Feature A, while the surface pavement, mounds and depression are designated Feature B. Terracing and a possible planting depression are also located along the edge of the a'a berm immediately west of the surface area of the site.

Feature A lava tube contains one entrance which is extensively modified on the surface to obscure its location for the purpose of refuge. The lava tube contains one main tube and two lateral tubes; the lateral tubes are designated 1 and 2. Cultural and human skeletal remains were identified within the main tube and lateral tube 1 - which are parallel and extend to the east. Lateral tube 2 extends to the southwest from the west end of the main tube and contains no visible cultural remains. At least seven constructed features - designated Subfeatures 1 through 7 - are present within the main tube and lateral tube 1. Five burial areas were identified within the lava tube, one in lateral tube 1 and four in the main tube; these are designated burials 1 through 5, respectively. Numerous other modifications and small sub-chambers are present in the lava tube but, because of the complexity of this site, are not included in the following description.

The entrance to the lava tube is constructed through the surface fill which encompasses an original sink area of the lava tube. The entrance extends into a tunnel-like passage retained by neatly faced boulder slabs and, along portions of the vertical face and ceiling, by wooden logs. The tunnel extends on a gentle slope 2.0 m. (6.6 ft.) to the northeast until diverting to the southwest where it descends steeply 5.0 m. (16.5 ft.) to the underlying floor surface of the lava tube and enters the west end of lateral tube 1. The tunnel passage measures between 1.0 m. (3.3 ft.) and 1.5 m. (4.9 ft.) high and averages 1.0 m. (3.3 ft.) wide. A test trench was excavated at a point approximately 2.0 m. (6.6 ft.) into the tunnel passage (see Testing Results below).

Lateral tube 1 is a relatively narrow, long and straight tube which connects to the main tube at three locations. The most western access to the main tube occurs immediately south of the entrance area into lateral tube 1. It is the least accessible due to a small crawl space. The second access - the main entrance to the main tube - is gained approximately 10.0 m. (33.0 m.) south of the entrance into lateral tube 1. The third access occurs at the east end of lateral tube 1, approximately 85.0 m. (278.9 ft.) south of the initial entrance.

Overall, lateral tube 1 measures 90.0 m. (297.0 ft.) long with widths ranging from 10.0 m. (33.0 ft.) at its western end to 2.0 m. (6.6 ft.) further east. Ceiling height averages 2.0 m. (6.6 ft.). The floor of the tube is covered with extensive ceiling collapse especially within the entrance area at its west end. Further east, Subfeatures 1 through 4 and burial 1 are present.

Subfeature 1, a narrow pavement, is located 15.0 m. (49.5 ft.) from the entrance to lateral tube 1. The pavement measures 15.0 m. (49.2 ft.) long E/W by 3.0 m. (9.8 ft.) at its widest point. Two constructed cupboards are observed at the extreme east end of this feature. Generally the paving abuts the tube wall along the south edge and is bordered by extensive ceiling fall on the north edge.

Subfeature 2 is located 3.0 m. (9.8 ft.) east of Subfeature 1. It is a paved terrace. This terrace abuts the north wall of the tube and a large boulder to the east. The terrace is triangular in shape and measures roughly 2.0 m. (6.6 ft.) N/S by 2.0 m. (6.6 ft.) E/W. An

historic spool, with a length of string winding down the length of the main tube and lateral tube 1, was observed adjacent to Subfeature 2.

Subfeature 3 is located adjacent to Subfeature 2. It is a paved area on the tube floor. Similar to Subfeature 1, this paved area runs along the south wall of the tube. It measures 8.0 m. (26.2 ft.) long E/W by 2.5 m. (8.2 ft.) wide.

Subfeature 4 is located 5.0 m. (16.4 ft.) east of Subfeature 3. The paved surface of this terrace abuts both walls of the tube. This pavement measures 12.0 m. (39.4 ft.) long by 4.0 m. (13.1 ft.) wide. Faced edges were observed on both the west and east ends. The west edge facing measures 1.4 m. (4.6 ft.) in height.

Burial 1 is located 6.0 m. (19.7oor condition as a result of natural decomposition and pedestrian disturbance. The remains include a collection of large-sized long bones belonging to at least two adult individuals. Based on pelvic configurations these remains represent a male and a female. No skulls are present with the burial. Evidence of a broken arm is observed in the male individual. A piece of leather hide and a cache of worked bone (non-human) is located immediately west of the burial. Various wood fragments are associated with burial 1 but not enough to suggest that these are coffin burials.

Lateral tube 1 terminates approximately 25.0 m. (82.0 ft.) east of burial 1, where it intersects with the main tube.

The main tube extends approximately 100.0 m. (330.0 ft.) in an east/west direction. Beginning at the west end of lateral tube 1, the main tube is accessible through a small crawl space roughly 0.8 m. (2.6 ft.) in diameter.

Burial 2 is located approximately 5.0 m. (16.5 ft.) south of the small crawl space on top of a terrace (Subfeature 5).

Subfeature 5 terrace measures approximately 4.0 m. (13.2 ft.) in diameter. The terrace is constructed of a pebble-and-small-cobble pavement abutting the wall of the tube on all sides except the east side. This east side is raised approximately 1.5 m. (4.9 ft.) and is constructed on top of a natural rise of ceiling collapse.

Burial 2 skeletal remains, based on the pelvic configuration and skull characteristics, represent a female individual. No vertebrae are present and only two teeth remain on the maxillae. Interestingly, there is no apparent breakage to the tooth sockets to suggest post-mortem removal nor are the sockets worn to indicate a prolonged tooth loss while the individual was alive. Thus, the lack of apparent wear on the remaining teeth, as well as on the teeth sockets, suggests the individual was rather young.

To the east of burial 2, beyond a small crawl space, the main tube of Site 18134 opens up into a high-ceilinged chamber measuring approximately 15.0 m. (49.5 ft.) in diameter. The floor of this chamber is covered with boulder-sized ceiling collapse. The main, most accessible entrance into the main tube from lateral tube 1 is present on the north side of the this chamber. A coral sinker (Acc. #47) was collected from this entrance area. Miscellaneous marine midden was observed along the floor of the south side of the chamber and various alignments cross the floor. A raised, modified surface or terrace (western extent of Subfeature 6) delineates the east side of this chamber. A hearth - indicated by a circular alignment of cobbles - is present along the east edge of the chamber, just below Subfeature 6. A shell fishhook (Acc. #49) was collected from the hearth area. A small "sub-tube" extends below the floor of the north edge of the chamber and continues in a parallel direction to Subfeature 6 and the natural configuration of the main tube's north wall for approximately 15.0 m. (49.5 ft.). It has a maximum height of 1.0 m. (3.3 ft.) and

maximum width of 3.0 m. (9.9 ft.).

Subfeature 6 demarcates the main habitation area of the lava tube. It begins approximately 13.0 m. (42.9 ft.) southeast of the main entrance of the main tube and it is constructed along an expanse of ceiling collapse. Subfeature 6 rises a maximum of 2.0 m. (6.6 ft.) above the floor of the chamber. The multiple and contiguous terraced surfaces and pavements of Subfeature 6 extend a total length of 50.0 m. (165.0 ft.) E/W. These surfaces suggest numerous activity areas (i.e., sleeping, eating etc..). At least 10 activity areas are discernable; these are generally characterized by well-paved pebble surfaces which are retained and separated from other areas by a cobble-and-boulder facing. The north side of Subfeature 6 abuts the lava tube wall. Some portions of its south side are raised to a maximum of 2.0 m. (6.6 ft.) high; these sections form relatively protected chambers below and between Subfeature 6 and the south side of the lava tube. An immense amount of marine midden and terrestrial midden - including a predominance of sea urchin - was observed along the various surfaces of Subfeature 6. Several charcoal concentrations and ash covered basins are also present. Three charcoal samples were collected from the surface of the primary habitation area of the main tube and one sample (Acc. C-7) was submitted for radiocarbon analysis.

Three burial areas (burials 3 through 5) are present on the Subfeature 6 surface. Burial 3 is the most substantial collection of skeletal remains in the lava tube; it is located on the western end of Subfeature 6, approximately 15.0 m. (49.5 ft.) southeast of the main tube's main entrance. Burial 3 is a collection of coffin burials of at least five individuals. The skeletal remains are somewhat complete and *in situ*, however, many of the bones are crushed by the collapsed coffins. The individuals represent two adult females - evidenced by gracile brow ridges - two adult males - evidenced by robust brow ridges - and a juvenile with no molars and little cusp wear on the existing teeth. Pieces of leather shoes, copper fragments, buttons, *lau hala* matting and remnants of a *pulu* or *hapu'u* fern pillow are associated with the burials. On the side of one of the coffin planks "Kailua" is written suggesting that the individual may have been shipped to Kailua-Kona from elsewhere. A white crystallized substance coats all of the skeletal remains of burial 3 and all other burial areas (except burial 2) in the lava tube.

Burial 4 is a coffin burial located approximately 10.0 m. (32.8 ft.) to the east of Burial 3. It is the remains of one individual; based on its relatively small bone size and pelvic configuration, the individual was likely a male youth. The coffin, although presently dilapidated, is placed perpendicularly to two underlying (parallel) wooden poles. The two wooden poles were likely the remains of a stretcher-like structure or *manele* which was used to transport the body to its burial place (Bowen 1961;52). Of particular interest, the coffin is placed perpendicular rather than parallel (offering a more stable foundation) to the underlying poles. It is suggested that this unusual placement may represent a symbolic canoe burial.

Burial 5 is located approximately 10.0 m. (33.0 ft.) east of burial 4. It represents the most decomposed skeletal remains in the lava tube offering little basis for interpretation. A koa wood fragment, plaited *lau hala*, and expansive layer of *pulu* is associated with the burial. Based on the presence of these items, it likely represents a canoe burial of which the *pulu* served as a bedding rather than just a pillow.

Beyond burial 5, the construction of Subfeature 6 extends roughly an additional 30.0 m. (99.0 ft.). The main tube in which Subfeature 6 predominantly lies averages 8.0 m. (264 ft.) wide. Ceiling heights above Subfeature 6 range from 2.0 to 4.0 m. (6.6 to 13.2 ft.). Roughly 17.0 m. (56.1 ft.) beyond the east end of Subfeature 6, the east end of lateral tube

1 intersects with the main tube.

At this juncture stands Subfeature 7, a modified mound of ceiling collapse. The modification is defined by cobbles and boulders piled on top of a somewhat level surface. The mound measures 6.0 m. (19.8 ft.) in diameter with an approximate height of 2.0 m. (6.6 ft.). The mound serves as a slight barrier between lateral tube 1 and the main tube. The opening here measures approximately 0.7 m. (2.3 ft.) high over this pile of boulders. A concentration of charcoal is present beneath the opening and may represent the remains of a torch or the location of a lantern. A smaller, less accessible opening to lateral tube 1 occurs roughly 5.0 m. (16.5 ft.) east of Subfeature 7. An *ahu* is present at this location.

The main tube continues 50.0 m. (165.0 ft.) east of Subfeature 7 where it diverts north for 20.0 m. (66.0 ft.) until ter of ceiling collapse. The north trending leg of the eastern portion of the main tube is extremely damp. This area likely served as a water resource for habitants in the lava tube. Scattered charcoal was observed throughout this eastern portion of the main tube.

Lateral tube 2 of Site 18134 begins west of Subfeature 6's west end, and is accessed immediately south of burial 3. The tube extends approximately 150.0 m. (495.0 ft.) to the west where no cultural remains were identified.

Returning to the surface area outside the lava tube: Feature B constructions are interpreted as being directly associated with the refuge component of the lava tube. Some alterations probably occurred as the result of burial placement.

The pavement at Feature B encompasses the original sink area of the lava tube. The pavement measures 16.0 m. (52.8 ft.) N/S by 12.0 m. (39.6 ft.) E/W. Its west boundary abuts the edge of the a`a berm. The pavement is composed of a rough surface of cobbles and boulders. The depth of the pavement or fill - as indicated in the vertical face of the descending tunnel passage into the lava tube - is approximately 2.0 m. (6.6 ft.) deep. A ramp-like depression occurs within the center of the pavement; it measures 4.0 m. (13.2 ft.) long NE/SW by 1.0 m. (3.3 ft.) wide and slopes moderately to the east where it adjoins the tunnel passage. This ramp is well-faced on the northwest, northeast and southeast sides. Two large boulder slabs are located along on each side of the ramp (these slabs probably served as capstones to the lava tube entrance). A drilled cowrie shell (Acc. #48) or *he'e* lure was collected from the southwest end of the ramp-like depression. Three boulder and cobble mounds are located at the center, and at the north and east edges of the pavement.

The central mound is located adjacent to the southwest end of the ramp-like depression. The mound measures 2.0 m. (6.6 ft.) NW/SE by 1.0 (3.3 ft.) NE/SW. It has a maximum height of 0.6 m. (1.9 ft.) and is roughly faced along its perimeter. A partially faced depression is located along the southwest edge of the pavement with its west side abutting the a`a berm. It measures 2.0 m. (6.6 ft.) NW/SE by 1.5 m. (4.9 ft.) NE/SW with a depth of 0.8 m. (2.6 ft.) below the pavement surface.

The north mound measures 1.5 m. (4.9 ft.) in diameter with a maximum height of 0.4 m. (1.3 ft.). A small pavement of a`a pebbles occurs along the south side of the mound.

The east mound measures 4.0 m. (13.2 ft.) in diameter and has a maximum height of 0.5 m. (1.6 ft.) along its east partially faced side.

Terracing occurs along the eastern edge of the a`a berm, approximately 2.0 m. (6.6 ft.) southwest of the depression. The terracing extends a length of 8.0 m. (26.4 ft.) N/S by a maximum 2.0 m. (6.6 ft.) wide with a maximum height of 1.1 m. (3.6 ft.). Two possible

planting depressions are present along the a'a berm surface 15.0 m. (49.5 ft.) north of the terracing. The depressions are roughly faced around their perimeter and have an average diameter of 2.0 m. (6.6 ft.). The facing stands to a maximum height of 0.8 m. (2.6 ft.).

Site 18134 lava tube exhibits two usage components including a prehistoric refuge habitation followed by a later prehistoric and historic burial usage. The presence of extensive internal modifications in conjunction with the concealed surface entrance strongly substantiates its usage as a refuge cave. The abundance of midden on the surfaces of the internal modifications also suggests that habitation - perhaps not limited to refuge only - occurred intensively and possibly over prolonged periods of time. In addition, a temporary or recurrent habitation component likely preceded the refuge habitation, as suggested by the other temporary or recurrent habitation lava tubes located in the vicinity. The charcoal sample collected from the surface within the lava tube (Acc. C-7) yielded a conventional radiocarbon age of A.D. 1655-1950.

The nature of the Feature B features also indicates that some degree of alteration to the original entrance area was conducted for easy access for burial placement. It is believed that the ramp-like depression was excavated to create a longer axis of entry needed - especially for the coffin burials - for carrying the individual burials inside. This would suggest that the initial entrance of the refuge lava tube was vertically accessed and, based on portions of intact facing of the ramp-like depression, probably measured a diameter of roughly 1.5 m. (5.0 ft.). The large boulder-sized capstones would have effectively covered this original measurement of the entrance. Excavation of the original pavement surface may also explain the presence of the surface mounds as refuse piles, especially the one located immediately adjacent to the ramp-like depression.

Testing Results

Limited testing was conducted within the lava tube of Site 18134 to better define the chronology of habitation at the site, examine sub-surface deposits and to collect charcoal for radiocarbon analysis. A 0.50 m. by 0.50 m. (1.6 ft. by 1.6 ft.) test unit was placed directly beneath - what is believed to be - the original overhang of the lava tube within the constructed refuge passage-way. The test unit was situated on a soil surface covered with midden. One stratigraphic layer - Stratum I - was identified. Excavation continued until encountering bedrock at a maximum depth of 8 cm. below the surface. Because of its shallowness, no profile was made.

Stratum I (0-8 cm.) consisted of a loosely compacted, brown (10 YR 5/3) loam silt. Marine and terrestrial midden were recovered from Stratum I including the following items: 12.8 gms. of cowrie (*Cyproea caputserpentis*); 0.1 gm. of *pipipi* (*Nerita picea*); 4.2 gms. of pearl shell (*Isognomon* sp.); 21.3 gms. of sea urchin (Echinoderm), 3.3 gms. of unidentified shell; 0.3 gm. of unidentified fish bone and scales; 0.1 gm. of small lizard; 0.5 gm. of Polynesian rat (*Rattusexulans*); 0.4 gm. of domestic dog (*Canis familiaris*); 0.3 gm. of medium vertebrate bone; 54.1 gms. of kukui-nut shell. A total of 31.5 gms. of charcoal was also collected from Stratum I.

Results of the limited testing at Site 18134 indicates that food (primarily of marine origin) was consumed within the constructed passage-way.

Interpretation: Suggested primarily by the midden content, the tested portion of the lava tube site (18134) was occupied on a temporary or recurrent basis. This area of short-term occupation either occurred prior to the refuge cave constructions in the original light zone

of the cave entrance, or while the cave was used as a refuge (the excavated area is in a protective niche off of the constructed passageway and would have provided a good defensive position against intruders).

SHPD Site #: 50-10-27-18135 **CSH Site #: 58**
Site Type: Faced mound
Function: Marker
Features (#): 1
Dimension: 1.9 m.^{2} (21.1 ft.^{2})
Elevation: 290 ft. a.m.s.l.

Description: Site 18135 is located on an undulating a'a outcrop. The soil deposition is shallow and supports few plants. *Koa haole*, Christmas-berry trees and *wiliwili* tress are present.

Site 18135 is a small, faced circular mound. It measures 1.3 m. (4.3 ft.) N/S by 1.5 m. (4.9 ft.) E/W. The mound is constructed with a'a boulders and stands 5 courses high. Small cobbles are scattered on the mounded surface. It is faced on its north side.

No midden or artifacts were observed.

The site is in fair condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18136 **CSH Site #: 59**
Site Type: Complex
Function: Agriculture
Features (#): 2
Dimension: 25.0 m.^{2} (262.5 ft.^{2})
Elevation: 300-310 ft. a.m.s.l.

Description: Site 18136 is a complex located on a moderate, *makai*-trending slope. The site is situated within a soil expanse at the base of a pahoehoe flow where it intersects an a'a flow.

Site 18136 consists of two features: a platform, designated Feature A and numerous agricultural features, designated Feature B.

Feature A (Figure 48) is a ramp-like platform. The platform measures 2.5 m. (8.2 ft.) N/S by 10.0 m. (32.8 ft.) E/W and has a maximum height of 0.6 m. (1.97 ft.). The platform is two-tiered. The upper tier is constructed of a boulder face and a cobble and boulder surface. A cupboard, measuring 0.30 m. (0.98 ft.) by 0.30 m. (0.98 ft.) and 0.40 m. (1.31 ft.) deep, was observed in its east end.

The lower tier is a terrace construction, abutting the ground surface on its north side. It is constructed of cobbles and boulders. The long axis of the platform is situated across the slope (*mauka-makai*).

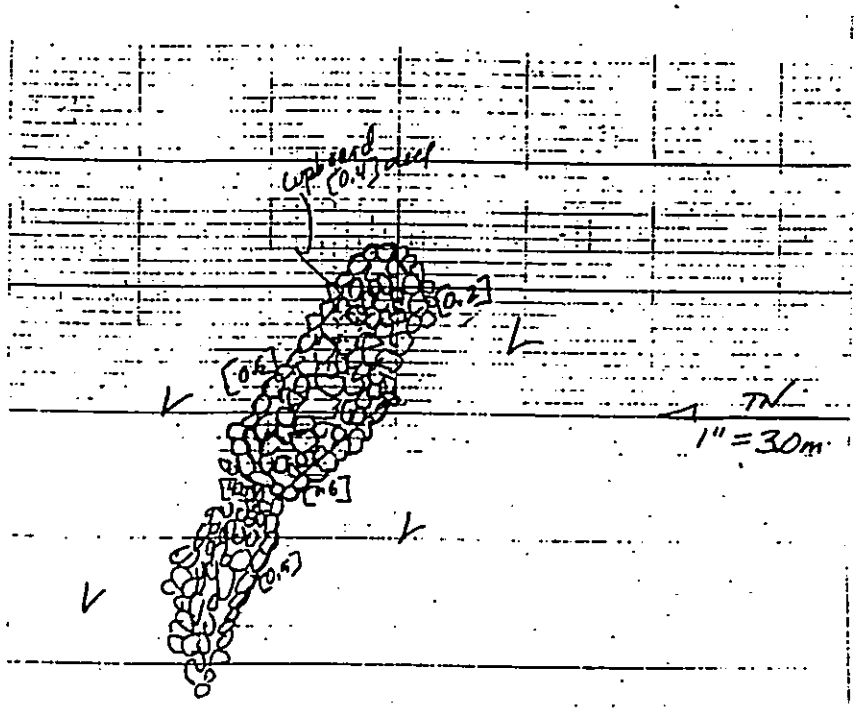


Figure 46 Site 50-10-27-18136, Feature A, See Overall Site Map for Feature B Mounds

Feature B consists of numerous mounds - obscured by dense vegetation - located around Feature A over an area of approximately 90.0 m.² (295.3 ft.²). The features include amorphous mounds, planting depressions, modified outcrops, terracing and mounded walls.

No midden or artifacts were observed. The site is in fair to poor condition and it may contain a cultural deposit.

CSH Site #: 60

SHPD Site #:	50-10-27-18137
Site Type:	Complex
Function:	Permanent habitation
Features (#):	5
Dimension:	1,596.0 m.² (17,236.8 ft.²)
Elevation:	300-305 ft. a.m.s.l.

Description: Site 18137 (Figure 49) is a complex located on and adjacent to two pahoehoe bluffs with an uneven terrain which slopes moderately southwest. The terrain contains an ample soil deposit among depressions in the pahoehoe; it is densely covered by *koa haole* and grasses.

Site 18137 consists of five features designated Features A through E. The features include two modified bluffs, two terraces and an enclosing wall. Two prominent bluffs and an exposed area of bedrock are utilized in the construction of these features.

Feature A is a modified bluff which contains two primary structures, two modified pahoehoe depressions. Various rough terraces also occur along the edge of the bluff and cracks in the pahoehoe surface are filled with cobbles. The bluff measures approximately 5.5 m. (18.0 ft.) N/S by 19.0 m. (62.3 ft.) E/W. The modified depression to the west has an interior measurement of 2.0 m. (6.6 ft.) N/S by 2.6 m. (8.5 ft.) E/W and is approximately 1.6 m. (5.2 ft.) deep. A wall - constructed along the western edge - encloses this depression.

The second modified depression is located to the east and measures 2.5 m. (8.2 ft.) N/S by 5.0 m. (16.4 ft.) E/W. The interior contains a small amount of cobble paving. The depression is completely enclosed by a wall constructed along the south edge of the depression.

No midden or cultural material was observed.

Feature B wall surrounds the entire complex as well as a roughly level basin bound by the prominent bluffs. The wall encloses an area measuring approximately 35.0 m. (115.5 ft.) N/S by 45.0 m. (148.5 ft.) E/W. The wall stands in at various states of preservation ranging from single cobble and boulder alignments to 2 to 5 course stacked faces. The wall is a maximum of 0.4 m. (1.3 ft.) high and 1.0 m. (3.3 ft.) wide. Preserved portions of the wall suggest that it was once a bifaced wall with a cobble core fill.

Adjacent to Feature B wall, at about 25.0 m. (82.0 ft.) from Feature A, a circular enclosure (planting depression) is present on the *mauka* (east) side of the wall. It measures roughly 1.8 m. (5.9 ft.) in circumference. It appears to be a naturally occurring depression which has been modified.

No midden or artifacts were observed in association with Feature B.

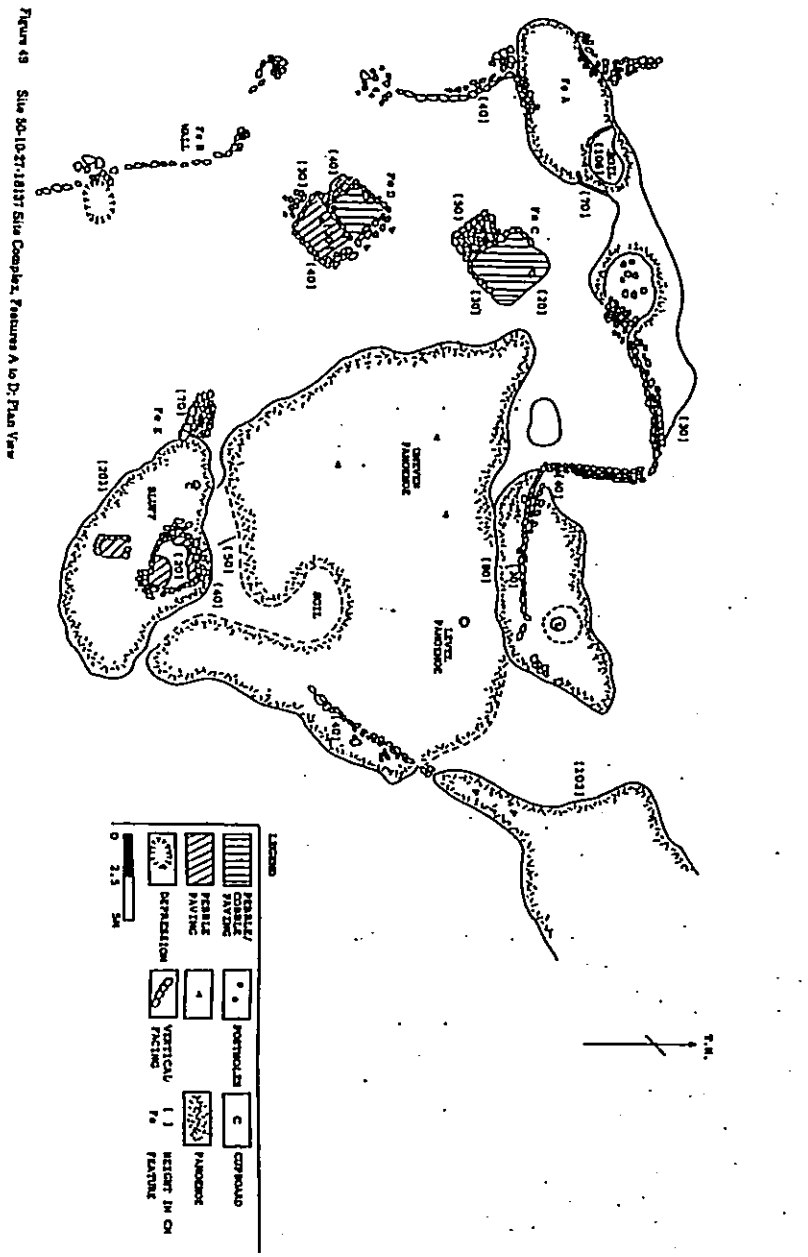


Figure 49 Site 50-10-27-18137 Site Complex, Features A to D; Plan View

Feature C is a square terrace with a smaller, rectangular terrace attached to its southwest side. The square terrace measures 3.0 m. (9.9 ft.) NW/SE by 4.0 m. (13.2 ft.) NE/SW and has a maximum height of 0.3 m. (0.9 ft.). Its northwest side is flush to the ground surface. It is constructed with a boulder perimeter and a pebble surface pavement. The rectangular terrace measures 3.0 m. (9.9 ft.) NW/SE by 2.0 m. (6.6 ft.) NE/SW and has a maximum height of 0.5 m. along its southwest side. It also has boulder perimeter - faced along its southwest side - and a boulder and cobble surface pavement.

No midden or artifacts were found in association with Feature C.

Feature D is a roughly rectangular terrace that measures 5.6 m. (18.4 ft.) NW/SE by 4.5 m. (14.8 ft.) NE/SW, and to a maximum height of 0.4 m. (1.3 ft.).

Two surface areas, to the northwest and to the southeast, are delineated by an internal alignment extending across the center of the terrace. The northwest area is paved with pebbles and the southeast is paved with pebbles and cobbles. Two possible postholes occur at the center of the terrace near its southwest side. Each posthole measures approximately 0.1 m. (0.33 ft.) in diameter. They are located on either side of the internal alignment, 1.0 m. (3.3 ft.) apart.

An alignment of cobbles forming a circle is present in the northwest section of the terrace. The alignment is in remnant condition and difficult to distinguish. While it has the general shape of a hearth, no charcoal was observed.

Feature E - like Feature A - consists of a modified bluff which includes three distinct structures: two terraces and a modified depression. Overall, the feature measures 7.3 m. (24.0 ft.) N/S by 11.9 m. (39.0 ft.) E/W with a maximum wall height of 0.8 m. (2.62 ft.).

One terrace occurs along the west edge of the bluff and forms a ramp-like surface leading up onto the bluff surface. It measures 3.0 m. (9.8 ft.) E/W by 1.5 m. (4.9 ft.) N/S with a maximum height of 0.7 m. (2.30 ft.) along its south faced side.

Another terrace is constructed along the south side of the bluff 8.0 m. (26.4 ft.) to the southeast of the first terrace. This second terrace measures 2.0 m. (6.6 ft.) N/S by 1.0 m. (3.3 ft.) E/W with a maximum height of 0.8 m. (2.62 ft.). The west and south sides of the terrace are faced and the east and north sides are flush to the bluff surface.

A modified depression is located along the north side of the bluff, beginning 1.5 m. (4.9 ft.) north of the second terrace. It measures roughly 3.0 m. (9.9 ft.) in diameter and has a wall constructed along its perimeter. The wall stands in 1-2 courses of cobbles to a maximum height of 0.4 m. (1.3 ft.). The base of the depression is soil-filled with two areas of pebble-and-cobble paving in its north and south areas. Two small cupboards were observed within and near the depression. The cupboard within the depression is located along its south side; a boulder slab leaning against the open cupboard is a probable capstone. The second cupboard is located 2.0 m. (6.6 ft.) to the northwest of the depression.

The site has a commanding view *makai* and *mauka* from its bluff location.

No midden or artifacts were observed at Site 18137.

The site is in fair condition and a cultural deposit may be present.

SHPD Site #: 50-10-27-18138 **CSH Site #: 61**
Site Type: Lava tube
Function: Recurrent habitation
Features (#): 1
Dimension: 846.0 m.^{2} (9,136.8 ft.^{2})
Elevation: 305 ft. a.m.s.l.

Description: Site 18138 (Figure 50) is a lava tube located beneath a gentle *makai*-trending pahoehoe lava surface. Soil pockets at the surface support *koa haole*, grass, air plants, lantana and *noni*.

The lava tube consists of a main tube oriented roughly NE/SW with three side tubes. The lava tube is accessible through two entrances, one to the east and another to the west. The main tube and primary living area measures 70.0 m. (231.0 ft.) long, stretching between and beyond the entrances. The east entrance also affords access to a small tube which extends beneath the main tube. This "sub-chamber" contains internal modifications - described below after the details of the main tube - which suggest refuge habitation.

The *makai* (west) entrance to the main tube occurs within a sink measuring 25.0 m. (82.0 ft.) long and 5.0 m. (16.4 ft.) deep. The light zone is wide and has an average ceiling height of 1.3 m. (4.1 ft.). Midden is visible on the surface in an area 6.6 m. (21.7 ft.) long by 2.5 m. (8.2 ft.) wide. A hammerstone was observed 1.2 m. (3.9 ft.) north of the entrance and a water-worn cobble fragment was observed 3.0 m. (9.8 ft.) east of the entrance.

The main tube extends 30.0 m. (99.0 ft.) southwest from the *makai* entrance. The main tube is separated by a central lava pillar into two parallel tubes (designated northwest and southeast) which join at a distance of 20.0 m. (65.6 ft.) to the southwest. The entrance to the southeast tube is partially restricted by two small faced terraces constructed along the tube walls. One terrace - located within 5.0 m. (16.5 ft.) south of the *makai* entrance - is roughly paved with cobbles; the second terrace - located 4.0 m. (13.1 ft.) southwest of the first terrace - has an uneven boulder surface. Sea urchin and opihi shells were observed near the terraces.

The southeast tube curves gently to the southwest and then widens. It is partially blocked at 10.0 m. (33.0 ft.) from the terraces by either natural collapse or loose construction. Midden is present in this wider section of the tube just before the collapse.

Beyond the ceiling collapse is a chamber measuring 4.5 m. (14.8 ft.) N/S by 8.0 m. (26.2 ft.) E/W by 2.15 m. (7.1 ft.) high. Kukui-nut shells are present. The northwest tube enters this chamber and continues as a ledge 1.8 m. (5.9 ft.) above the floor of the chamber along the northwest chamber wall.

A possible burial platform is located along the west wall of this chamber. The rectangular platform is constructed on ceiling collapse. It has a flat cobble surface.

Openings to two small tubes are present along the west wall of this chamber at distances of 1.2 m. (3.9 ft.) and 2.0 m. (6.6 ft.) north of the terrace. Their size and rough lava floors restricted exploration.

The northwest tube is characterized by a low ceiling and a sharp lava floor. It extends west for approximately 15.0 m. (49.2 ft.) where it rejoins the lower, southeast tube. Midden and a mother-of-pearl tool, possibly a knife, were observed within the first 7.0 m. (23.0 ft.) of the northwest tube.

From the *makai* entrance, the main tube stretches 22.0 m. (72.2 ft.) northeast to the *mauka* (east) entrance. This section between the two entrances has a low ceiling; and the floor has a rough lava surface.

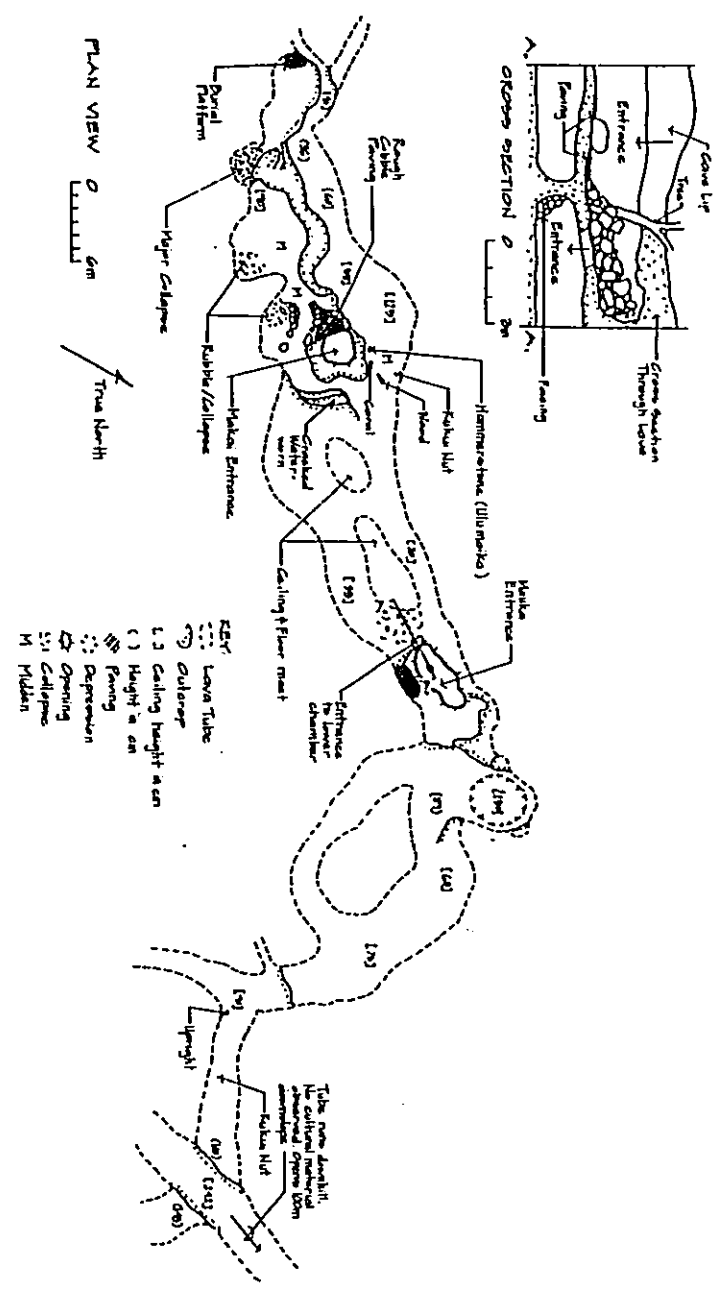


Figure 50 Site 50-10-27-18138, Plan View

The *mauka* entrance is located in a sink which measures 5.0 m. (16.4 ft.) long by 2.0 m. (6.6 ft.) wide by 2.0 m. (6.6 ft.) deep. The area within the light zone has a ceiling height of 2.0 m. (6.6 ft.). The main tube continues from the entrance approximately 20.0 m. (66.0 ft.) to the northeast. The floor is fairly smooth in this area with ceiling heights ranging from 0.7 m. (2.3 ft.) to 0.9 m. (2.9 ft.). From this point the tube diverts to the southeast for 8.0 m. (26.4 ft.) where a side tube extends to the west until intersecting with the light zone of the *makai* (west) entrance. The tube continues 10.0 m. (49.5 ft.) southwest beyond the side tube's juncture at which point it branches into two smaller tubes extending to the southeast and to the east, respectively. An upright boulder was observed at the tubes' juncture. The southeast tube has an extremely rough lava floor and was inspected to a maximum length of 50.0 m. (165.0 ft.); no cultural materials were observed. The east trending tube was inspected for approximately 100.0 m. (330.0 ft.). No culture was observed - except for a crab claw - and inspection was difficult due to the rough lava floor and areas with extensive ceiling collapse. Numerous other subsidiary tubes branch off of the eastern tube but were not inspected because of their low ceiling heights.

A small tube beneath the main tube is accessible from the *mauka* entrance. Its floor lies 0.9 m. (2.95 ft.) below the main tube floor. A slope of ceiling collapse leads into this lower tube. At its base the slope is retained by a faced portion of a wall. The wall surrounds a level soil floor. The enclosing wall effectively retains ceiling collapse to the north, east and west. The enclosed area measures 6.0 m. (19.8 ft.) N/S by 2.0 m. (6.6 ft.) E/W. The wall is defined by a cobble facing standing to a maximum height of 0.6 m. (1.9 ft.).

Site 18138 is in fair condition and a cultural deposit may be present.

CSH Site #: 62

SHPD Site #:	50-10-27-18139
Site Type:	Pavement
Function:	Temporary habitation
Features (#):	1
Dimension:	7.3 m.^{2} (78.7 ft.^{2})
Elevation:	295 ft. a.m.s.l.

Description: Site 18139 (Figure 51) is a small roughly square patch of cobble pavement which appears to fill a natural pahoehoe sink. The pavement is located on an undulating pahoehoe flow with scattered patches of soil visible. Vegetation present consists of grass and *koa haole*.

The pavement measures 2.7 m. (8.9 ft.) square and is bound on all sides by the pahoehoe outcrop.

No midden or artifacts were observed on the surface.

The site is in fair condition. A cultural deposit may be present.

CSH Site #: 63

SHPD Site #:	50-10-27-18140
Site Type:	Modified outcrop
Function:	Agriculture
Features (#):	1
Dimension:	56.0 m.^{2} (604.8 ft.^{2})
Elevation:	297 ft. a.m.s.l.

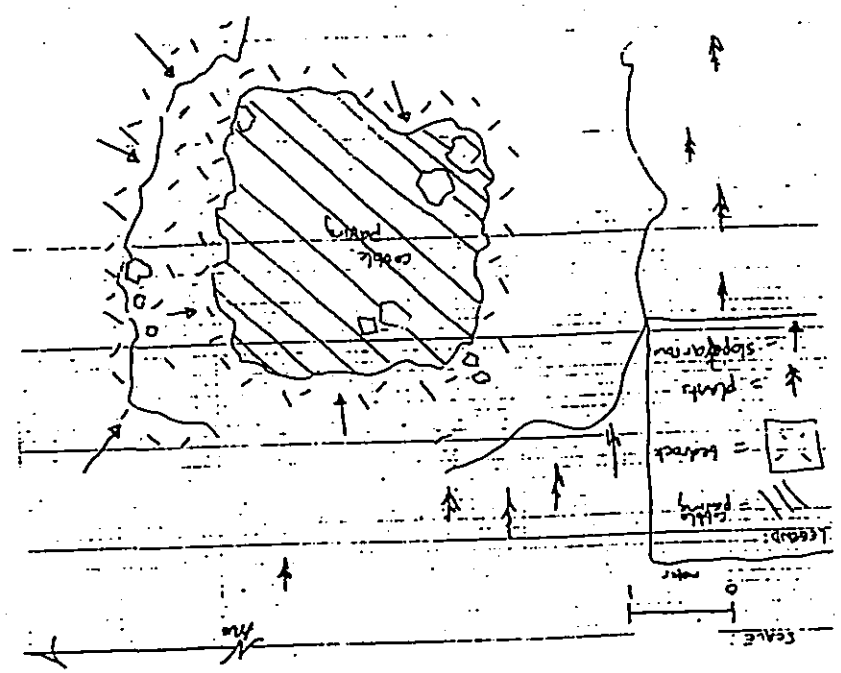


Figure 51 . Site 50-10-27-18139, Plan View

Description: Site 18140 (Figure 52) is a modified outcrop forming a large boulder enclosure. The site is located on an undulating pahoehoe flow with shallow patches of soil. Vegetation at the site consists of scrub *koa haole* and grasses.

The modification exhibits little formality in its construction. The resultant enclosed area measures 8.0 m. (26.2 ft.) N/S by 7.0 m. (23.0 ft.) E/W. The modification reaches a maximum height of 2.5 m. (8.2 ft.). It incorporates a large, shallow pahoehoe bubble in its construction. Within the enclosed area a few large pahoehoe slabs were observed, some upright. An alignment of boulders and slabs bisect the enclosed area into eastern and western sections.

No midden or artifacts were observed.

The site is in poor condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18142 **CSH Site #:** 65
Site Type: Modified outcrop
Function: Agriculture
Features (#): 1
Dimension: 19.2 m.^{2} (207.1 ft.^{2})
Elevation: 270 ft. a.m.s.l.

Description: Site 18142 (Figure 53) is a modified outcrop defined by a roughly terrace which is located on an undulating pahoehoe lava terrain. The terrain contains shallow patches of soil. Vegetation in the area consists of moderately dense *koa haole* and grasses.

The terrace modification measures 7.1 m. (23.3 ft.) NE/SW by 2.7 m. (8.9 ft.) NW/SE with a maximum height of 0.9 m. (2.95 ft.). Facing is present on its southwest and southeast sides, but otherwise the modification is informal. The surface is neither level nor paved. A grassy area to the southeast (*mauka*) is likely to have been the source of the pahoehoe cobbles and boulders used in the construction of this site.

No midden or artifacts were observed.

The site is in poor condition although it is possible that a cultural deposit may be present.

SHPD Site #: 50-10-27-18143 **CSH Site #:** 66
Site Type: L-shaped enclosure
Function: Temporary habitation
Features (#): 1
Dimension: 13.2 m.^{2} (142.6 ft.^{2})
Elevation: 315 ft. a.m.s.l.

Description: Site 18143 (Figure 54) is an L-shaped enclosure built on an exposed outcrop of pahoehoe. The surrounding terrain is a slight rise on a gentle, *makai*-tending slope. The area has a soil lens that supports *koa haole* and grass.

The enclosed area measures 3.3 m. (10.8 ft.) N/S by 4.0 m. (13.1 ft.) E/W with a maximum wall height of 0.4 m. (1.31 ft.). At one time this structure may have been a C-shape, but one wall has deteriorated beyond recognition. The exterior side of the north-

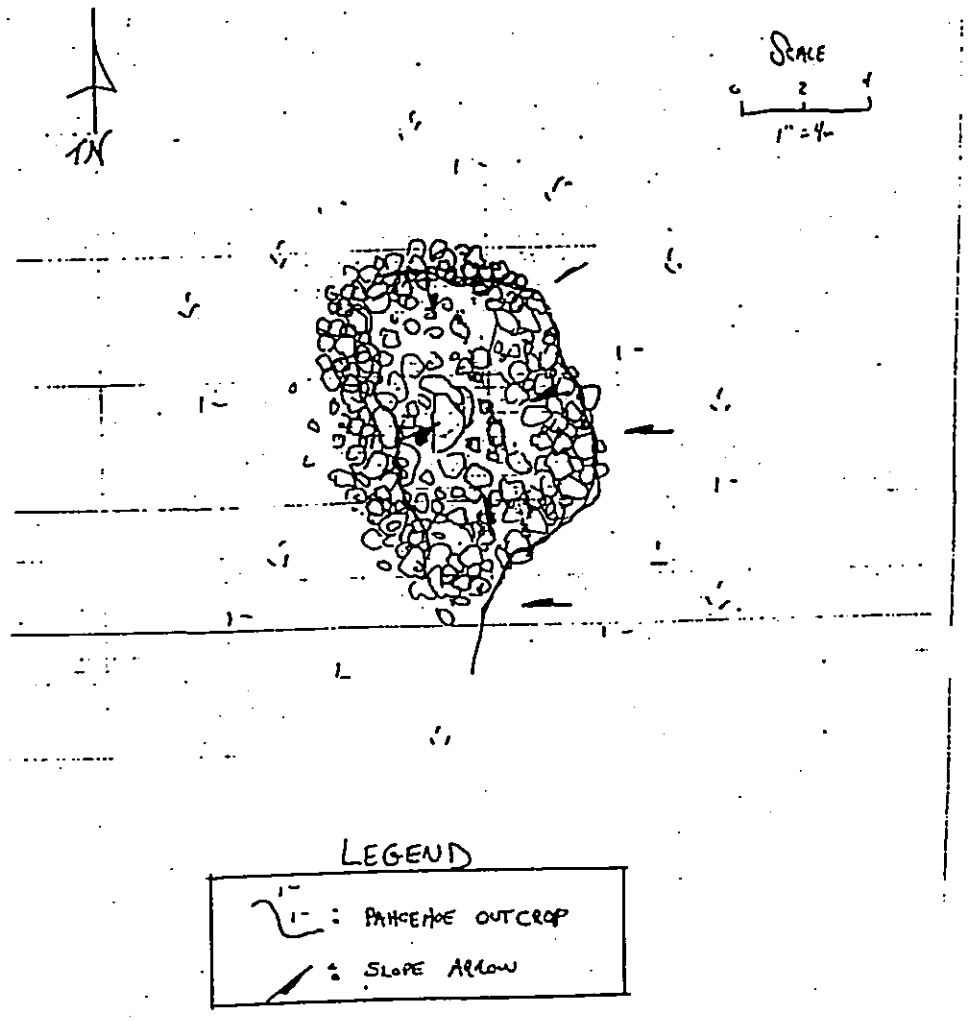


Figure 52 Site 50-10-27-18140, Plan View

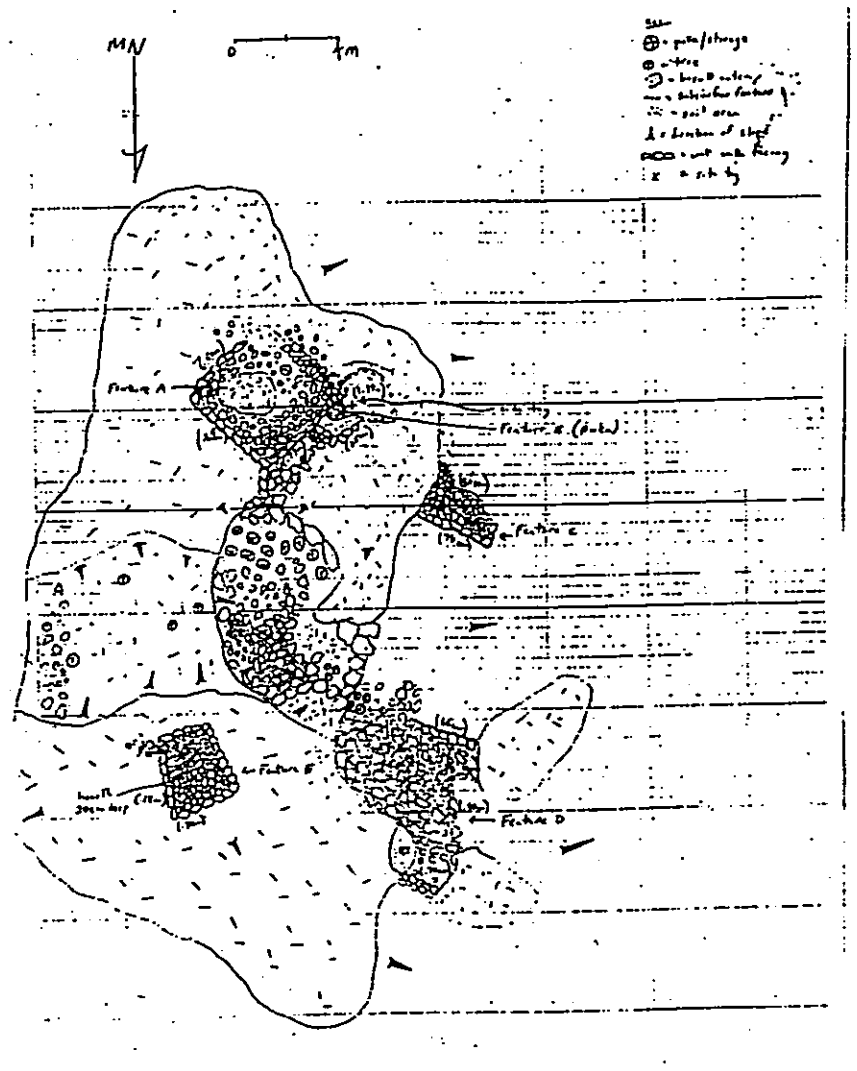


Figure 53 Site 50-10-27-18141, Plan View

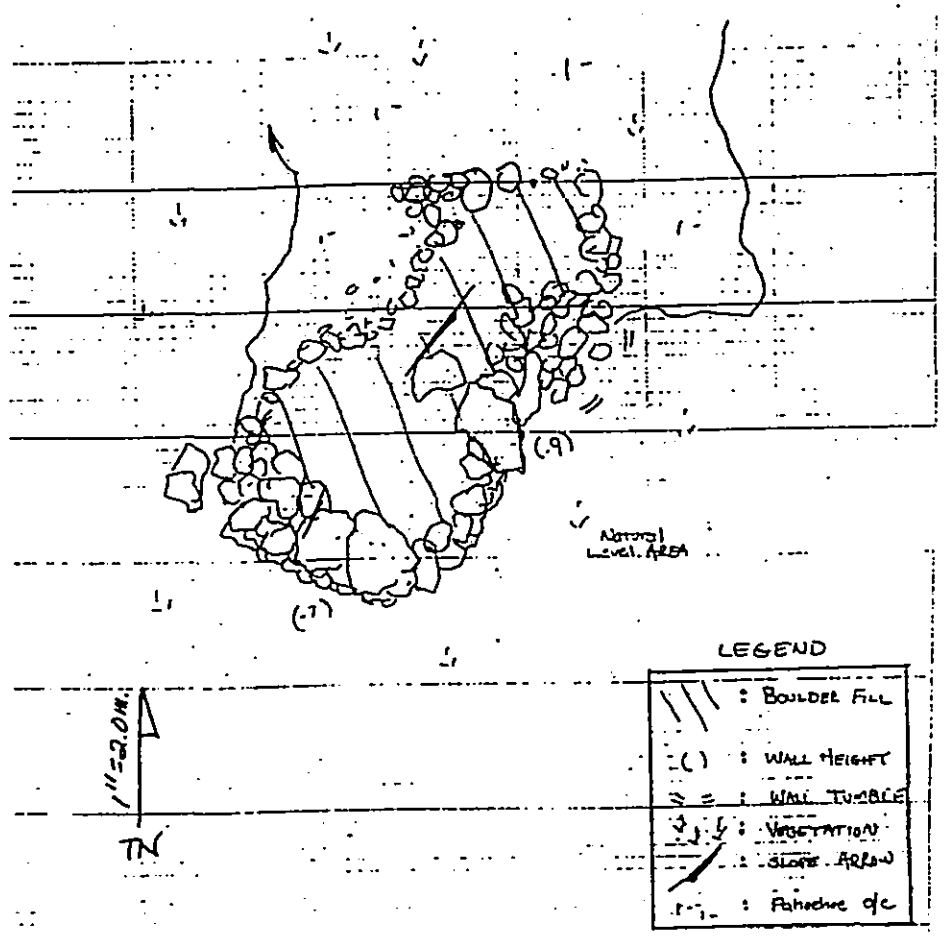


Figure 54 Site 50-10-27-18142, Plan View

south wall is built mainly of large cobbles with a small cobble fill. This wall is mostly collapsed. The east-west wall is constructed of boulders and stands to twice the height of the north-south wall.

No midden or artifacts were observed.

The site is in remnant condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18186 **CSH Site #: 114**
Site Type: Wall
Function: Possible trail
Features (#): 1
Dimension: 30.0 m.^{2} (324.0 ft.^{2})
Elevation: 55 ft. a.m.s.l.

Description: Site 18186 is a wall segment located on a level-to-undulating pahoehoe flow. The area is scattered with pockets of soil which supports *koa haole, kiawe,* grasses and wild *`ilima.*

The wall segment is oriented east/west. It measures approximately 20.0 m. (65.6 ft.) E/W by 1.5 m. (4.9 ft.) N/S with a maximum height of 0.5 m. (1.64 ft.). The wall consists of a large cobble and medium boulder perimeter with a small cobble filled interior, rising not more than one course high. Facing was observed on two sections of the wall. The wall has intermittent collapsed sections that either occurred naturally or resulted from bulldozing.

No midden or artifacts were observed except for one piece of modern refuse, an aluminum can.

Site 18186 is in remnant condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18187 **CSH Site #: 115**
Site Type: Lava tube
Function: Temporary habitation
Features (#): 1
Dimension: 82.5 m.^{2} (891.0 ft.^{2})
Elevation: 305 ft. a.m.s.l.

Description: Site 18187 (Figure 55) is a lava tube located on a gentle, *makai*-trending pahoehoe slope. The area has scattered pockets of soil which supports grass, *koa haole* and *laua`e.*

The tube entrance measures 2.5 m. (8.2 ft.) wide and 0.9 m. (2.95 ft.) high. The main chamber contains much midden in the light zone. The midden consists of sea urchin, mammal bone, kukui-nut shell and miscellaneous other marine shell.

Approximately 1.0 to 1.5 m. (3.3 to 4.9 ft.) west of the entrance, a clustering of boulders was observed.

West of the boulders 3.0 m. (9.9 ft.) is a 1.0 m. (3.3 ft.) drop where two lateral tubes are present. **Lateral tube 1** extends west for 2.0 m. (6.6 ft.). **Lateral tube 2** extends to the southwest for approximately 25.0 m. (82.0 ft.) before the ceiling height constricts and does not allow further exploration. Soil was observed in this lateral tube along with land snail shells, but no cultural material was observed.

Site 18187 is in poor condition and no cultural deposit is believed to be present.

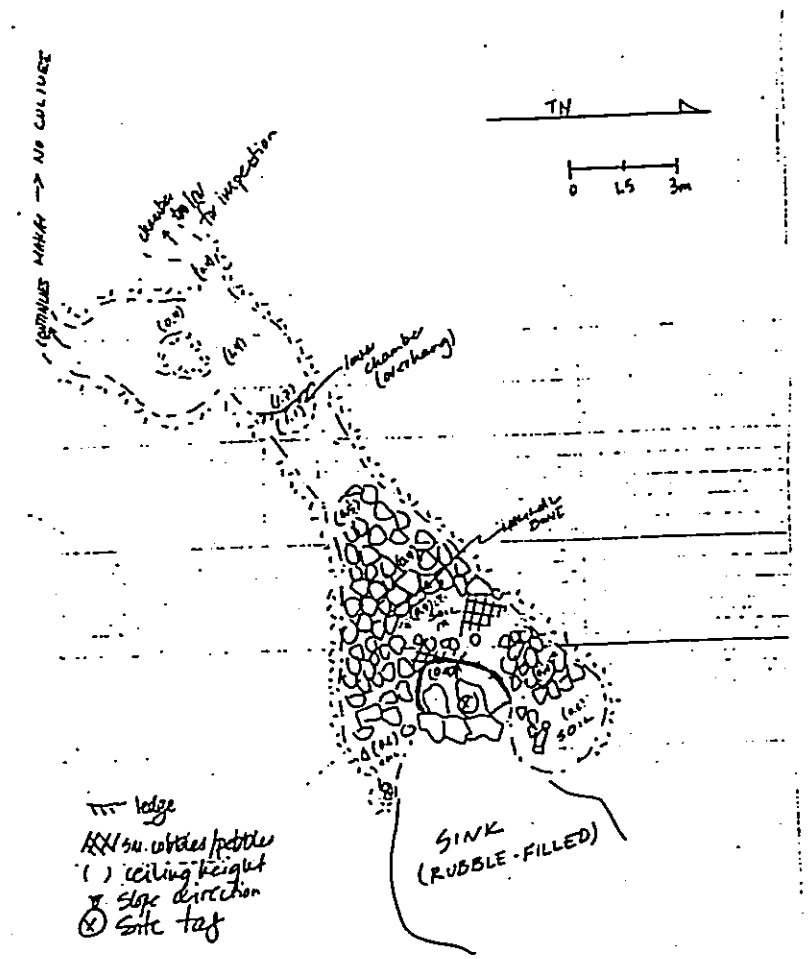


Figure 55 Site 50-10-27-18187, Plan View

SHPD Site #: 50-10-27-18188 **CSH Site #: 116**
Site Type: Lava tube
Function: Permanent habitation
Features (#): 1
Dimension: 47.3 m.² (510.8 ft.²)
Elevation: 66 ft. a.m.s.l.

Description: Site 18188 (Figure 56) is a small lava tube. The surrounding terrain is relatively level pahoehoe lava with some soil pockets supporting grass and *koa haole*.

This site is associated with permanent occupation of an adjacent site to the south (Site 18189) and is situated immediately south of Site 18099 kerbstone trail.

The entrance into the tube is gained at the southeast side of a blister area through a 2.5 m. wide opening. Natural breaks in the pahoehoe form stairs for descending into the lava blister. There is a main chamber with a small side chamber to the northeast. The main chamber measures 11.0 m. (36.1 ft.) E/W by 4.3 m. (14.1 ft.) N/S with a maximum ceiling height of 2.2 m. (6.6 ft.). As evidenced by the presence of a small mesh screen and soil piles within and outside of the lava tube, most of the main chamber has been previously excavated. The thick midden deposit is rich in several varieties of marine shell, mammal bone and other terrestrial midden; basalt and volcanic glass flakes and gourd fragments were also observed. Along the northwest wall of the blister a semi-circular cobble alignment is present. It measures 0.3 m. (0.98 ft.) in diameter and abuts the northwest wall. The alignment resembles a hearth; however only midden was observed in its interior.

A small side tube extends 5.0 to 6.0 m. (16.4 to 19.7 ft.) northeast of the main chamber before pinching off. This chamber's ceiling is low with a maximum height of 0.6 m. (1.97 ft.).

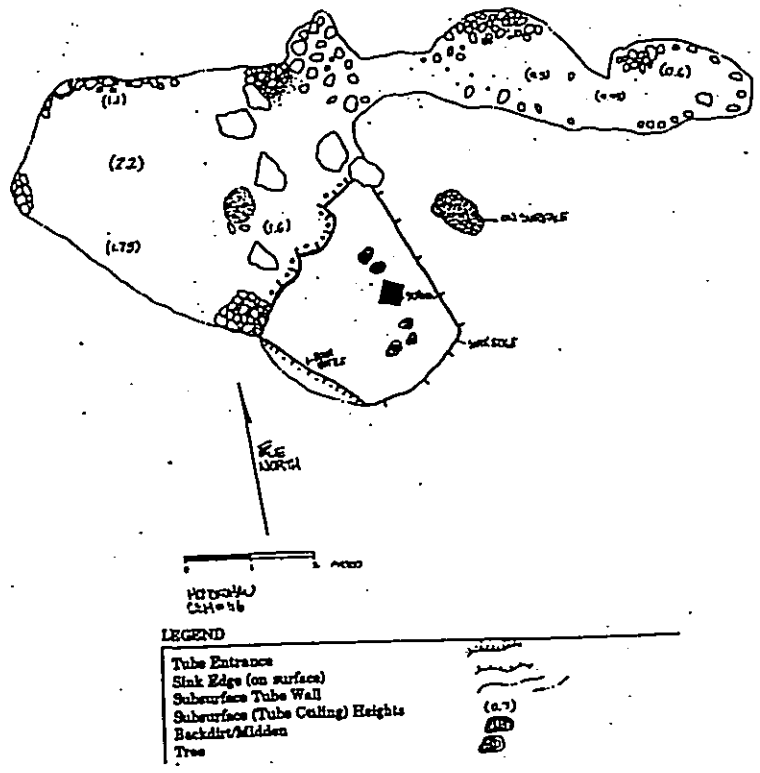
The site is in fair condition and a cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18189 **CSH Site #: 117**
Site Type: Complex
Function: Permanent habitation
Features (#): 3
Dimension: 120.0 m.² (1,296.0 ft.²)
Elevation: 69 ft. a.m.s.l.

Description: Site 18189 (Figure 57) consists of a pavement and two terraces -designated Features A through C - located on a gently sloping *makai*-trending pahoehoe flow. The area has shallow, scattered pockets of soil which supports fountain grass and *koa haole*. Site 18188 lava tube is located 11.0 m. (36.1 ft.) northwest of Feature A of this complex.

Feature A is a terrace located in the north end of the complex; Feature B is a terrace located 4.3 m. (14.1 ft.) south of Feature A; and Feature C is a terrace located 1.6 m. (5.2 ft.) to the southwest of Feature B.

Feature A is a terrace located in the north end of the complex; Feature B is a terrace located 4.3 m. (14.1 ft.) south of Feature A; and Feature C is a terrace located 1.6 m. (5.2 ft.) to the southwest of Feature B.



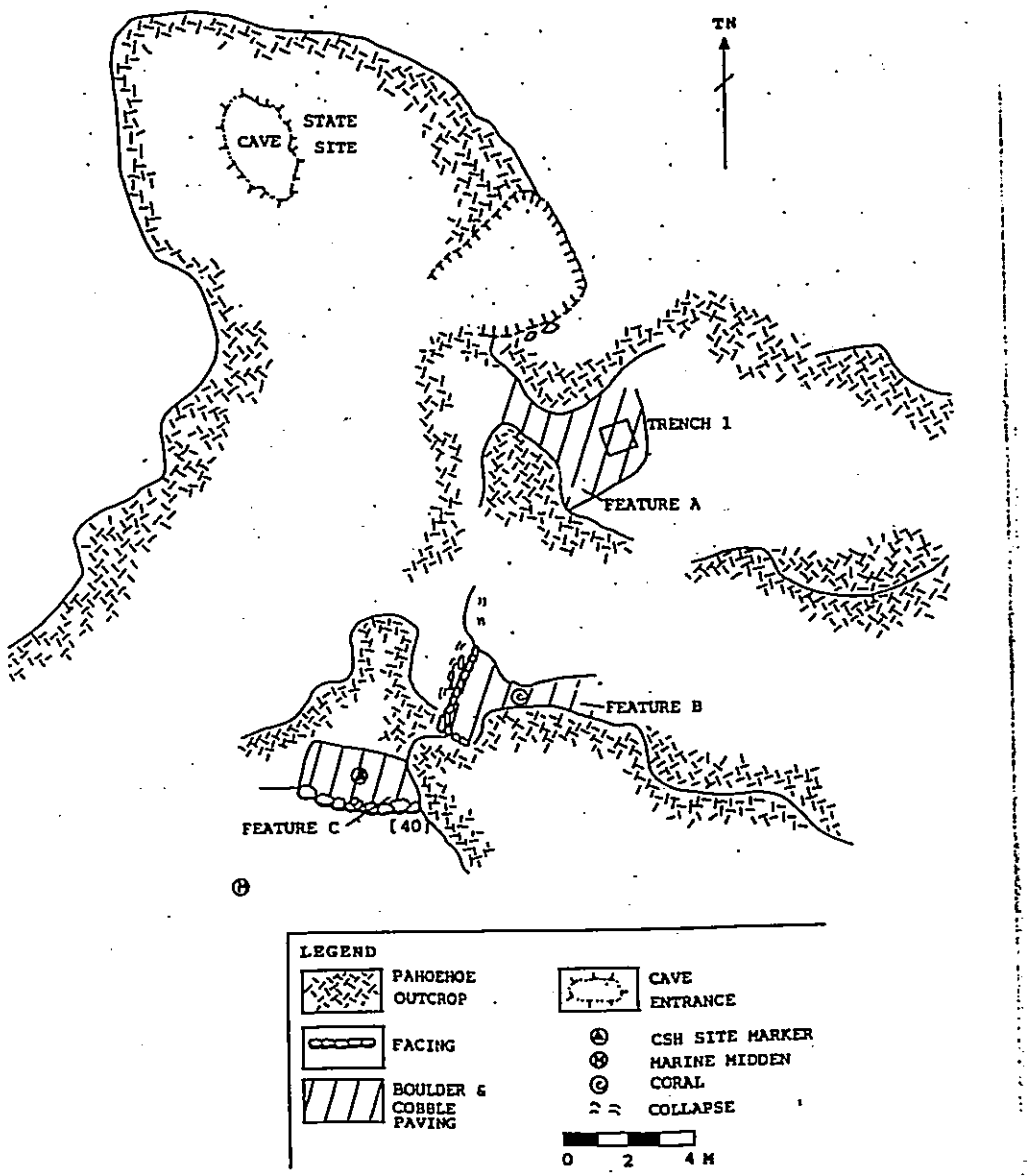


Figure 57 Site 50-10-27-18189 Site Complex, Features A to C; Plan View

Feature A is a square-shaped terrace of boulders and cobbles; the terrace measures 2.6 m. (8.5 ft.) N/S by 3.2 m. (10.5 ft.). In the southeastern portion of the terrace, the top of an upright slab is barely visible indicating the presence of a fire hearth. A test unit was excavated over the hearth feature (see **Testing Results** below).

Feature B of Site 18189 is an irregularly-shaped terrace which measures 3.0 m. (9.8 ft.) N/S by 4.1 m. (13.5 ft.) E/W and 0.4 m. (1.3 ft.) high. The west and south sides are faced with small boulders. The surface is a rough pavement of boulders and cobbles. A single coral fragment was observed on the eastern edge of this feature.

Feature C is a rectangular-shaped terrace area that measures 1.9 m. (6.2 ft.) N/S by 3.8 m. (12.5 ft.) E/W. The south side is faced with small boulders. It has a maximum height of 0.4 m. (1.31 ft). Its surface is roughly paved with boulders and cobbles.

There is a scatter of marine shell midden located 2.8 m. (9.2 ft.) to the southwest of Feature C. The midden scatter measures roughly 1.4 m. (4.6 ft.) in diameter.

The petroglyph field of Site 18081 are also located in close proximity, approximately 25.0 m. (82.0 ft.) to the southwest of this site.

The site is in fair condition and, based on the testing results, there may be a cultural deposit.

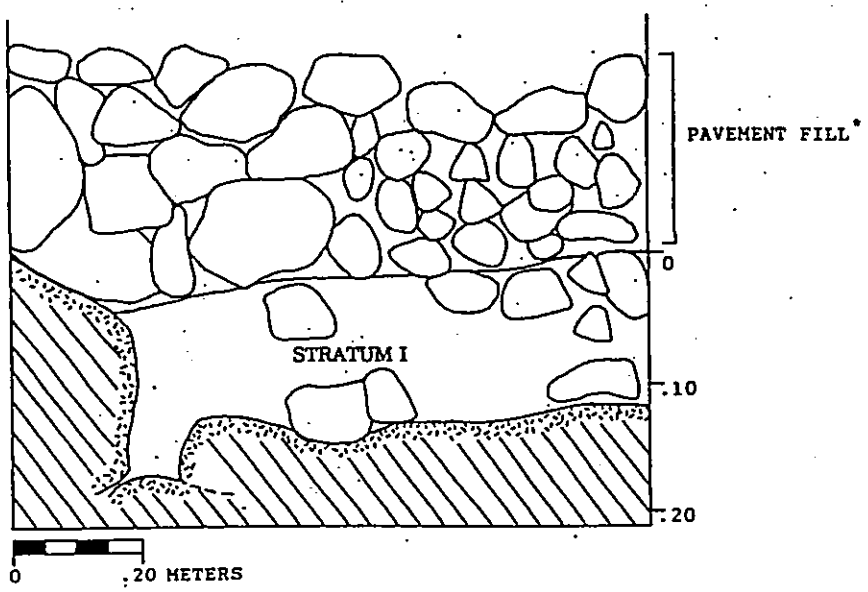
Testing Results

Limited testing (Figure 58) was conducted at Feature A of Site 18189 to determine the site's function and to collect charcoal for radiocarbon analysis. Test unit 1 - a 1.0 m. by 1.0 m. unit - was placed at the center of the pavement, approximately 1.0 m. (3.3 ft.) from the northeast perimeter of the feature. The unit was oriented so that its northeast half encompassed the hearth feature constructed in the pavement surface.

After removing cobbles from the surface of the test unit, the horizontal extent of the hearth - designated Hearth 1 - was exposed; it was delineated by an inset, square alignment of boulders measuring a diameter of 0.35 m. (1.15 ft.) E/W by 0.40 m. (1.31 ft.) N/S. The excavation of the test unit began with removing the hearth interior. The base of Hearth 1 was defined by a flat-topped boulder foundation encountered at a depth of 26 cm. below the pavement surface. The hearth matrix consisted of a loosely compacted, light gray silt infused with charcoal flecks. The feature fill was bagged for laboratory analysis and it was subsequently screened through a 16-inch mesh. An abundance of midden was recovered from the Hearth 1 fill including the following: 1.4 gms. horn shell (*Cerithium* sp.); 14.6 gms. cowrie (*Cypraea caputserpentis*); 0.5 gm. periwinkle (*Littorina* sp.); 1.1 gms. *pipipi* (*Nerita picea*); 9.7 gms. pearl shell (*Isognomon* sp.); 1.6 gms. unidentified shell; 15.4 gms. sea urchin (Echinoderm); 0.6 gm. Crustacean; 0.3 gm. kukui-nut shell; and 0.1 gm. land snail. A small amount of charcoal (0.9 gms.) was recovered from the hearth fill. A few pieces of coral were also noted while excavating the hearth fill.

Following the removal of Hearth 1, excavation expanded into the remaining portions of the 1.0 m. by 1.0 m. test unit outside of Hearth 1 where another 3 gms of charcoal was collected.

The pavement fill extended to a depth of 40 cm. below its surface and consisted mainly of large to medium cobbles and small boulders. A small amount of midden was collected from the pavement fill, including: 11.6 gms. *Conus* sp.; 10.5 gms. cowrie (*Cypraea*



*INCLUDES HEARTH #1 (NOT SHOWN)

STRATUM I — BLACK (10 YR 2/0), LOAM SILT, INCLUDES HEARTH #2 (NOT SHOWN); CULTURAL MATERIALS

BOULDERS, COBBLES AND PEBBLES

BASALT BEDROCK

UNEXCAVATED BOULDERS AND BEDROCK

Figure 58 Site 50-10-27-18189 Feature A, Test Unit 1 Profile

caputserpentis); 0.9 gm. pearl shell (*Isognomon* sp.); 0.3 gm. unidentified shell; and 0.8 gm. kukui-nut shell. Coral was noted within the pavement fill. At the base of the fill; two medium-sized boulders surrounded by a substantial amount of soil (Stratum I) was encountered.

Stratum I - 25 cm. thick - (40-65 cm. below surface) consisted of a loosely compacted, black (10 YR 2/0), loam silt with small cobbles and pebbles intermixed. A second hearth feature - Hearth 2 - was encountered below Hearth 1's foundation boulder, at a depth of 47 cm. below surface.

Hearth 2 had a horizontal measurement of 0.48 m. (1.6 ft.) N/S by 0.35 m. (1.15 ft.); it extended to a maximum depth of 56 cm. below surface. Hearth 2 was characterized by a loosely compacted light gray silt intermixed with charcoal. The hearth fill was subsequently screened through a 16-inch mesh screen and the following midden types were recovered: 0.6 gm. *Conus* sp.; 21.2 gms. cowrie (*Cypraea caputserpentis*); 0.2 gm. periwinkle (*Littorina* sp.); 1.8 gms. *pipipi* (*Nerita picea*); 48.8 gms. pearl shell (*Isognomon* sp.); 223.5 gms. sea urchin (Echinoderm); 29.6 gms. unidentified shell; 0.1 gm. unidentified fish bone and scales; 0.3 gm. small to medium mammal; 0.2 gm. medium vertebrate; 2.1 gms. kukui-nut shell; and 0.5 gm. land snail. Small to medium size charcoal pieces (154.7 gms.) were also collected from within the hearth fill. The presence of coral was noted.

Stratum I (40-65 cmbs.) yielded midden and indigenous artifacts. The midden inventory includes the following: 29.4 gms. *Conus* sp.; 4.0 gms. horn shell (*Cerithium* sp.); 366.1 gms. cowrie (*Cypraea caputserpentis*); 1.9 gms. periwinkle (*Littorina sp.*); 28.7 gms. *pipipi* (*Nerita picea*); 1.2 gms. *kupe'e* (*Nerita polita*); 0.8 gms. *Theodoxus cariosus*; 0.9 gm. spotted stromb (*Strombus maculatus*); 338.0 gms. pearl shell (*Isognomon* sp.); 29.9 gms. unidentified shell; 709.3 gms. sea urchin (Echinoderm); 1.0 gm. Crustacean; one shark tooth; 0.1 gm. triggerfish (Acanthurid); 0.1 gm. spiny puffer (Balistid); 0.8 gm. unidentified fish bone and scales; 0.6 gm. medium bird; 0.1 gm. small lizard; 0.2 gm. house mouse (*Mus musculus*); 0.2 gm. Norway or roof rat (*Rattus norvegicus* or *R. Rattus*); 0.2 gm. Polynesian rat (*Rattus exulans*); 0.2 gm. domesticated dog (*Canis familiaris*); 1.1 gms. domesticated pig or goat or sheep (*Sus scrofa* or *Capra hircus* or *Ovis* sp.); 5.1 gms. pig (*Sus scrofa*); 3.5 gms. small to medium mammal; 0.4 gm. small or medium vertebrate; 0.4 gm. medium vertebrate; and 25.8 gms. kukui-nut shell. Small to large pieces of charcoal (489.8 gms.) were collected from this level. The indigenous artifacts include seven volcanic glass flakes (Acc. #64 and #67); one perforated, polished bone fragment (Acc. #65); and a shell pendant (Acc. #66) with a single drilled hole.

The abundance of cultural deposits and presence of two hearths indicates that Site 18189 (Feature A) was utilized for food preparation and consumption related to permanent habitation of the site.

Interpretation: Based on the abundance of artifacts and midden, associations with other pavement features, and the presence of a constructed hearth (possibly two episodes of hearth construction and use) suggest that the feature is a permanent habitation structure used for food preparation and likely consumption. This site - located adjacent to the *maukalmakai* kerbstone trail (Site 18099) - represents the *makai*-most permanent habitation unit in the project area. Given the lack of historic artifacts present, the site was likely occupied during prehistoric times.

SHPD Site #: 50-10-27-18190 **CSH Site #: 118**
Site Type: Complex
Function: Permanent habitation
Features (#): 7
Dimension: 1,373.5 m.² (14,833.8 ft.²)
Elevation: 315 ft. a.m.s.l.

Description: Site 18190 (Figure 59) comprises seven features - designated A through G - located on a pahoehoe bluff with an a'a flow to the north and a soil expanse to the south. The site is on a moderate southwesterly slope. The area has scattered pockets of soil which support fountain grass and *koa haole*. The complex includes several terraces (Features A, B, C and G), a pavement (Feature D), a lava blister (Feature E) and an alignment (Feature F).

Feature A is an irregularly-shaped two-tiered terrace. It measures 8.4 m. (27.6 ft.) N/S by 4.1 m. (13.5 ft.) E/W with a maximum height of 0.8 m. (2.62 ft.). Facing was observed along the southwest and southeast sides. The east side of the terrace is constructed against a bluff.

The lower tier is roughly rectangular and is constructed of small boulders, 3 to 5 courses high. The lower tier surface is fairly level and is paved with small boulders, cobbles and pebbles.

The upper tier is retained by boulders on its south side, rising 3 courses above the lower tier. The tier is raised slightly on its north side which displays no formal facing. The surface is paved with small boulders, cobbles and pebbles.

Feature B of Site 18190 consists of two narrow terraces located 4.6 m. (15.1 ft.) west of Feature A. The eastern-most terrace measures 2.5 m. (8.2 ft.) N/S by 0.7 m. (2.3 ft.) E/W with a maximum height of 0.35 m. (1.15 ft.). The western-most terrace measures 3.0 m. (9.8 ft.) N/S by 1.1 m. (3.6 ft.) E/W with a maximum height of 0.7 m. (2.3 ft.). Both terraces are constructed of stacked boulders averaging 3 courses high on their west or down-slope sides. Both have fairly level surfaces of boulder and cobble paving. A 1.0 m.² test unit was excavated within the southern portion of Feature A (see Testing Results).

Feature C is a rectangular-shaped terrace located 1.0 m. (3.3 ft.) directly west of Feature B. The terrace measures 4.1 m. (13.5 ft.) N/S by 2.3 m. (7.5 ft.) E/W with a maximum height of 0.65 m. (2.1 ft.). The terrace is raised and faced on its southwest and northwest sides. The remaining sides abut the outcrop slope. The feature is constructed of stacked boulders, 3 courses high. The surface is an uneven paving of boulders and cobbles.

Feature D of Site 18190 is a roughly rectangular pavement on pahoehoe located 16.8 m. (55.1 ft.) northeast of Feature A. It measures 5.3 m. (17.4 ft.) N/S by 2.9 m. (9.5 ft.) E/W with a maximum height of 0.4 m. (1.31 ft.). The surface consists of cobbles with a scattering of small boulders. The feature fills in a depression in the outcrop surface.

Feature E is a lava blister located 4.5 m. (14.8 ft.) east of Feature D. It measures 12.0 m. (39.4 ft.) N/S by 4.5 m. (14.8 ft.) E/W with a maximum ceiling height of 0.8 m. (2.6 ft.). The floor has a layer of soil; scattered cobbles and boulders occur along the wall of the blister.

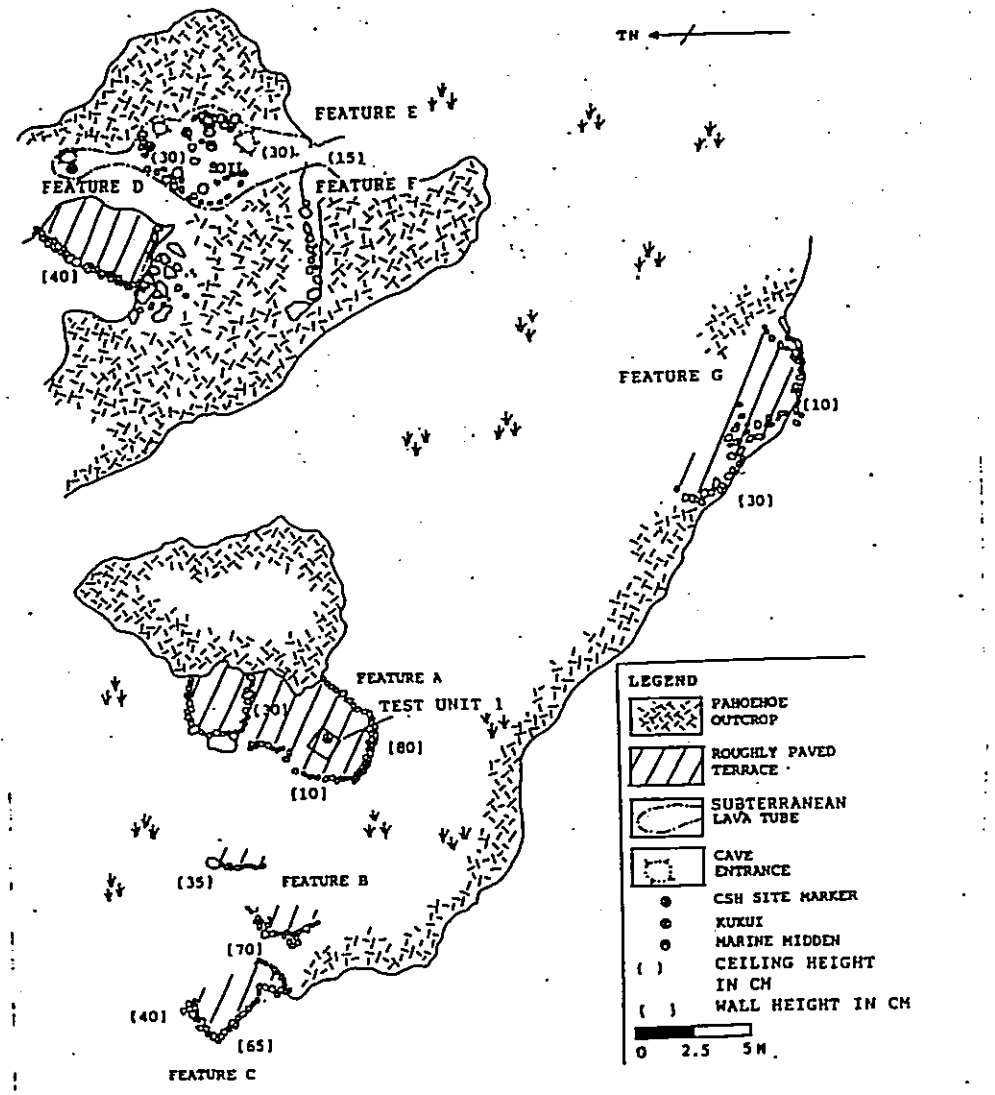


Figure 59 Site 50-10-27-18190 Site Complex, Features A to G; Plan View

Three entrances are located in the north, south and middle portions of the blister. Below the south entrance are two stacked, boulder slabs which serve as stepping stones into the blister.

The main chamber contains scattered to concentrated midden deposits including *kukui*, cowrie, sea urchin, and mollusks. In addition, one pencil urchin spine and one waterworn stone were observed near the south entrance. Two artifacts were collected: a rounded coral abrader (Acc. #68) and a bone needle (Acc. #69). A cleared soil area is present in the center of the chamber which may represent a hearth.

Feature F of Site 18190 is an alignment of boulder slabs and large cobbles with an adjacent concentration of pebbles located 3.2 m. (10.5 ft.) to the southwest of Feature E. It measures 5.5 m. (18.0 ft.) E/W by 0.7 m. (2.3 ft.) N/S. The alignment and nearby outcrop enclose a small soil area.

Other modifications to the outcrop occur in this area. These modifications are probably the result of clearing adjacent soil areas.

Feature G is a roughly-constructed terrace located 19.0 m. (62.3 ft.) south of Feature F. It measures 11.0 m. (36.1 ft.) E/W by 2.5 m. (8.2 ft.) N/S with a maximum height of 0.3 m. (0.98 ft.). The terrace is constructed of cobbles and boulders with no clear facing observed.

With the exception of Feature E, no midden or artifacts were observed.
Site 18190 is in fair condition and there may be a cultural deposit.

Testing Results

Limited testing (Figure 60) was conducted at Feature A of Site 18190 to determine the site's function and to collect charcoal samples for radiocarbon analysis. The test unit - a 1.0 m. by 1.0 m. (3.3 ft. by 3.3 ft.) unit - was placed at the center of Feature A terrace's southwest end.

The excavation extended through the terrace fill and underlying soil layer (Stratum I); the excavation was terminated upon reaching bedrock at a maximum depth of 70 cm. below surface. Stratum I - 30 cm. thick - consisted of a silt loam intermixed with cobbles and small boulders.

A scant amount of midden was recovered from the upper layer of the terrace (0-40 cm. below surface), including the following: 32.3 gms. cowrie (*Cypraea caputserpentis*); 0.3 gm. spotted stromb (*Strombus maculatus*); 1.8 gms. pearl shell (*Isognomon* sp.); 1.0 gm. sea urchin (Echinoderm); 0.6 gm. medium bird; and 26.5 gms. kukui-nut shell.

An increased amount of midden was recovered from the lower layer of the terrace (40-70 cm. below surface) including: 49.1 gms. two species of cowrie (*Cypraea caputserpentis* and *Cypraea maculifera*);0.7 gm. *Thaididae* sp.; 3.8 gms. pearl shell (*Isognomon* sp.); 2.8 gms. unidentified shell; 6.2 gms. sea urchin; and 21.6 gms. kukui-nut shell.

The limited testing at Site 18190 minimally indicates that food, primarily marine in origin, was consumed at Feature A.

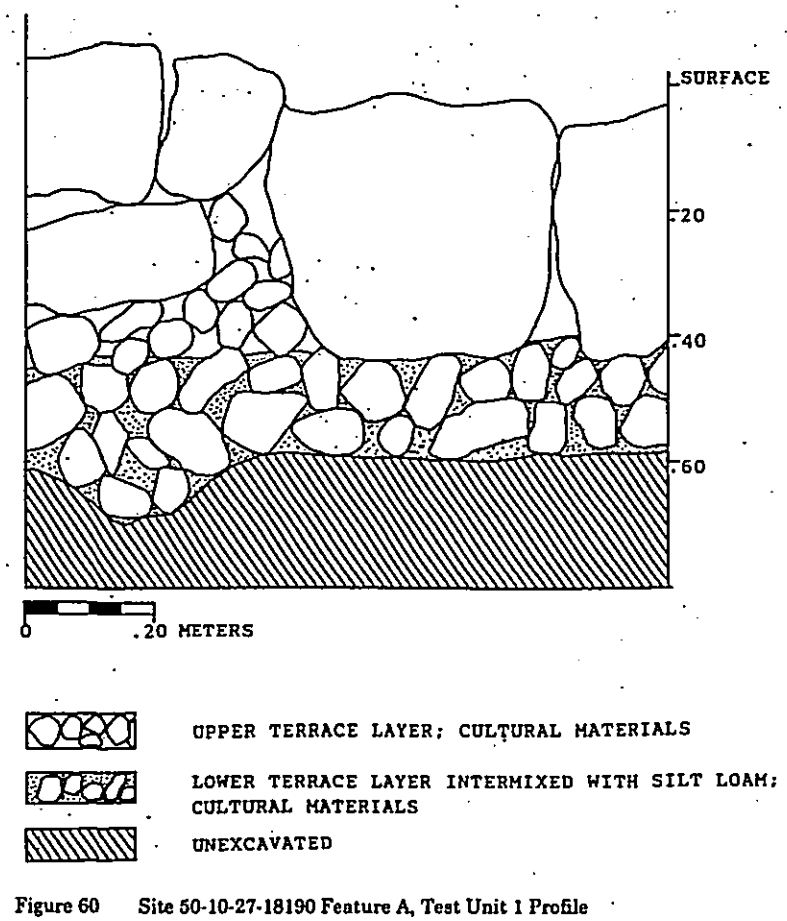


Figure 60 Site 50-10-27-18190 Feature A, Test Unit 1 Profile

Interpretation: Although a comparatively moderate amount of midden was recovered from the excavation (the gram weight represents large shell fragments of few individuals), the feature's association with other complex component features and its architectural characteristics (size, spatial layout and construction) suggests that the site, overall, is a permanent habitation complex.

SHPD Site #: 50-10-28-18192 **CSH Site #: 120**
Site Type: C-shaped enclosure
Function: Temporary habitation
Features (#): 1
Dimension: 8.6 m.^{2} (93.3 ft.^{2})
Elevation: 69 ft. a.m.s.l.

Description: Site 18192 (Figure 61) is a C-shaped enclosure located on uneven pahoehoe with small soil pockets which support fountain grass, *koa haole* and *kiawe*. Low ridges cut across the slope which descends moderately to the southwest.

The enclosure is roughly defined by piled cobbles and small boulders, one course high. It measures 3.2 m. (10.5 ft.) N/S by 2.7 m. (8.9 ft.) E/W with a maximum wall height of 0.4 m. (1.31 ft.). No facing was observed. The opening to the enclosure is located on the southwest (*makai*) side.

The site may have functioned as a temporary habitation - perhaps associated with *mauka/makai* travel - as it is located relatively close to the west end of Site 18099 trail.

No artifacts or midden were observed.

Site 18192 is in poor condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18193 **CSH Site #: 121**
Site Type: Modified outcrop
Function: undetermined
Features (#): 1
Dimension: 13.4 m.^{2} (144.7 ft.^{2})
Elevation: 165 ft. a.m.s.l.

Description: Site 18193 (Figure 62) is a modified outcrop located on a flat section of pahoehoe outcrop which slopes gently *makai*. The area has scattered pockets of soil which supports grass
and *koa haole*.

Modification consists of a pavement with some raised edges constructed of boulders and cobbles. The site is situated within a small sink (collapsed lava tube). The pavement measures 2.8 m. (9.2 ft.) N/S by 4.0 m. (13.2 ft.) E/W with a maximum height of 0.4 m. (1.31 ft.). A north/south-oriented alignment of three upright slabs bisects the pavement. A slight depression lies adjacent to the west side of the alignment; a test trench was placed within the depression (see **Testing Results** below).

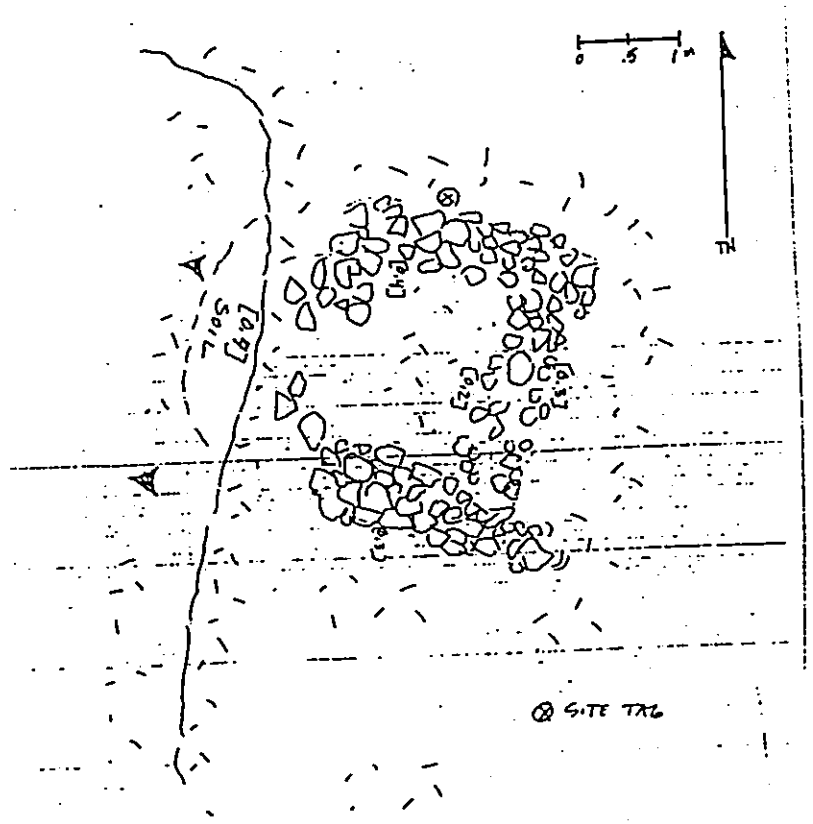


Figure 61 Site 50-10-28-18192, Plan View

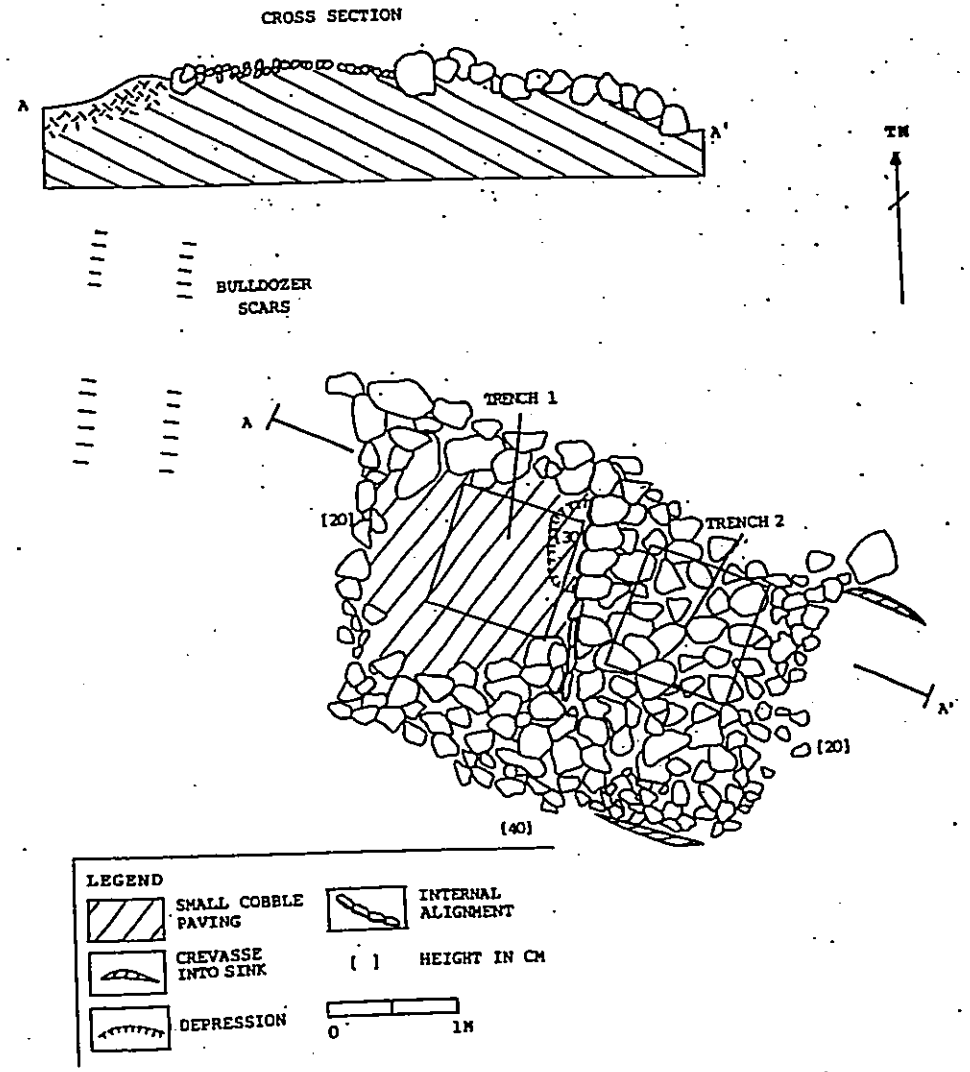


Figure 62 Site 50-10-27-18193, Plan View

The surface of the pavement is uneven; the west half is paved with cobbles. Along the east edge of the pavement the outline of the sink is clearly visible. A second test unit was placed in the east portion of the pavement (see **Testing Results** below).

No midden or artifacts were observed.

State site 18193 is in poor condition and - based on the testing results described below - no cultural deposit is likely to be present.

Testing Results

Limited testing was conducted at Site 18193 to ascertain the presence or absence of a human burial. Two 1.0 by 1.0 m. (3.3 by 3.3 ft.) test units - Test unit 1 and Test unit 2 - were placed in the center of the pavement roughly 0.5 m. (1.6 ft.) apart.

Test unit 1 was excavated to bedrock at a maximum depth of 40 cm. below surface (Figure 63). No stratigraphic layers were present between the pavement fill and the underlying bedrock. Test unit 2 was excavated to bedrock at a maximum depth of 75 cm. below surface (Figure 64). Sea urchin parts were present on the surface of Test unit 2. At 55 cm. below surface, a small lava tube entrance was encountered. The entrance measured 20 cm. in height and was not accessible. Access into the lava tube was gained through a second entrance 6.0 m. (19.7 ft.) northwest of the test unit. No cultural remains were observed within the lava tube or recovered from the excavations.

Interpretation: Other than the determination that no burial is present at the site, the excavation data provided little assistance in determining the actual function of the site. Functional interpretation is indeterminate.

CSH Site #: 122

SHPD Site #: 50-10-28-18194
Site Type: Complex
Function: Agriculture
Features (#): 3
Dimension: 327.0 m.^{2} (3,531.6 ft.^{2})
Elevation: 115 ft. a.m.s.l.

Description: Site 18194 (Figure 65) is a complex consisting of three features - designated A to C - located on a prominent bluff comprising a transitional mixture of a'a and pahoehoe. The terrain slopes gently *makai*. Scattered pockets of soil support fountain grass and *koa haole*.

Feature A is a modified outcrop; Features B and C are enclosures.

Feature A modified outcrop is defined by a filled crevice located atop a pahoehoe bluff or dome. As indicated by the dome formation, the crevice likely leads into an underlying lava tube. The crevice is filled in with cobbles; its perimeter measures 2.0 m. (6.6 ft.) N/S by 1.0 m. (3.3 ft.) E/W. The fill surface lies 1.5 m. (4.9 ft.) below the bluff surface. A rough alignment of small boulders and cobbles is present along the western edge of the crevice on the bluff surface. This feature is a possible habitation feature.

Feature B of Site 18194 is a C-shaped enclosure located 2.7 m. (8.9 ft.) south of Feature A. The open side of the C-shape is constructed against the vertical face of the

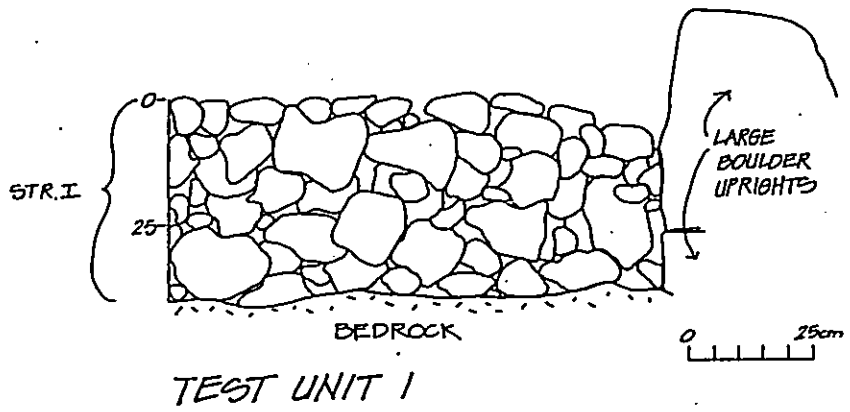


Figure 63 Site 50-10-27-18193 Feature A, Test Unit 1 Profile

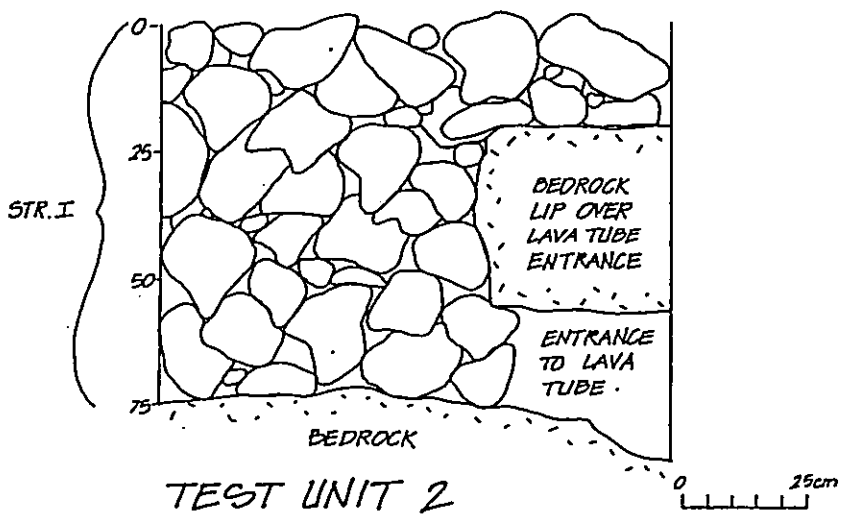


Figure 64 Site 50-10-27-18193 Feature A, Test Unit 2 Profile

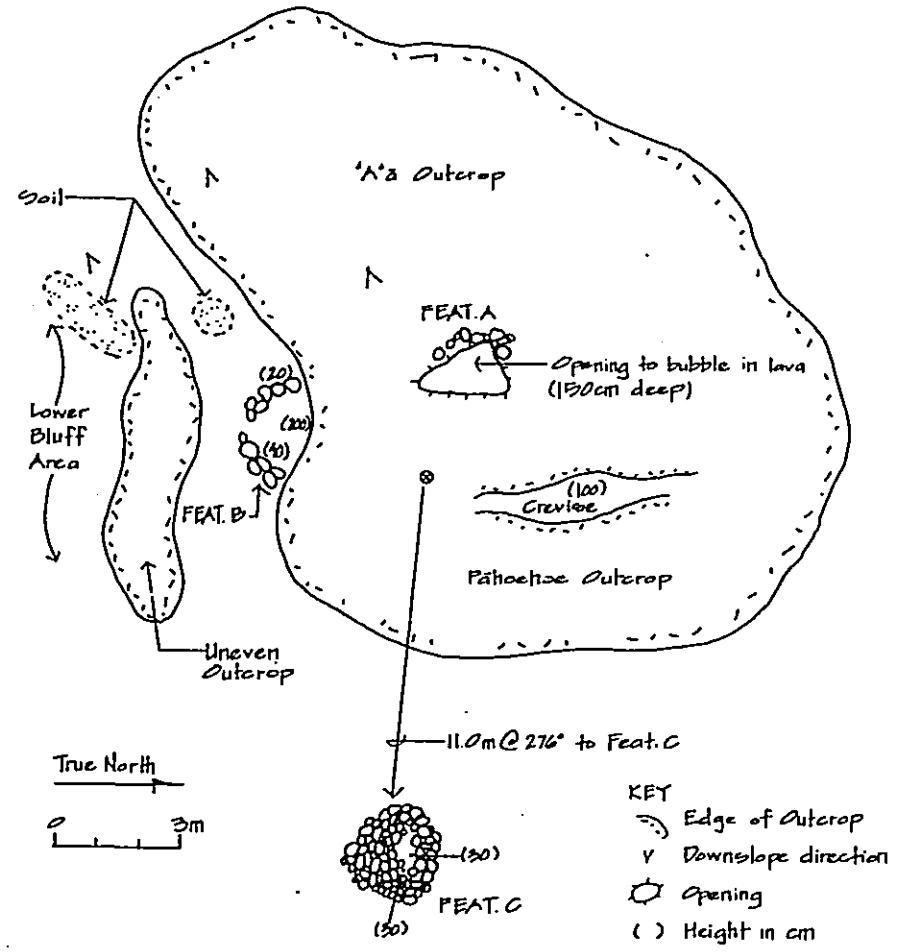


Figure 65 Site 50-10-27-18194, Plan view

outcrop bluff. The enclosed area measures 1.5 m. (4.9 ft.) N/S by 1.0 m. (3.3 ft.) E/W with a maximum wall height of 0.5 m. (1.64 ft.). The walls are constructed of cobbles and small boulders. The interior of the east wall is faced and stands 1 to 2 courses high. Feature B is likely an agricultural feature.

Feature C is a roughly square-shaped enclosure located 13.2 m. (43.3 ft.) east of Feature A. The enclosure measures 2.8 m. (9.2 ft.) N/S by 2.3 m. (7.5 ft.) E/W with a maximum wall height of 0.3 m. (0.98 ft.). The walls are constructed of boulder and cobbles slabs. The interior of the north wall is faced. The interior surface of the enclosure contains a loose loam over outcrop and scattered collapse. Feature C is likely an agricultural feature.

No artifacts or midden were observed.

Site 18194 is in fair condition and a cultural deposit may be present.

SHPD Site #: 50-10-28-18195 **CSH Site #:** 123
Site Type: Terrace
Function: Recurrent habitation
Features (#): -
Dimension: 6.3 m.² (68.0 ft.²)
Elevation: 108 ft. a.m.s.l.

Description: Site 18195 (Figure 67) is a terrace located on uneven pahoehoe with small soil pockets supporting a sparse growth of *koa haole*, fountain grass and *kiawe*. The terrain slopes gently *makai*.

The terrace surface is level and consists of pebbles and small cobbles. Boulder alignments demarcate the east and west sides of the terrace. The east side is one course high with a maximum height of 0.3 m. (1.0 ft.), while its west side is set flush to the outcrop surface.

No artifacts or midden were observed.

Site 18195 is in fair condition and no cultural deposit is believed to be present.

SHPD Site #: 50-10-27-18197 **CSH Site #:** 125
Site Type: Lava tube
Function: Burials
Features (#): 2
Dimension: 251.1 m.² (2,711.9 ft.²)
Elevation: 200 ft. a.m.s.l.

Description: Site 18197 (Figure 68) is a small lava tube with two chambers - designated A and B - located on an undulating pahoehoe flow near an a'a flow ridge. Scattered pockets of soil support grass and *koa haole*. The terrain slopes gently *makai*.

The lava tube contains three distinct burials. One burial is located in Chamber A and the remaining two are in Chamber B. The lava tube entrance at the surface measures 1.0 m. (3.3 ft.) in diameter; the light zone of the lava tube is well-lit, measuring 1.5 m. (4.9 ft.) in diameter with a ceiling height of 0.8 m. (2.62 ft.).

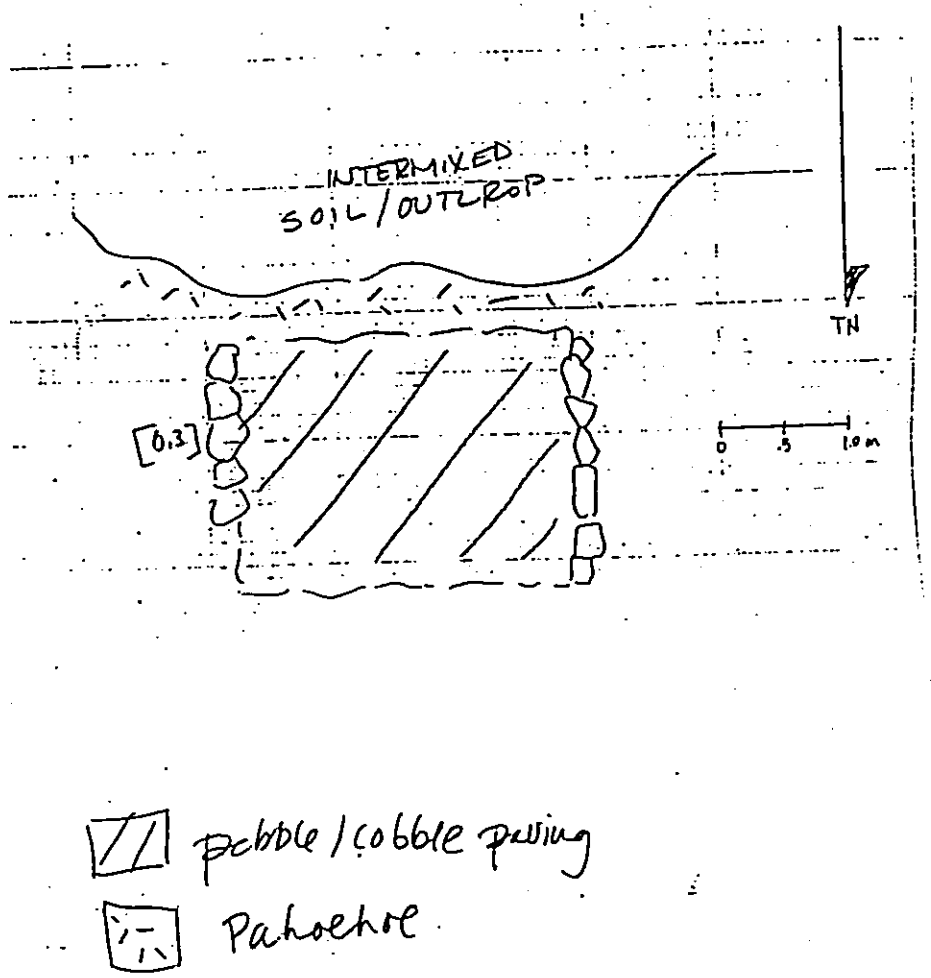


Figure 67 Site 50-10-28-18195, Plan View

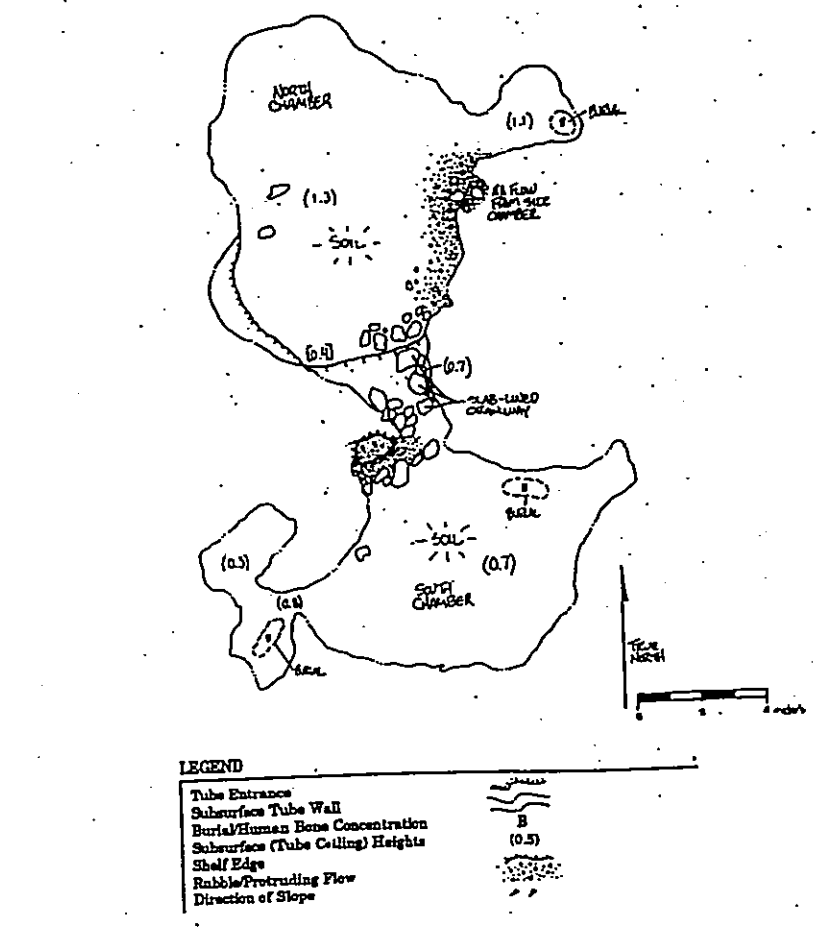


Figure 68 Site 50-10-27-18197 Lava Tube; Plan View

Chamber A extends northwest from the entrance. This chamber is a large oblong area measuring 11.0 m. (36.1 ft.) E/W by 8.0 m. (26.2 ft.) N/S with an average ceiling height of 0.8 m. (2.6 ft.). The entrance to Chamber A is partially blocked off near the surface entrance and the floor appears to be lined with pahoehoe slabs - these may be misplaced uprights which previously blocked the entrance. Soil observed in shallow pockets has probably collected as a result of wash.

The burial is located in a small alcove on the north side of the chamber. The alcove measures 2.5 m. (8.2 ft.) in diameter and has a ceiling height of 1.1 m. (3.6 ft.). Most of the bones have decayed but those intact are diagnostically human.

Chamber B is similar in size and shape to Chamber A. Chamber B contains two burials. The blocked entrance to Chamber B lies to the northeast in the lava tube entrance. Removal of one large pahoehoe boulder allows access into the chamber. Chamber B measures 10.0 m. (32.8 ft.) N/S by 7.0 m. (23.0 ft.) E/W with a maximum ceiling height of 0.9 m. (2.95 ft.).

The first burial lies 2.5 m. (8.2 ft.) north of the chamber entrance. Among the bones identified were one humerus, two ulnae, a pelvis fragment, one scapula and a portion of a cranium.

The second burial is located 7.3 m. (24.0 ft.) southeast of the chamber entrance in a small alcove. The alcove measures 4.0 m. (13.1 ft.) E/W by 2.0 m. (6.6 ft.) N/S with a ceiling height of 0.8 m. (2.62 ft.). Long bones as well as a mandible with a single molar and non-diagnostic fragments were observed.

No artifacts or midden were observed.

Site 18197 is in fair condition.

SHPD Site #: 50-10-28-18356 **CSH Site #: 51, 153, 301**
Site Type: Wall sections
Function: *ahupua'a* boundary
Features (#): 1
Dimension: 2,570.0 m. (8,430.0 ft.) overall extent
Elevation: 260-950 ft. a.m.s.l.

Description: Site 18356 is a segmented wall extending along the boundary between Honokohau I and II *ahupua'a* in an east/west direction. The overall distance between the extreme ends of the wall measures 2570.0 m. (8430.0 ft.). Three primary wall sections (designated CSH site 51, 153 and 301) were recorded during the survey. Each of these sections are bifaced boulder walls measuring an average 0.8 m. (2.6 ft.) wide and 1.0 to 1.3 m. (3.3 to 4.3 ft.) high.

No midden or artifacts were observed.

Site 18356 is in fair to poor condition and no cultural deposit is believed to be present.

VI. SITE SUMMARY AND INTERPRETATION

Introduction

During the inventory survey, a total of 73 structural and non-structural (lava tube, blisters and rock shelters) sites were identified within the project area.

Formal Site Types

Formal site or feature type designations are based on certain physical characteristics and commonly refer to structural elements of a site. These characteristics are defined below. Sixteen primary site types were identified within the project area. Table 2 tallies the occurrences of each of these formal features/site types in the project area.

Definitions:

Ahu: A cairn of stacked or piled stones].

Alignment: A single row of stones one course high.

Complexes: Two or more associated features combined into a single site.

Enclosure: A walled structure which completely encloses an area. Enclosures are further categorized by their configurations which are referred to as: *rectangular*, *circular*, or *irregularly-shaped*.

Lava Blister: A small subterranean lava formation. Unlike lava tubes, however, they tend to be circular and do not extend in any direction for a great length.

Lava Tube: Modifications or apparent usage of a subterranean lava formation characteristic of pahoehoe lava flows.

Modified Outcrop/bluff: Natural outcrop altered by the placement or removal of stones.

Modified Sink: A natural depression in the terrain which has been humanly altered.

Mound: Linear, circular or amorphous stone pile which typically lacks a vertical face and level surface.

Pahoehoe Basins: Small circular depression pecked into a pahoehoe outcrop surface.

Pahoehoe Excavations: Shallow excavations usually not more than 4 m. in diameter within pahoehoe surface.

Pavement: A stone-filled floor or surface.

Petroglyphs: Images or configurations carved or pecked on a rock surface.

Platform: A raised free-standing stone structure with three or more vertical faces; it also refers to circular structures with vertical facing.

Refuge Cave: A cave modified to conceal underlying lava tube within, distinguished by defensive camouflage; also typically contains water collection source, food remains and paved living areas.

Rock Shelter: Varying degrees of construction which modifies a rock shelter (or outcrop overhang). This structure is distinguished by an apparent primary focus on the enhancement of natural features.

Sink: A collapsed section of a lava tube.

Terrace: A raised stone construction partially built against, or level to, a ground or outcrop surface. These structures commonly resemble platforms. Unlike platforms, however, they are not totally free-standing.

Trails: A trodden lava surface, pavement, or stone alignment set into the ground or outcrop surface. A stepping stone trail is a single-file foot trail that follows the configuration of the shoreline and extends between the coast and upland localities; a kerbstone trail is a modified single-file foot trail with a perimeter of stone curbing - kerbstone - and an extended width for use as a horse trail.

Wall: A bifaced and free-standing stone structure which is an isolated segment or defines large boundaries (such as land tracts or cattle barriers).

Table 2 - Occurrences of Formal Site Types at Kaloko Honokōhau Business Park

Site Types	(#)	Site numbers and Habitation type: (temporary (T), Permanent (P), recurrent (R); burials or possible burials present*
trail(s)	(5)	02, 18099, 18103. 18122, 18133,
Walls & wall segments	(6)	13031, 18080, 18087, 18105, 18186, 18356
Petroglyphs	(2)	18081, 18091
Outcrops	(7)	18083 (T), 18089, 18108, 18130, 18140, 18142, 18193,
Rock shelters	(2)	18084 (T), 18128 (T),

Site Types	(#)	Site numbers and Habitation type: (temporary (T), Permanent (P), recurrent (R); burials or possible burials present*
Lava tubes	(14)	18085 (T), 18088* (T), 18094 (T), 18102 (T), 18117*, 18124 (T), 18125 (T), 18131 (R), 18132 (T), 18134* (T / refuge), 18138 (R), 18187 (T), 18188 (P), 18197*
pecked basin, pahoehoe excavation	(2)	18086, 18097
Complexes can contain numerous elements - terraces, enclosures, platforms, trails, etc.	(14)	18090 (T), 18092 (R), 18098 (P), 18111 (T/ag), 18112 (P), 18116* (P), 18118 (Ag), 18121 (R), 18127 (R), 18136 (Ag), 18137 (P), 18190 (P), 18189 (P), 18194 (Ag)
ahu	(4)	18093, 18096, 18100, 18114,
mound	(2)	18095, 18135
Enclosure, enclosure remnants	(9)	18101 (T), 18104, 18107, 18109, 18110, 18119, 18126 (P), 18143 (T), 18192 (T),
platform	(2)	18106 (undetermined), 18113,
Lava blister	(1)	18120 (R)
sink	(1)	18123
pavement	(1)	18139 (T)
terrace	(1)	18195 (R)

The predominance of enclosures, terraces, modified surface and underground features in this Honokōhau project attests to the thrift and conservation of energy and natural materials of the planners and builders in this area, to use the natural landscape features for their gardens, orchards and housing, both in pre-history and among early historic ranchers and farmers.

Functional Categories and Land Use

The function of a site is determined by criteria which include: site construction and complexity; locational context (association with other sites or geographical determinants); analysis of cultural remains (surface and subsurface); building material; and external correlations with other archaeological sites in Hawai`i.

Ten primary functional categories were identified among the sites within the present project area. Many sites combine more than one of these functions Table 3 tallies

the frequencies of these functions, including those with multi-function components.

Table 3 - Occurrences of Functional Categories by Archaeological Site at Kaloko Honokōhau Business Park (multiple function before single function)

Site Function	Site Number(s)	% of 73
Habitation, temporary/burial	18088, 18117	3%
Habitation, temporary/agriculture	18111	1%
Habitation permanent, burial/symbolic	18116	1%
Permanent Habitation/ trail/ marker	18112	1%
Refuge/ Permanent Habitation/burials	18134	1%
Ag./work area/ storage	18113, 18136	3%
Ag./ animal pen	18104	1%
Agricultural	18089, 18095, 18106, 18108, 18109, 18110, 18118, 18123, 18130, 18140, 18142, 18194	16%
Ahupua`a boundary	18356	1%
Animal pen	18105, 18107	3%
Burial(s)	18197	1%
Habitation, Permanent	18098, 18126, 18137, 18188, 18189, 18190	8%
Habitation, Recurrent	18092, 18119, 18120, 18121, 18127, 18131, 18138, 18195	11%
Habitation, Temporary	18083, 18084, 18085, 18090, 18094, 18101, 18102, 18124, 18125, 18128, 18132, 18139, 18143, 18187, 18192	20%
Marker	18093, 18096, 18100, 18114, 18135(?)	7%
Mining	18097	1%
Symbolic	18081, 18091	3%
Trail	02, 18099, 18103, 18122, 18133, 18186	8%
Undetermined	13031, 18080, 18086, 18087, 18103, 18106, 18193	10%

Of the 73 recorded sites there are nine with multiple functions categories and 64 listed under a single functional interpretation. The most common functional type is temporary habitation and mixed temporary habitation (i.e. Temporary Habitation/burial, temporary habitation/agriculture.) Agricultural sites were the next most prevalent site type followed by other habitation site types — recurrent and permanent. Five sites — 18088, 18116, 18117, 18134 and 18197 contained burials.

Seven remnant structure sites which are so poorly preserved or have no clear associations that we have classified them as of "undetermined" function. This category includes 4 walls or wall remnants; 1 platform, 1 pecked pahoehoe basin and a modified outcrop. These sites are isolated and assigning function to any of these sites would be inappropriate.

Agriculture

Sweet potato was likely the most abundantly grown crop in the project area because of the plant's adaptability to stony and dry environments. It was commonly planted in mounds. Henry J. Lyman, the son of missionary couple who first arrived in Hilo in 1831, describes features in Puna similar to pahoehoe excavations which were cultivated with sweet potatoes:

> Wherever the lava could be pounded into scoria, a plantation of sweet potatoes was laboriously formed by digging among the stones and filling the holes with dried grass brought from the mountainside. Placed in the nests, the tuberous buds were covered with gravel, and there grew with astonishing luxuriance, yielding the largest and finest potatoes on the island. (in Frierson 1991:167)

During the mid 1800's, Captain Charles Wilkes of the American Exploring Team comments on the agricultural use of pahoehoe excavations which he observed specifically in the Kona region:

> Cultivation is carried on in many places where it would be deemed almost impractible in any other country...The natives, during the rainy season, also plant, in excavations among the lava rocks, sweet potatoes, melons, and pine-apples, all of which produce a crop. (Wilkes 1845:91)

The agricultural sites and features that occur between the 40 to 320 ft. a.m.s.l. are characterized by minimal constructions, including mounds, modified outcrops and possibly, pahoehoe excavations. (The functional interpretation of pahoehoe excavations in the project area is debatable; and some of these features are discussed further in the Mining summary of this report). The scattered nature and rough constructions (indicating little energy expended) suggests that intensive agricultural activity was not practiced below approximately 500 ft. a.m.s.l. in the *ahupua`a*. These agricultural features represent marginal agricultural activity associated with the few permanent residences in the area or with permanent habitation at the coast.

Habitations

Thirty-four (34) sites (46.5% of the total 73 sites) in the project area are interpreted as having a habitation function with most of these also containing non-habitation component features, such as: burials, agriculture, markers, trails and petroglyphs. Three modes of habitation - permanent, temporary and recurrent - are suggested to be represented in the project area. Distinction among the three modes is made based on the set of criteria for sites in the Kona area developed by Cultural Surveys Hawaii's criteria for sites in the Kona area (for greater detail see Robins et al. 2000): 1) size; 2) substantiveness of sites/features; 3) architectural types; 4) Internal features/Multiple features; 5) Other Functional Associations; 6) Geographic location; 7) Topographic setting and 8) Cultural Material.

Using the criteria developed previously by CSH and used in the 803-acre inventory survey (see Robins et al. 2000) 9 of the sites in the present project area were interpreted as permanent habitations (representing 23% of the total 34), two are single-feature sites (18126, 18188); and seven are multiple-feature sites (complexes) which contain between 2 and 15 component features. These sites and complexes include 23 structural or natural features (representing 67% of the total 34 habitation features). Two lava tube were interpreted to have, at some point in time, served as permanent habitations (sites 18134 and 18188).

Caves Used for Habitation

There are varying opinions on the matter of whether caves were or were not permanently occupied. While we think it is possible that some of our lava tube caves were permanently inhabited since they fit Kirch's criteria for permanent habitation caves (Kirch 1985:251), it seems that in general, the opinion held by many archaeologists is that caves were only temporarily inhabited, although sometimes over long period of times (Cordy, 1991: 533). We note that these lava tube caves are associated with other permanent habitation sites on the surface and they show numerous internal modifications. The internal features (terraces, pavements and platforms) are well constructed and have petroglyphs and *papamū* which are commonly associated with permanent habitations.

In addition, the spacious size, light availability, and degree of modification in some of the lava tubes would surely have provided a comfortable and protected environment for occupation seasonally, periodically, or perhaps in association with certain activities. We believe some of these Honokōhau lava tube caves were used intensively, even if not as permanent habitations.

Refuge/Habitation

One lava tube site (Site 50-10-27-18134) in the 300-acre project area is an exceptional example of a refuge cave, comparable to numerous other well-known refuge caves in the Kona District (*i.e.*, Ching 1971; Schilt 1984; and Hammatt *et al.* 1995). Entrances to known refuge caves are characteristically modified to conceal the presence of

the underlying lava tube (Figure 33); then they also might have blinds within the tube to hide behind and walls at different location along the tube designed to prevent easy access beyond. The primary habitation area of Site 18134, evidenced by extensive internal modification and presence of cultural deposits, is focused far within the lava tube allowing ample space and time for defensive action if the cave was entered.

Oral traditions and archaeological data indicate that refuge was commonly sought in late prehistory during intense civil strife and battles between district chiefs of Hawaii and between Hawaii and Maui chiefs. Rose Schilt classifies this period as the Refuge Phase of which she proposes - based on the oral traditions and archaeological data - occurred between A.D. 1600 to the Late Prehistoric and Early Historic times (Schilt 1984:117). The refuge period is believed to have terminated around 1791 when political rivalry between district chiefs was dissolved under Kamehameha's reign over Hawai'i Island.

Three distinct phases of use occur at Site 18134 refuge cave. These phases include an (1) initial habitation period of limited use (temporary shelter) followed by (2) an intensive use for permanent and refuge habitation. Following abandonment (3) the fortified cave was used for burial placement, during the prehistoric or early historic era. Prehistoric burials (evidenced by differential preservation and no coffin remains) occur in the Site 18134 lava tube, suggesting that the lava tube had been abandoned prior to western contact or soon after.

Several of the other lava tubes in the project area also have varying degrees of modifications of their entrances. These sites are not considered to be refuge habitations, as they are not obscured on the surface and the internal modifications do not seem to be constructed for defense purposes.

VII. AGE DETERMINATIONS

Radiocarbon Dating

Fifty-nine charcoal samples (totaling 3191.1 grams) of charcoal were recovered from 22 sites in the 800-acre project area. Five of the samples were submitted to Beta-Analytic Inc. of Coral Gables, Florida, for radiocarbon analysis.

All five radiocarbon dated samples came from caves; one of which was in the present project area. The sample, C-07, Beta 55204, in this project area was taken from a surface context from a lava tube Site 18134.

The C^{13} adjusted ages of the submitted samples (established by Beta Analytic Inc.) were calibrated according to the Calib (version 3.0) computer program (Stuiver and Reimer 1993).Three of the 800-acre Honokōhau Project charcoal samples provided multiple date ranges and the remaining two samples yielded dates that extend from prehistory into modern times. In consideration that only indigenous cultural materials were found in association with all of the dated charcoal samples, the earlier date ranges during prehistoric times are the more likely time periods attributable to the sites or cultural layers associated with the charcoal samples. Sample C-07 from Cave site 18134 yielded a range of A.D. 1665 to 1955.

Relative Dating

A distinction between historic and prehistoric archaeological sites is devised in the present study on the basis of site architecture, state of preservation, presence of historic or prehistoric (indigenous) cultural materials and in some cases presumed function (*i.e.*, ranching and Japanese homesteads).

Of the 282 sites and complexes in the 800-acre project area, 73 are in the 300-acre Kaloko-Honokōhau, of these 73 sites and complexes eight are classified as prehistoric/historic (and of these five are trails); 3 are considered only historic (a petroglyph, pahoehoe excavations and an animal pen. The rest (62) are all considered to be prehistoric.

Prehistoric ages are generally assigned to sites or complexes which have traditional Hawaiian architectural characteristics (e.g., multiple structures, internal features [cupboards, uprights, stone-lined hearths] and, mound constructions) associations with other prehistoric sites and complexes, presence of indigenous cultural materials and absence of historic materials, similar state of preservation (used comparatively to sites

Table 5 - Radiocarbon Dating Analysis

CSH Acc. No.	BETA No.	Site/ Context	C^{14} Age B.P.	C^{13}/C^{12}	Adjusted C^{13} Age	Calibrated Age* (2 sigma)
C-01	55205	13012 cave/surface	80+/- 50	-22.8	120 +/- 50	*A.D. 1685-1739 A.D. 1809-1929 A.D. 1954-1955
C-07	55204	*18134 cave/surface	100.6 +/- 0.7% mod.	-19.0	50 +/- 50	A.D. 1665-1955
C-14	55206	18185 cave/TU 2; Str. I; Lev. 20-30	100 +/-0.6% mod.	-22.2	40 +/- 50	*A.D. 1688-1733 A.D. 1812-1926 A.D. 1954-1955
C-27	55207	18225 Fea. M/TU 1; Str. I; Lev. 10-20	100 +/-0.7% mod.	-15.8	150+/- 50	A.D. 1656-1955
C-29	55208	18265 cave/TU 1; hearth fill; Lev. 0-7	100.5 +/- 0.7% mod.	-18.4	70 +/- 50	*A.D. 1680-1754 A.D. 1803-1937 A.D. 1954-1955

* Preferred dates based on archaeological context
** Stuiver and Reimer 1993
* site 18134 is within the 300-acre Kaloko Honokōhau Business Park project area

It is plausible that some or many of the prehistoric sites in the project area were used continuously into early historic times, but a lack of observable historic cultural materials does not support use in historic times.

VIII. SUMMARY

A. Historical Background of the Project Area

The present project area is situated within the *ahupua'a* of Honokōhau I and II, and like other areas in Kona has gone through a number of different phases of occupation and land use. Archaeological and historical research has defined three main zones of land use, coastal, intermediate and upland. Prehistorically, settlement was focused mainly within the coastal zone, especially around the ponds at Kaloko and Honokōhau. The present project area is within the Intermediate Zone. The majority of sites appear to have been utilized for temporary habitation and small agricultural plots with a trail system between the coast and the uplands traversing the project area.

During the early historic period Honokōhau would have had a substantial population situated along the coast with agricultural practices continuing in the upland areas, however by the mid-1800's the inhabitants of both Honokōhau had migrated from the coastal zone toward and along the Mamalahoa Highway corridor. The Land Commission Awards (LCAs) Testimony and Register information reflects this migration toward the Māmalahoa Highway corridor and upland agricultural zone. During the Māhele (1847-1853), the two *ahupua'a* were given to two members of the reigning *ali'i*. Honokōhau I - comprising 2653 acres - was awarded (LCA 11216) to Mikahela Kekauonohi, great-granddaughter of Kekaulike (ruler of Maui); Honokōhau II - 480 acres - was awarded (LCA 9971) to William Pitt Leleiohoku, husband of Nahienaena (daughter of Kamehameha) and, later, of Princess Ruth Ke'elikōlani.

None of the eleven subsequent *kuleana* awards (1850s) within the two *ahupua'a* are within the project area. These *kuleana* awards are located between 800 and 1680 ft. a.m.s.l. thus all outside the present project area. However within the project aren are numerous *mauka/makai* trails which would have permitted upland residents to access the ocean, the early church and the fish ponds at the coast.

At the end of the 19th century the economy of the area had shifted from a subsistence-based economy to a market-based and export economy. This accounted for the shift of families from the coastal region to the upland area along the new highway corridor. The decline in population was also a reflection of the numerous epidemics that were sweeping through the native populations at this time. The decline continued into the early 20th century, when the project area was completely abandoned for habitation type land use.

In conjunction with the decline of the population in Honokōhau there was an increase in cattle ranching in the later half of the 1800s and extending to the mid-1900s. The majority of the project area is rough 'a'a and pahoehoe terrain with little soil development, and was thus not prime pasture land, though part of large grazing areas. The project area contains numerous pasture walls that are from this ranching era.

The Honokōhau Quarry started in the 1960s, has modified roughly 1/3 of the 300-acre project area, clearing away any pre-existing archaeological sites. Quarry operations have included grubbing, grading, excavation and construction of associated infrastructure

(*e.g.* roads and buildings). The quarry clearing has had an impact on site distribution in the project area.

B. Distribution

Of the 73 recorded sites in the project area 50 (68%) are located between the 40 and 175 ft. a.m.s.l. in several concentrations; few sites were identified between 175 and 225 ft. a.m.s.l, which is a steady rise to the next plateau. Between 225 and 320 a.m.s.l. are the remaining 23 (32%) sites, which are more dispersed than the sites *mauka* of this zone.

Site distribution in this intermediate zone is predicated mostly by the topography and lava type of the landscape and the functional site types generally reflect their proximity to acquirable subsistence resources. The sites within the project area are distributed among two of the three areas characterized by slightly differing natural landscapes: (1) The area rising steadily from 40 to 175 ft. elevation with lava tubes and *kipuka* in pahoehoe lava surrounded by the dominant a`a flow; 2) No sites are found on the steeply rising hillside between the 175 and 225 a.m.s.l. though this central band of steeply rising slope across (N/S) the project area would have at one time contained one or more trails; 3) the most *mauka* area (*i.e.* 225-320 ft. a.m.s.l.) still within this intermediate zone, a more gently sloping plateau area with sinks, lava tubes and rock shelters widely dispersed. The upper (*mauka* or east) project boundary is at approximately the 320 ft. a.m.s.l., and archaeologically, is an arbitrary limit to the sites in this area. Beyond the upper boundary the same kinds of sites exist, with a predominance of temporary habitation components and agriculture. This general pattern continues up to the 900 a.m.s.l where sites become more dense with more permanent habitation and agricultural sites and features begin to dominate the landscape. The largest gap in site distribution is within the northern 1/3 of the project area which, as mentioned earlier, is due to the modern Honokohau Quarry operations.

C. Function

The function among the 73 sites include 18 (25%) sites with temporary habitation components; 14 (19%) sites have agricultural components; 10 sites (14%) have permanent habitation components; and 8 (11%) have recurrent habitation components. There are six trails or portions of trails, three kerbstone trails (-02, 18099 and -18122) and three stepping stone trails (-18103; 18112; and 18133). Site -18112 stepping stone trail is a component within a multi-component site. Burial sites or sites with burial components include 5 (7%) sites all of which are within lava tubes.

D. Probable Age

The probable age among the sites ranges from pre-Contact era, a combination of pre- and post-Contact and historic-era sites. Sixty (82%) of the 73 sites are considered to be pre-Contact sites, three (4%) are possibly pre-Contact; two (3%) are clearly historic (a petroglyph and an animal pen/ag area; another one is probably historic site (a mining site); and eight (11%) sites showed elements that were both pre- and post-Contact.

IX. SIGNIFICANCE AND RECOMMENDATIONS

An important aspect of the survey was to provide functional interpretations and to apply an initial assessment of significance. The functional interpretations were established on the basis of structural characteristic and in some cases associated artifacts, in conjunction with external correlations with other archaeological studies and interpretations in the general region. Additionally, limited subsurface testing was performed to provide important information regarding the likely function of the sites and chronological information.

A. Significance Assessments for Sites in the Project Area

Appropriate procedures have been followed to identify and gather sufficient inventory information to make initial assessments regarding site significance, the report (Robins *et al.* 2000) has been prepared and submitted to SHPD/DLNR for its "consensus determination."

The initial significance assessments are based on criteria established by both the Hawai'i and the National Registers. To be significant, an historic property shall through design, construction materials, workmanship, feeling and association meet one or more of the following criterion:

a) Be associated with events that have made an important contribution to the broad patterns of our history;

b) Be associated with the lives of persons important in our past;

c) Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

d) Have yielded, or be likely to yield, information important for research on prehistory or history;

e) Have an important traditional cultural contribution or value to the native Hawaiian people or to other ethnic groups of the State.

Table 6 - Kaloko Honokōhau Business Park- Site Significance Assessments

Site Criteria	Site #s (* burials)
A,C,D	18099
A,C,D,E	02, 18134*
C,D	18098, 18112, 18133
C,D,E	18091

Site Criteria	Site #s (* burials)
D	13031, 18080, 18083, 18084, 18085, 18086, 18087, 18089, 18090, 18092, 18093, 18094, 18095, 18096, 18097, 18100, 18101, 18102, 18103, 18104, 18105, 18106, 18107, 18108, 18109, 18110, 18111, 18113, 18114, 18118, 18119, 18120, 18121, 18122, 18123, 18124, 18125, 18126, 18127, 18128, 18130, 18131, 18132, 18135, 18136, 18137, 18138, 18139, 18140, 18142, 18143, 18186, 18187, 18188, 18189, 18190,18192, 18193, 18194, 18195,, 18356
D,E	18081, 18088*, 18116*, 18117*, 18197*

B. Recommendations

Of the 73 sites, eight (8) sites were recommended for preservation, 31 are recommended for Data Recovery, and 34 sites for No Further Research.

Recommended treatment of sites may change as a result of further study through data recovery. For example, burials may be uncovered during excavations. In this case, preservation would be the favored alternative. Information on functional associations may also be generated in data recovery, which could change the presently recommended treatment.

Preservation

Eight sites are slated for preservation. Table 7 lists function and site type of the eight preservation sites.

Table 7 - Kaloko Honokōhau Business Park- Preservation Sites

State site # for sites slated for Preservation	Function and Site Type
18116	Permanent habitation complex (with burial component)
02, 18099	Transport or Transit Trails
18088, 18117, 18134, 18197	Lava tubes with burials
18081	Petroglyph Concentration along Mamalahoa Trail

Recommendations for site preservation in the present study area were made in consideration of all the previously recorded sites which have been or are recommended to

be preserved in other portions of Honokōhau I and II *ahupua'a* (*i.e.*, Kaloko-Honokōhau National Park sites, Project 82 sites [Robins et. al. 1993] and the Kealakehe Parkway Extension project sites [Barr *et al.* 1994]). Additionally, site integrity and the ability to consolidate sites and associated features were major factors in preservation criteria. Isolated features were in general, not primary candidates for preservation.

The 8 sites in the project area recommended for preservation include good examples of a permanent habitation site and complexes (surface structures and lava tubes with agricultural areas), all confirmed burial sites, a refuge cave, petroglyphs, and partial preservation of two traditional/historic trails.

Preservation of sites within the Kaloko Honokōhau Business Park include a complex centered around a lava tube (Site 18116) with burials but which also contains evidence of habitation use. Site 18116 has surface components, including habitation, agricultural and recreational (*i.e. papamū*) functional types. Thus, this site includes a range of functional site/feature types not just burials.

All of the burial sites (5) in the project area are recommended for preservation and should be protected from any potential adverse impact. Final treatment of the burial sites and any other inadvertent burial finds on the property will be reviewed and ultimately determined by the Hawaii Island Burial Council. This work will be done in accordance with a Burial Treatment Plan, which will be reviewed and subject to approval by the Department of Land and Natural Resources (DLNR) and the Hawaii Burial Council.

Portions of one *mauka-makai ahupua'a* trail (sites 50-10-27-18099) and of the Māmalahoa Trail (50-10-27-02) are recommended for preservation. The *mauka-makai* trail (18099) has sections which are excellent examples of trails that once extended between the coastal and upland settlements of Honokōhau I and II *ahupua'a*. However, the Site -18900 trail is in fair to poor condition because it is in a state of disrepair and has been breached in numerous places by roaming cattle, pasture improvements, possible alteration by Japanese homesteaders inland of the present project area and major construction near Queen Ka'ahumanu Highway.

The Māmalahoa Trail is a non-traditional 19th-century trail altered for use as a jeep trail during the 20th century. Similar to the condition of the two *mauka-makai* trails in the project area, the Māmalahoa Trail has been breached along its course in the Kekaha region, as well as along its course in the present study area. In the project area the major land changes that have altered or obliterated portions of the trail include the Queen Ka'ahumanu Highway and a culvert underpass. Additionally in Honokōhau and adjacent Kealakehe, the Kealakehe Parkway and Queen Ka'ahumanu interchange, a Chevron gas station and the Honokōhau Industrial Park and access road have also obliterated the trail. The Māmalahoa Trail section in the present study area (also referred to as the "King's Highway") is also privately owned by Lanihau Partners

The preservation of the Māmalahoa Trail would need to take into account continued major construction activities within Honokōhau, Kealakehe and Kealuolu. Recently, data

recovery work (Shideler, Perzinsky and Hammatt 1999) related to the loss of 200 ft., on the Māmalahoa Trail within Honokōhau was undertaken in advance of the widening of Queen Ka`ahumanu Highway and the newly constructed Kaloko-Honokōhau National Historic Park entrance, thus, another major breach in the trail within Honokōhau.

Based on the major breaches within and adjacent to the project area, the poor remnant condition of the trail, and private ownership of the trail within the project area, preservation of only a representative sample appears warranted.

Preservation treatment should be in accordance with a Preservation Plan submitted to the SHPD/DLNR and Hawaii County for revivew and approval. The plans should have arrangements for short-term and long-term preservation.

Data Recovery

There are 31 sites slated for Data Recovery. Table 8 lists function and site types of the 31 sites.

Table 8 - Kaloko Honokōhau Business Park- Data Recovery Sites

State site # for sites slated for Data Recovery	Function and Site Types
18088, 18112, 18126, 18137, 18190, 18188, 18189	Permanent habitation sites or complexes
18092, 18120, 18121, 18131, 18195	Recurrent habitation sites or complexes
18083, 18084, 18085, 18090, 18094, 18102, 18111*, 18124, 18125, 18132, 18139, 18187	Temporary habitation sites or complexes
18103, 18122, 18133	Transportation Trail & Trail markers
18110, (18111*)	Ag complexes or features
18080, 18106	Undetermined wall, platform,

*Note Site 18111 has both temporary habitation and agricultural components

Data recovery should proceed in accordance with a data recovery plan which is to be submitted to DLNR State Historic Preservation Division and Hawaii County for review and approval.

The sites selected for data recovery include a variety of site and function types attributable primarily to traditional Hawaiian use. These sites represent all modes of habitation sites (temporary, recurrent and permanent), simple and non-intensive agricultural complexes, petroglyphs, animal containment and trails.

Some of the following research topics may be considered in future data recovery work in the Honokōhau I and II *ahupua`a*. These topics would assist in discerning the

overall settlement pattern of Honokōhau I and II *ahupua`a* and the Kekaha region of Kona, and perhaps contribute to a better understanding of the day-to-day life and social organization of the Honokōhau I and II residents.

C. Data Recovery - Potential Research Topics

(1) *Chronology* of traditional Hawaiian settlement and land use in Honokōhau I and II *ahupua`a* and expansion into the intermediate and upland zone. External correlations: compare with other Hawai`i Islands or Kona-specific "cultural sequence" models (e.g., Schilt 1984; Kirch 1985; and Cordy *et al.* 1991).

2) *Function analysis* of site/feature types and relationship of feature components in sites, with a focus on *kauhale* and *kūlana kauhale* research. External correlations: compare with other *kauhale* or household models (e.g., Handy and Pukui 1991; Cordy *et al.* 1991; Mitchell and Kolb 1992; and Hammatt *et al.* 1993, Kirch 1997).

3) *Socio-political rank* of Honokōhau I and II occupants in the intermediate and upland zones. Hypothesis could be based on size, nature and architecture of the sites, and type of material remains. External correlations: compare with Dr. Ross Cordy's model of social rank determinants in coastal Kaloko and Honokōhau I and II *ahupua`a* (Cordy 1991).

No Further Research

There are 34 sites recommended for No Further Research. Table 9 lists the function and site types of these sites.

Table 9 - Kaloko Honokōhau Business Park- No Further Research Sites

Sites slated for No Further Research	Function and Site type
18101, 18128, 18143, 18192	Temporary Habitation site or feature
18119, 18127	Recurrent Habitation site or feature
18104, 18105, 18107	Animal containment
18089, 18095, 18108, 18109, 18113, 18118, 18123, 18130, 18135, 18136, 18140, 18142, 18194	Agricultural or possible agricultural feature
18356	Ahupua`a boundary wall
18093, 18096, 18100, 18114	*Ahu* or Marker
13031, 18087, 18186	Indeterminate wall segment
18086, 18193	Undetermined pecked basin, outcrop
18091, 18097	Historic petroglyph, mining? feature

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Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 9

Market Study and Economic Impact Report

THE HALLSTROM GROUP INC.
REAL ESTATE CONSULTANTS & APPRAISERS

**Market Study,
Economic Impact Analysis,
and Public Cost/Benefit Assessment
of the Proposed**

KALOKO-HONOKOHAU BUSINESS PARK

Located at

Honokohau, North Kona, Hawaii

Prepared for

**Mr. James S. Greenwell
President
Lanihau Management Corporation**

[illegible]

May 2000

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EXECUTIVE SUMMARY

Introduction

An ambitious master plan designed to incorporate a comprehensive spectrum of industrial and mixed-use industrial/commercial businesses into a single, centrally located working community, the proposed Kaloko-Honokohau Business Park will encompass approximately 337 mauka acres in the southerly reaches of the Kailua-Kona to Kawaihae coastal corridor. The development will be a diverse project serving the expanding urban-support needs of the West Hawaii region during the coming decades by providing a competitive siting for a variety of new and existing uses in the area.

The holding represents an excellent opportunity for in-fill within the emerging prime industrial/commercial region that serves a growing West Hawaii, a chance to locate "heavy" industrial uses in a proximate location, and to bring about land classification conformance (as significant portions have been used for quarrying operations for several decades). It is well-located along the highway between two existing, successful light industrial park developments.

The envisioned project will capitalize on a superior site having favorable access to main thoroughfares, proximity to primary market and consumers, and at the center of an area of the island slated for future urbanization. It will contribute to the regional industrial/business land base, enhance the island's economy through construction and operation, and strengthen the state and county tax base.

The development will transform a prominently situated holding from sparsely-vegetated, poor-quality lava "ranch" lands, having virtually no meaningful economic historic use apart from quarrying, into a dynamic mixed-use project meeting expressed real property market demands and producing employment, wages and tax receipts that will benefit the island's public and private financial foundation.

The purpose of our assignment has been to analyze the proposed subject business park in light of competitive, regional, prevailing and

forecast economic/market conditions in order to answer four primary study questions:

1. Is there sufficient market demand to absorb the various components of the Kaloko-Honokohau Business Park during a reasonable exposure period given competing developments and statewide/regional economic trends?

2. From a market perspective, will the subject be an appropriate use of the underlying site relative to governmental land planning objectives, accepted master plan design characteristics, and the area environs?

3. What will be the general/specific and direct/indirect economic impacts in West Hawaii resulting from the undertaking of the subject development through employment, wages, business operations, profits and construction/economic activity?

4. What will be the impact on the state and county "public purse" from the project in regards to costs of services required versus increased tax/fee receipts?

These issues were addressed through a comprehensive research and inquiry process utilizing data from market investigation, governmental agencies, various Hawaii-based media, industry spokespersons/ sources, on-line databases, and published public and private documents.

The pertinent results of our study are highlighted in this *Executive Summary*. Supporting narrative, tabular data and other materials contributing to these conclusions are contained within a series of addenda comprising the body of the report. The synopsis presentation is divided into eight sections:

1. **Primary Study Conclusions**

2. **The Subject Property and Proposed Project**

3. **Overview of the West Hawaii Region**

4. **The West Hawaii Industrial Market Sector**

5. **Analysis of Quarry and General Industrial Market Factors**

6. **Appropriateness of the Subject for the Planned Use and Absorption Estimates**

7. **Economic Impact Analysis of the Proposed Development**

8. **Assessment of the Public Costs/Benefits Associated With the Project**

The primary source information regarding the subject used in our study were: maps, phasing schedules and cost estimates provided by Okahara & Associates, Inc.; project descriptions, details and planning objectives and timing guidelines provided by William L. Moore Planning; and, lease documents, background materials, consulting studies, and other materials provided through the Lanihau Management Corporation.

The proposed Kaloko-Honokohau Business Park site and environs were inspected on several occasions for this assignment during the fourth quarter of 1999 and the first quarter of 2000.

Our study addresses all three phases of the proposed development, which will require some 20-plus years to be fully developed, but focuses on Phase I of the industrial and mixed-use areas and the initial increment of the quarry which will be absorbed over the coming decade.

Primary Study Conclusions

Based on our analysis of the subject property, its environs, and envisioned development, we have reached the following primary study conclusions regarding the proposed Kaloko-Honokohau Business Park project:

- The subject property enjoys an excellent, desirable and exceptionally competitive location between two existing industrial/business parks, and is centrally sited within the emerging Kailua-Kona to Keahole industrial/commercial corridor, an area that has demonstrated strong appeal among regional businesses. Direct access and frontage onto Queen Kaahumanu Highway (West Hawaii's main thoroughfare) is

extensively available to the property, and the interior roads will connect into the street system of the nearby developments. It is a natural in-fill site and will bring a historic quarry/heavy industrial operation into land use conformance. It will fit in well with the existing and proposed industrial/business uses nearby at Honokohau, Kohanaiki and Kealakehe. By every market perspective it is a favorable location for the proposed use.

- Following an extended period when demand for industrial lots was down significantly and new development was at a virtual standstill, the activity in the sector has meaningfully recovered during the past 24 months. Two new projects offered lots and experienced rapid absorption in 1999, the vacancy rates among existing buildings have declined, and numerous new structures are being proposed. All relevant indicators point to the early stages of an up-cycle period in West Hawaii, with tourism rising, a solidifying economic base, decreasing unemployment rates, and an increase in business creation.

- The study area had successfully absorbed some 240.2 gross acres of industrial lands and 1.91 million square feet of finished floor space through 1999, averaging 8.9 acres and 73,200 square feet annually since 1979. Based on population, business expansion and general economic trends, we forecast total additional demand will be at 388.5 gross acres and 3.18 million square feet over the next 20 years, more than doubling the present inventory.

- The existing in-place supply of industrial/business land in the Keahole to Kailua-Kona corridor will be sufficient to meet market demands only for another three or four years. After that time, additional subdivisions will be required if the sector is to maintain an appropriate demand/supply balance. The recent offerings at Kaloko Phase II, Honokohau and Kohanaiki, while serving to fill pent-up demand which built during the past decade, are almost fully absorbed, mostly by owner-user purchasers who plan on building and occupying the finished space over the next five years. Other existing projects (such as the HOST Park and at Kawaihae) are not competitive in the general market sector. While there are large acreage industrial additions proposed in the region, virtually all would have to be

developed in a timely manner in order to meet demand levels. Although there would be an oversupply if all were approved and built during the projection period, we consider this highly unlikely. Several of the projects are second phases of existing parks that have yet to be scheduled, others are not yet approved, some have undesirable leasehold land tenure, and one will probably be put to commercial uses. The development of a highly competitive highway-fronting location in the high market demand Kaloko-Honokohau neighborhood is a reasonable course to achieve market stability.

- The availability of "heavy" (general) industrial lands in West Hawaii are extremely limited, with most located near Kawaihae well-removed from the growing Keahole to Kailua-Kona business corridor. The continuing urbanization of the study area will require such lands to achieve economic self-sufficiency, and they should be located near consumers, suppliers, and end-users to be economically and transportation efficient. All other existing and proposed competitive regional industrial parks are focusing on mixed-uses with significant commercial-type components. Based on experiences of similar size communities elsewhere more than 100 acres of heavy (general) industrial lands will be needed in West Hawaii over the next two decades. The subject property provides an excellent location, and the only currently proposed alternative to meet these market needs.

- Based on historic and prevailing market trends, and the anticipated movements in the West Hawaii industrial/business sector, we estimate it will take from about 10 years marketing and exposure time to successfully absorb the 102 gross acres of industrial/mixed-use lands in the first phase and the initial 50-plus acres of the quarry and heavy (general) industrial lands. The second increment, comprising 82.8 acres of industrial/mixed-use and 50-plus acres of quarry/heavy industrial will require an additional nine to ten years. And, the final 43 acres of industrial/mixed use will be absorbed over a subsequent four to six years. The entire development will take 23-plus years to be fully absorbed.

- The development of the Kaloko-Honokohau Business Park (subdivision, building the improvements and business

operations) will create 174,683 worker years of employment during the 34 years required to build-out the project, paying total wages in excess $5.2 billion in year 2000 dollars. Thereafter, the operating business will generate 6,915 permanent jobs on site and an additional 3,357 off-site, with total annual wages of $298.75 million. The project will lower unemployment in the construction trades by 15 to 25-plus percent during its building process, and the permanent on-site employees will represent about five percent of the total county workforce three decades hence; making the park one of the primary employment centers on the neighbor islands. The direct economic impact of the undertaking will total more than $5.2 billion during the development time-frame, with indirect impacts of more than twice this amount as the capital, wages and profits flow through West Hawaii. The operating business will collect an estimated $839 million annually in gross revenues, and overall the project has the potential to be a diverse, foundational component in the Big Island comparable with the Campbell Industrial Park on Oahu.

- As with most large scale privately-built industrial/commercial projects, the subject development has the potential to be a major net contributor to the tax base of the state and Hawaii County. Minimally, on an actual cost basis the level of services required from the state (not directly reimbursed through user costs/fees) are estimated to be less than $200,000 annually by build-out in year 2000 dollars. For the county, which will provide emergency services (the primary cost), the actual yearly costs on a stabilized basis at build-out will be an estimated $505,750. Maximally, if viewed on a per capita allowance basis, as a portion of all governmental costs associated with every person throughout the day (which is atypical as most costs are generally viewed as accruing to a place of residence), the total costs to the state would be $8.152 million per year, and $1.940 million to the county. Regardless of the cost perspective, each level of government will see a large revenue benefit, as the stabilized revenues flowing to the state will be more than $58.48 million annually, and some $6.990 million to the county each year. The net benefit to the state at completion after 34 years will be from $50.2 to $58.2 million per year, and to the county it will be from $5.05 to $6.48 million annually. Individually, each of the three phases

of the park will generate a net revenue benefit for both the county and the state, and in no single year will there be a shortfall by either governmental entity.

The Subject Property and Proposed Project

The subject property is generally a 3,450- by 4,100-foot rectangle, containing 326 acres, with the longer dimension being the upslope measurement. An additional 10.5-acre parcel (459 by 1,000 feet deep) is appended to the southerly/makai corner of the site along the highway. The holding is located in the coastal corridor, one-half mile inland, circa four miles north of urban Kailua-Kona and four miles south of the Keahole Airport, in the North Kona District of Hawaii County, State of Hawaii. The entire 336.9-acre site has 3,900 lineal feet of frontage along Queen Kaahumanu Highway.

The property is identified on State of Hawaii Tax Maps as Third Division, Tax Map Key 7-4-08, Parcels 13 (por.) and 30. The holding has a gradual slope except for a bulge in the central/northerly area, and a dip in the southerly portion, and is currently undeveloped.

The site is reached from Queen Kaahumanu Highway, an expansive right-of-way currently with two paved lanes and shoulders that is the primary thoroughfare along the West Hawaii coast. Most of the regional businesses are located in the corridor served by the highway, and it provides direct access to the leeward resort communities. An improved intersection (with turn pockets) currently allows access from the highway to the quarry site.

The holding is presently within the Conservation District on State Land Use Maps. This designation must be changed to the Urban District in order to support the proposed development. The County of Hawaii General Plan designates the site for "industrial" and "urban expansion," and "Keahole to Kailua Development Plan" specifically addressing the region, classifying the property as Limited Industrial and Quarry. County zoning is presently "Open," and will require change to a combination of Industrial-Commercial Mixed Use, Limited Industrial, and Quarry/General Industrial.

The proposed subdivision will create 150 to 200 finished, building-ready lots ranging from about three-quarters of an acre to several acres in size in the industrial and mixed-use areas, and 15 to 30 graded

quarry/heavy industrial lots up to eight acres. The site will be mass graded, and improved with underground infrastructure systems, including water, sewer, power, drainage, electrical and telecommunication utilities. Streets in the light industrial and mixed-use areas will be two-lane, with curb parking lanes, and will be improved with sidewalks, gutters, curbs and street lighting.

The developers foresee a mix of the uses currently evident in the adjoining Kaloko Industrial and Business Parks, and at the Honokohau Mauka project, with a mix of light industrial, service commercial, and retail users in a variety of single and multi-tenant metal clad and masonry buildings. Specifically, commercial/retail uses are considered likely fronting Queen Kaahumanu Highway and in the makai areas of the development, focusing on the traffic and passer-by activity along these roadways, and with light industrial (such as warehouse, suppliers, repair shops, base yards) using the more interior mauka lots.

Users in the quarry/heavy industrial area would include an expansion of existing users and new tenants having similar bulk land needs.

Overview of the West Hawaii Region

The subject development will service the industrial and business needs created by the continuing urbanization of West Hawaii, a 1,000 square mile region covering the leeward side of the Big Island. The area stretches some 100 miles along the coastline and is comprised of the districts of North and South Kohala and North and South Kona, which contain a variety of land and use types, including lava deserts, rain forests, ranch and agricultural lands, and urban development.

The area is in the midst of a major transition in regards to land use and the economic base. Forty years ago West Hawaii was a stable agrarian culture, with scattered villages, a resident population of about 14,000, little tourism, and limited commercial and industrial development. All products were shipped from Oahu, there were few major retailers, it had a relatively primitive financial structure, and most of the island's businesses were located on the Hilo side.

Over the past four decades, the trend towards an urban economy has been exceptional, though cyclical, echoing the transitions seen on Oahu in the 1940s through 1960s, and on Maui in recent years. Today, the state's major businesses are represented in West Hawaii, with

TABLE 1

SUMMARY OF HISTORIC AND PROJECTED POPULATION AND ECONOMIC INDICATORS
FOR THE WEST HAWAII REGION 1960 TO 2020 (1)
Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

	Historic				Projected		
	1960	1970	1980	1990	2000	2010	2020
Resident Population							
Hawaii County	61,332	63,468	92,053	120,317	149,600	173,900	205,400
% Annual Compounded Change		0.34%	3.79%	2.71%	2.20%	1.52%	1.68%
West Hawaii Region	14,167	14,472	27,518	43,373	65,031	82,776	104,343
% Annual Compounded Change		0.21%	6.64%	4.66%	4.13%	2.44%	2.34%
% of County Total	23.10%	22.80%	29.89%	36.05%	43.47%	47.60%	50.80%
Economic Indicators							
1. Tourism							
Hawaii County Room Count	581	3,166	5,389	8,952	9,900	11,400	13,000
% Annual Compounded Change		18.48%	6.40%	4.28%	1.01%	1.42%	1.32%
West Hawaii Region	152	1,584	3,844	6,825	7,600	8,900	10,200
% Annual Compounded Change		26.41%	9.27%	5.91%	1.08%	1.59%	1.37%
% of County Total	26.16%	50.03%	65.27%	76.24%	76.77%	78.07%	78.46%
Hawaii County Visitor Arrivals	119,000	477,720	761,103	1,030,900	1,300,000	1,800,000	2,350,000
% Annual Compounded Change		14.91%	4.77%	3.08%	2.35%	3.31%	2.70%
West Hawaii Region (2)	27,000	254,720	442,483	730,900	975,000	1,450,000	1,975,000
% Annual Compounded Change		25.16%	5.68%	5.15%	2.92%	4.05%	3.14%
% of County Total	22.69%	53.32%	58.14%	70.90%	75.00%	80.56%	84.04%
2. Job Count							
Hawaii County Job Count	22,293	28,410	38,200	57,200	63,500	78,400	93,000
% Annual Compounded Change		2.45%	3.01%	4.12%	1.05%	2.13%	1.94%
West Hawaii Region (est.)	3,300	8,600	17,300	34,200	40,200	53,900	68,000
% Annual Compounded Change		10.05%	7.24%	7.05%	1.63%	2.98%	2.35%
% of County Total	14.80%	30.27%	45.29%	59.79%	63.31%	68.75%	71.58%

(1) Includes the districts of North Kohala, South Kohala, North Kona and South Kona.
(2) Estimated according to port of entry.

Sources: US Census (population figures), Hawaii Visitors Bureau (tourism)
County of Hawaii and State DBED (employment), and
The Hallstrom Group, Inc.

independent major facilities and not mere transhipment points. The type of businesses are evolving to that of a freestanding modern community, as opposed to the traditional "outer island" character. Where few base businesses once existed and consumer options were limited, there is now competition and an expanding spirit of local entrepreneurship.

At present there are approximately 64,165 people residing in West Hawaii, with an average daily count of about 21,690 tourists. By the year 2020, it is projected the resident population of the region will be 104,343 (an increase of 63 percent) and the daily visitor count will be 42,688 persons (up 97 percent).

These persons generate a significant demand for urban land uses, which is expected to more than double over the next two decades, as more competition enters into the market and the transitional economy further solidifies into typical modern form.

A summary of West Hawaii population and economic indicators is displayed on Table 1.

Currently there is an estimated 1.8 square feet of commercial development in the study area, some 1.96 square feet of finished industrial space, about 7,600 visitor units, and over 24,000 residential units. Each of these use types is expected to grow by a minimum of 70 to 120 percent by the year 2020, an increase which will be further stimulated by the emergence of West Hawaii as a more energized political unit. Where it was often overlooked in regards to civic resources in past years, the region is now the recipient of significantly more public projects.

The Kailua-Kona to Keahole corridor (which contains the subject property) has been identified as the focal point for future urbanization and the location of the supporting industrial, commercial and civic uses vital to the long-term success of the region. Both the state and county have developed land use plans for this area during the past 11 years in order to establish a reasonable framework for uses in the West Hawaii coastal corridor.

The region boomed in the mid to late-1980s, with major development of all types, particularly those associated with resort and commercial uses. More than one million square feet of commercial space was

added, including the first stores for major mainland retailers (Costco, K-Mart Safeway, Borders, among others), and the visitor unit inventory expanded by nearly 3,000 units. Significant growth was also experienced in the industrial and residential sectors.

By the end of the decade, the regional job count had doubled (from 17,300 to 34,200 positions), unemployment had dropped to about six percent, and real estate appreciation was well into double-digits annually. Major projects were being pursued in West Hawaii that would have added another 25,000 resort units, 15,000 residential units and more than 600 acres of commercial/industrial/business lands.

The deep recession of the early to mid-1990s resulted in a severe stagnation of virtually all economic activity. By 1996, the population of West Hawaii had stabilized, unemployment was above 10 percent, construction activity was at a standstill, and most of the proposed projects had been placed on hold or abandoned. There were some positive aspects, such as the successful acceptance of the "big box" retailers, the high-quality reputation being established by the coastal resorts, and that the number of business declaring bankruptcy were less than seen in other island locales.

Several factors have contributed to the change from stagnation to growth in recent years, notably a resurgence of tourism (due to direct daily flights to Kona from the mainland and Japan, and upscale resort development drawing the newfound West Coast wealthy), an increase in construction activity, and a general (though limited) strengthening of the statewide economy. The orientation of the visitor industry towards the mainland U.S. traveler also helped the region weather the problems associated with the Asian currency crises of late 1997.

Virtually every indicator points to the returning health of the West Hawaii market. Unemployment has dropped several points to about eight percent, construction activity is up by more than half from four years ago, appreciation is being evidenced in the real estate market once again, and agents report significantly increased interest in available commercial and industrial space, with building owners offering fewer concessions to prospective tenants. Many landowners are reviving development plans that had been on hold for the past decade, and the absorption of new inventory additions in the resort, residential and industrial sectors is typically exceeding all expectations.

It is evident the economy is in an "up" or growth cycle, one that is expected to continue for several years. Even if there is an economic slowdown on the mainland, the increasing number of direct flights to West Hawaii should help off-set any downturn, as should the more diversified and established business community that is emerging in the region which will be less subject to off-island whims.

The fundamental regional economic support for the proposed Kaloko-Honokohau Business Park development is highly favorable at this time.

The West Hawaii Industrial Market Sector

The success of the subject project will be dependant upon the demand and supply characteristics of the industrial sector of West Hawaii. While the project will contain a mixed-use (commercial/industrial) component employing a relatively new zoning designation, the uses in the subdivision will generally reflect the historic uses found in light industrial development throughout the region, which have always had strong commercial/business aspects.

The proposed Kaloko-Honokohau Business Park light industrial and mixed-use commercial lots would be competitive with other existing and proposed industrial/commercial developments in West Hawaii for buyers and tenants. The sphere of economic influence in this market is the entire leeward (or west) side of the island encompassing the districts of North and South Kona, and North and South Kohala.

The westerly side of the central mountain range has become basically autonomous from the windward/easterly side over the past two decades, with expanded public facilities and an emerging independent business community. The on-island demand of the resident, tourist and business groups in the area are focused towards regional suppliers and services. The subject would be competing to provide space for these businesses.

The vast majority of regional demand has been focused into the Queen Kaahumanu Highway corridor between Kailua-Kona and the Kona International Airport. This is anticipated to continue based on the favorable location and access characteristics of the area.

TABLE 2

HISTORIC AND PROJECTED DE FACTO POPULATION LEVELS
IN PRIMARY MARKET AREA 1999 TO 2020
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

Year	Year End 1999	Projected 2000	2005	2010	2015	2020
RESIDENT POPULATION						
North Kohala	6,165	6,227	6,810	7,484	8,210	8,960
% Average Annual Change	%	1.01%	1.87%	1.98%	1.94%	1.83%
South Kohala	17,948	18,140	20,651	23,720	26,508	29,422
% Average Annual Change	%	1.07%	2.77%	2.97%	2.35%	2.20%
North Kona	29,942	30,425	34,268	38,932	44,620	49,981
% Average Annual Change	%	1.61%	2.53%	2.72%	2.92%	2.40%
South Kona	10,110	10,239	11,347	12,640	14,210	15,980
% Average Annual Change	%	1.28%	2.16%	2.28%	2.48%	2.49%
Total Resident Population	64,165	65,031	73,076	82,776	93,548	104,343
% Average Annual Change	%	1.35%	2.47%	2.65%	2.60%	2.31%
TOURIST POPULATION						
Average Regional Daily Visitor Count	21,690	22,740	26,589	30,920	36,234	42,688
% Average Annual Change	%	4.84%	3.39%	3.26%	3.44%	3.56%
TOTAL REGIONAL DE FACTO POPULATION	85,855	87,771	99,665	113,696	129,782	147,031
% Average Annual Change	%	2.23%	2.71%	2.82%	2.83%	2.66%

(1) All figures drawn or extrapolated from "DBEDT 2020 Projections" series Table A

Source: State of Hawaii Department of Business Economic Development & Tourism, and The Hallstrom Group, Inc.

Our analysis of the West Hawaii industrial market sector was divided into three general subsections: quantification of demand, identification of supply, and correlation of indicators.

Demand is a function of both long- and short-term perspectives; the former using resident and tourism population requirements as a basis for determining additional industrial spatial needs over the next two decades, the latter based on absorption levels currently being achieved in study area subdivisions and prospects for further business expansion over the next several years.

The level of existing and proposed industrial acreage supply was then analyzed, with the demand/supply quotients then compared to arrive at a conclusion of need (or lack thereof) for further designation of industrial lands in West Hawaii.

Quantification of Demand

1. Mid to Long-Term Demand Indicators

Fundamentally, demand for industrial development is a direct function of consumer demand for the finished product or service. As population levels (resident and tourist) increase, the need for additional services is proportionately created. We have therefore quantified the level of projected spatial needs for the study region using a per capita spatial demand trends analysis.

By ascertaining an appropriate *"per square foot of industrial development per person"* allowance, and applying this ratio against forecast West Hawaii de facto population levels, the regional demand for industrial space over time can be quantified.

Consumer Population Levels -- Demand for West Hawaii industrial space is a function of two ultimate constituent consumer groups, local residents and tourists visiting the area.

Table 2 displays our projections for these demographic categories during our 20-year study and projection time-frame 2000 to 2020.

Per Capita Spatial Demand Trends -- The best indicators of appropriate industrial demand requirements for an urban island economy can best be drawn from the experience of Oahu, which though historically under-supplied, provides useful insight into the probable growth trends of the outer islands. The total estimated developed industrial space on

the island was 35,200,000 square feet at year-end 1999, this equates to a de facto per person ratio of 38.58 square feet as of the end of last year.

This compares with nationwide estimates by the Urban Land Institute and others which indicate a range of 25 to 35-plus square feet per person is appropriate for an urban economy. The overall national range represents the lower end of the spectrum for Hawaii. In the islands, unlike the mainland, many quasi-service and full commercial users locate in industrial projects instead of retail development, pushing the effective per capita "industrial" figure higher.

Maui, which is a market several steps advanced beyond West Hawaii in its transformation from agriculture to urban uses, currently has about 41 square feet of identified mixed use industrial floor space per person in the de facto population. Kauai has 35 square feet; and Hilo, 33 square feet.

At present, West Hawaii has an estimated 1,967,040 square feet of competitive industrial space, as shown on Table 3. This equates to an average per capita supply of 22.90 square feet per person in the de facto population of 85,855. This is undersupplied relative to other island markets and mainland levels; a conclusion bolstered by the emerging shortfall of product in the region as the economy has grown over the past several years, and by the rapid absorption of newly available industrial lots in late 1999.

We have concluded an appropriate full-service objective in per capita finished spatial allowance for West Hawaii would be circa 29 to 42 per square feet per person in the de facto population (tourist and resident). Based on the market data, we anticipate spatial demand to increase from the current level (22.90 square feet) to the stabilized supply level at a rate of 1.19 percent ("slow" growth) to 3.08 percent ("extraordinary" growth) compounded annually during the study period.

Application of the Model – By multiplying the de facto population forecasts by the per capita spatial trends, we can estimate the probable demand for finished industrial space in West Hawaii. This figure can be translated into underlying acreage requirements through use of an appropriate Floor Area Ratio (FAR).

TABLE 3

SUMMARY OF PROJECTED INDUSTRIAL SPACE DEMAND SCENARIOS
FOR WEST HAWAII 1999 THROUGH 2020
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
All Figures in Gross Square Feet Except as Noted

TOTAL SPACE DEMAND (Sq. Ft.)

Scenario	1	2	3	4
Year	*Slow Growth*	*Moderate Growth*	*Accelerated Growth*	*Extraordinary Growth*
2000	2,018,733	2,018,733	2,018,733	2,018,733
2005	2,441,793	2,541,458	2,690,955	2,690,955
2010	2,956,096	3,183,488	3,524,576	3,524,576
2015	3,569,005	3,958,351	4,542,370	4,542,370
2020	4,263,899	4,852,023	5,734,209	5,734,209

PERIODIC DEMAND (Sq. Ft.)

Scenario	1	2	3	4
Year	*Stable Growth*	*Moderate Growth*	*Accelerated Growth*	*Extraordinary Stable Growth*
2000	—	—	—	—
2005	423,060	522,725	672,222	672,222
2010	514,303	642,030	833,621	833,621
2015	612,909	774,863	1,017,794	1,017,794
2020	694,894	893,672	1,191,839	1,191,839

CUMULATIVE STUDY PERIOD DEMAND (Sq. Ft.)

Scenario	1	2	3	4
Year	*Stable Growth*	*Moderate Growth*	*Accelerated Growth*	*Extraordinary Stable Growth*
2000	—	—	—	—
2005	423,060	522,725	672,222	672,222
2010	937,363	1,164,755	1,505,843	1,505,843
2015	1,550,272	1,939,618	2,523,637	2,523,637
2020	2,245,166	2,833,290	3,715,476	3,715,476

CONCLUDED STUDY MID-POINT DEMAND

	Finished Space Demand in Square Feet			Total Gross Land Area Demand (1)
	Total	Periodic	Cumulative	
2000	2,018,733	—	—	246.5
2005	2,591,290	572,557	572,557	316.5
2010	3,297,184	705,894	1,278,451	402.7
2015	4,153,024	855,840	2,134,291	507.2
2020	5,146,085	993,061	3,127,352	628.5

(1) Assuming average FAR of .25 and gross to net usability loss of 30% of the site.

Source: The Hallstrom Group, Inc.

We have tested four demand scenarios using the following assumptions:

Growth Scenario	Per Capita Space in 2020 (Sq. Ft./Person)	Annual Growth Rate from Present
Slow	29.0	1.19%
Moderate	33.0	1.84%
Aggressive	39.0	3.08%
Extraordinary	42.0	2.70%

The results from the analysis are summarized on Table 3. The indicated mid-point demand conclusion is shown at the bottom of the table.

Based on our study, we estimate the total increase in demand for finished industrial space in West Hawaii between the report date and the year 2020 will be some 3,179,045 square feet.(1) This equates to a two decade demand for industrial lands of approximately 388 gross acres during the study period.

2. Short-Term Demand Indicators

A summary of estimated industrial space demand in the study area over the past two decades is shown on Table 4. The figures are based on inspection of tax office records, discussions with developers and brokers, and review of space listing data. Also shown are estimated market-wide floor space vacancy rates for existing/established buildings.

The key factors in short-term demand analysis are the velocity of absorption for offered product, and vacancy rates in completed developments. If newly subdivided lots and multi-tenant buildings are quickly sold or "leased out," and the tenant turnover rate is low, the market is healthy.

Such a positive condition has been emerging in West Hawaii over the past two years. The recovery of tourism, increasing demand for resort-

(1) Includes 3,127,352 square feet between 2000 and 2020, and 51,693 square feet of latent demand in 1999-2000.

TABLE 4

SUMMARY OF ESTIMATED ABSORPTION AND VACANCY RATES
FOR INDUSTRIAL SPACE IN WEST HAWAII THROUGH 1999
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

Year	Finished Space Constructed Annual (Sq. Ft.)	Finished Space Constructed Cumulative (Sq. Ft.)	Estimated Vacancy Rate (% of Mkt.)	Effective Space Available (Sq. Ft.)	Gross Land Area Requirement Periodic (Acres)	Gross Land Area Requirement Cumulative (Acres)	Available Acreage (1)	Oversupply or (Undersupply)
Pre-1978	430,000	430,000	—		52.52	52.52	117.6	65.08
1978	89,600	519,600	3.50%	18,186	10.94	63.46	124.6	61.14
1979	94,500	614,100	1.00%	6,141	11.54	75.00	132.6	57.60
1980	39,800	653,900	2.00%	13,078	4.86	79.86	132.6	52.74
1981	16,300	670,200	2.50%	16,755	1.99	81.85	141.6	59.75
1982	28,800	699,000	2.00%	13,980	3.52	85.37	141.6	56.23
1983	43,100	742,100	1.00%	7,421	5.26	90.63	147.7	57.07
1984	57,300	799,400	0.50%	3,997	7.00	97.63	217.9	120.27
1985	68,700	868,100	1.00%	8,681	8.39	106.02	217.9	111.88
1986	85,700	953,800	2.00%	19,076	10.47	116.49	217.9	101.41
1987	108,600	1,062,400	3.00%	31,872	13.26	129.75	217.9	88.15
1988	122,200	1,184,600	3.50%	41,461	14.92	144.68	217.9	73.22
1989	139,500	1,324,100	4.50%	59,585	17.04	161.71	223.7	61.99
1990	171,000	1,495,100	5.00%	74,755	20.88	182.60	223.7	41.10
1991	118,200	1,613,300	6.50%	104,865	14.44	197.03	223.7	26.67
1992	55,000	1,668,300	7.50%	125,123	6.72	203.75	223.7	19.95
1993	36,940	1,705,240	8.50%	144,945	4.51	208.26	223.7	15.44
1994	18,900	1,724,140	9.00%	155,173	2.31	210.57	223.7	13.13
1995	38,600	1,762,740	9.50%	167,460	4.71	215.28	233.6	18.32
1996	64,500	1,827,240	9.25%	169,020	7.88	223.16	233.6	10.44
1997	56,400	1,883,640	8.50%	160,109	6.89	230.05	233.6	3.55
1998	38,400	1,922,040	7.50%	144,153	4.69	234.74	233.6	(1.14)
1999	45,000	1,967,040	5.50%	108,187	5.50	240.24	305.8	65.56
Annual Average 1978-1999	73,192		4.69%		8.94			

Note: Figures include some quasi-commercial space in industrial parks.
(1) Available acreage increases with the opening of new industrial/business subdivisions. Excludes OTEC and HOST Parks.

Source: Various, CB Commercial, and The Hallstrom Group, Inc.

oriented and upscale residential product, and success of numerous "big box" retailers has vitalized the construction, trade and service sectors. The cumulative effect has been to absorb the inventory oversupply in industrial real estate which existed in the early to mid-1990s, and create a favorable high demand cycle. Finished space absorption has been slowed by lack of new product, not limited demand, a situation which will change as new buildings are constructed at Kaloko Industrial Park II and the Kohanaiki Business Park.

In response to the development at Kohala resorts and a general economic upturn, the industrial sector surged upwards during the mid- to late 1980s, followed by a deep recession that lasted until mid-decade in the 1990s. Construction and absorption similarly peaked and waned over the past 18 years, typically with a 12 to 18-month delayed reaction period. With virtually every major economic indicator pointing to a regional upcycle beginning in 1997-1998, the current high demand is an expected by-product of the general upturn.

The actual number of lots absorbed in 1999 outpaced the finished space land requirement. Two projects, the Kaloko Business Park, or Kaloko Phase II (35 one-acre lots), and Kohanaiki Business Park development (26 one- to five-acre lots), sold more than 80 percent of their available inventory during last year, at prices ranging from $8.50 to $18.00 per square foot. While the successful offerings were the culmination of several years of pre-sale marketing, the exceptional acceptance of the product is of significant note. Our discussions with realtors indicates demand for additional lots continues.

An excellent picture of the finished space market leasing conditions can be taken from *West Hawaii Today*, the only daily newspaper in leeward Big Island and the primary vehicle for advertising available space, as the MLS does not contain such data. We have surveyed listings in the "Business Property for Rent" section of the classifieds on a biannual basis from October 1987 through October 1999.

While it is challenging to make exact industrial versus commercial space delineations, we estimate there is some 100,000 to 110,000 square feet of finished vacant industrial floor space in the regional market, which equates to a vacancy rate of 5.5 percent. This is the lowest amount of available space since 1991, and the lowest vacancy rate since 1990. During the preparation of this report, absorption of available space quickened significantly, with the vacancy rate

dropping by more than 1.5 points in the last quarter of 1999. Recent discussions indicate vacancy levels are now at about five percent.

The increase in demand is reflected in the tightening rent rolls of multi-tenant buildings. In the Kona Industrial Park, about 30 percent mixed-use buildings have space available, down from 40 percent one year ago. In the Kaloko Industrial Park, about 8 to 10 percent of multi-tenant projects are offering floor space, down from 12 to 15 percent in mid-1999.

The strongest space demand is coming from the industrial users (contractors, suppliers, storage and specialty service providers) not the quasi-commercial users, who now have numerous alternatives at in-town developments. The industrial users favor the access, lesser congestion, joint industrial use mix, and lower rents of the Kaloko-Honokohau area.

The landlords report that up until mid-1999 it was a common practice to offer 30 to 60-plus days free rent during a move-in period. However, there has been a stiffening of incentives in recent months as the market has strengthened.

Based on discussions with brokers and agents, it is apparent the new offerings have gone a long way to meeting the pent-up demand that had been emerging very slowly during the prolonged recession. The last significant addition to the standing lot inventory had been in 1987, and the intervening decade without additional supply had developed some new or expanding interest in alternative sites awaiting favorable economic conditions despite the generally slow conditions from 1991 into 1997.

However, with the signals pointing to a meaningful upcycle emerging in West Hawaii, there continues to be a demand for industrial lots. Agents report resale discussions among the initial buyers at the new projects, and that investors are now again showing interest in lots in the region, whereas virtually all of the original purchasers were end-user parties.

3. Demand Conclusions

Based on our investigation and analysis of the West Hawaii industrial market sector, we have reached the following conclusions:

- The long-term economic future of the study region is positive, with significant growth anticipated in population and consumer levels, business activity, development and the primary industries over the long term. This will create demand for an estimated 3.18 million square feet of finished industrial space over the next two decades if the goal of a modern, service-based economy is to be achieved. Upwards of 388 bulk acres of holdings will be required to meet the needs.

- Following an extended period of low activity in early to mid-decade, the West Hawaii economy and industrial real estate sector (a foundational indicator) have shown substantial recovery and growth since late 1996, with particular strength over the past nine months. An average of 73,200 square feet has been leased annually, a figure which will likely be broken in 2000-2001 as the market continues a general upcycle which began in 1996-1997. Regional demand is expected to reach up to 125,000 square feet annually by mid-decade, with demand for about 15 new finished lots each year.

- We anticipate the industrial sector expansion will continue over the next several years as increasing tourism, construction activity and business development and enlargement occurs. This will be the second major thrust towards standard urbanization for West Hawaii. Thereafter, demand will stabilize at a lower level and show more gradual growth.

We anticipate the large majority of this development/use (90 to 95-plus percent) will be focused along Queen Kaahumanu Highway between northerly Kailua-Kona and the Kona International Airport.

Identification of Supply

1. Existing Supply

There are currently nine major industrial developments in West Hawaii, seven of which are "general" market developments. An overview of the inventory offered and their general status are individually summarized in the following paragraphs and on Table 5.

TABLE 5

SUMMARY OF MAJOR EXISTING INDUSTRIAL PROJECTS
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Chronological Order of Development

Project Name	Location	Approx. Gross Average	Number of Subdivided Lots	Original Offering Date	Land Tenure	Original "Sales" Price (per Sq Ft)	Absorption Speed (lots/year)	Lot Size Range (acres)	Comments
Kaul Home II	Kamakau, North Kohala	81.6	23	1968	Lease	$0.60	1.15	1.0 to 12.9	IGSL park not truly marketed until mid-70's.
Kona Industrial Subdivision	Kailua-Kona, North Kona	52.3							Main industrial park in West Hawaii, adjacent to Kailua-Kona. Subject to expansion area for project.
Phase I			18	1969	Lease	$0.70 (1)			
Phase II			11	1973	Lease	$2.30			
Phase III			7	1977	Lease	$3.10			
Phase IV			8	1979	Lease	$3.23			
Phase V			8	1981	Lease	$4.89			
Totals			53						
Honokohau Small Boat Harbor	Honokohau, North Kona	6.1	4	1983	Lease	$4.00	4.00	.23 to 4.1	State harbor support lands, must be service-related use. Rents to reach market levels by 1995.
Kaloko Industrial Park	Kaloko, North Kona	70.2	15	1984	Fee	$6.75	13.47	1.0 to 1.4	First major fee park in region, much space occur. in late 80's.
Hawaiian Ocean Sciences and Technology (HOST) Park (2)	Kaloko, North Kona	547.0	Open	1990	Lease	Open	0.00	Open	Major directed-use development. No tenants as yet.
State Kaloko Subdivision (2)	Kaloko, North Kona	5.8	4	1990	Lease	$12 to $18	4.00	.2 to 1.1	On Hwy, adjacent to police and waste transfer stations.
Honokohau Mauka Ind. Subdivision	Honokohau, North Kona	9.9	3	1995	Fee	$6 to $26 (4)	3.00	3.1 to 3.5	Mauka of boat harbor, developed as joint venture. Highway-front park is demand.
Kaloko Business Park	Kaloko, North Kona	34.3	32	1999	Fee	$8 to $22	—	1.0 to 1.7	Expansion of industrial park, 14 lots in negotiations/escrow after two years pre-sale efforts.
Kahaoshi Business Park	Kahaoshi, North Kona	37.9	26	1999	Fee	$8.50 to $17.11	—	1.0 to 1.1	New park, 23 lots sold or reserved.

Note: List does not include heavy-industrial, marine-oriented State subdivision at Kawaihae Harbor, non-competitive Waimea lands, NELH tract or other minor projects.

(1) Fee simple indicator taken from basis for lease rent or capitalized value of rents.
(2) Unavailable for open market light industrial and quasi-commercial uses. Not considered as providing competitive product.
(3) Market portion only of state 60-plus acre subdivision, remainder of land in public use.
(4) Average indicated value of $18.43 per square foot at basis. Portions of Highway-front larger parcel subsequently leased for $26 per SF.

Source: County Planning Department, Various and The Hallstrom Group, Inc.

These developments are generally built-out, with just a few remaining vacant lots in the most competitive of the older developments (the new projects at Kaloko and Kohanaiki have yet to be built upon). With the exception of the new projects, the existing subdivisions do not have the capacity to provide meaningful additional inventory supply to the general industrial sector.

2. Proposed Supply

There are numerous industrial projects proposed for West Hawaii over the coming decade(s). These planned developments are summarized on Table 6.

Cumulatively, the "probable market" subdivisions in the primary study area will contain some *752 gross* acres of "light" industrial and mixed-use lands, which would equate to circa *500 to 560 net* acres (or less) of finished sites.(2) Apart from the subject, the total proposed addition to the industrial supply would be 650 gross acres or some 430 to 485 net acres of finished lots.

Several additional projects have been proposed. However, for the most part they are either outside the primary market area, have specialized uses proposed or have uncertain status at this time. We have considered it unlikely these secondary projects can/will provide meaningful competitive inventory during the projection period.

Based on our analysis, apart from the subject, the total probable development for competitive light industrial and mixed-use industrial/commercial acreage in the primary study area during the study period is only some 423 gross acres and 282 to 317 net acres.

The 100-acre addition to Kona Industrial Park has been long-delayed, will be focused towards commercial uses (perhaps exclusively), and has an underlying land tenure (leasehold) which the market has now largely rejected. The expansion of industrial lands at Kealakehe as part of the state master planned community are only a minor concept within a slow moving major development and may never be actualized. The Hawaiian Homelands project is also leasehold, well outside the primary market sector, has been on hold for more than a decade, and is not considered competitive.

(2) Excludes 102.429 acres of Quarry/"Heavy" Industrial lands at the proposed Kaloko-Honokohau Business Park.

TABLE 6

SUMMARY OF MAJOR PROPOSED INDUSTRIAL PROJECTS
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

Project Name	Location	Planned Inventory: Approx. Gross Acreage	Planned Inventory: Estimated Floor Space (1) (in Sq Ft)	Estimated Operation Date	Comments
PROBABLE "MARKET" PROJECTS					
Kaloko Industrial Park Phases III & IV	North Kona	103	740,502	2003	N. Adjacent to subject property.
Honokohau Business Park, Phase I	North Kona	150 (2)	718,740	2003	Subject, has 50+ ac. heavy ind.
Honokohau Business Park, Phase II	North Kona	140 (2)	646,846	2011	Subject, has 50+ ac. heavy ind.
Honokohau Business Park, Phase II	North Kona	33	211,559	2020	Subject, no heavy industrial.
Honokohau Marina Ind. Subdivision, Phase II	North Kona	54	388,120	Mid-Decade	Upslope expansion of existing park.
Kohanaiki Business Park, Phase II	North Kona	31	222,869	Mid-Decade	Upslope expansion of existing park.
Keauhombo (QLT) Project	North Kona	100	718,740	Unknown	Expansion of Kona Ind. Sub. and other nearby lands. (4)
Bata Kealakehe Subdivision, Phase II	North Kona	50	359,370	Unknown	Considered as component of various master plans for large mass building.
Ilevenlau Ilimoe Lands Project	North Kohala	154	1,104,860	Unknown	Expansion of Kawi Hawi II Park.
Parker Ranch 2020 Site	North Kohala	25	179,685	On Hold	Part of regional master plan. Near Kamuela Airport. Timing uncertain.
SPECIALIZED OR UNCERTAIN PROJECTS					
Mauna Lani Resort	South Kohala	105	N/A	On-hold	In resort use. Master plan allocation.
Waikoloa Resort	South Kohala	230	2,041,875	On-hold	Part of DLU approved plan, may be withdrawn upon revision.
Kawaihae Harbor Project	South Kohala	N/A	N/A	On-hold	Potential State-sponsored park.
Oanea Project	North Kona	50	403,375	On-hold	Support for HOST Park.

(1) Assuming FAR of .33 of net acreage (70% of gross), unless other indicators available.
(2) Includes 50 acres of heavy industrial/quarry lands. Floor area estimate for 100 acres of light industrial/commercial only.
(3) Includes 50 acres of heavy industrial/quarry lands. Floor area estimate for 90 acres of light industrial/commercial only.
(4) Includes master-planned areas calling for mixed-use industrial/business park development and quasi-commercial uses. Developer focusing on mauka commercial/residential lands. Kona acreage has been utilized for temporary soil stockpiling.

Source: County Planning Department, Various EIS, and The Hallstrom Group, Inc.

Of the secondary projects, all are uncertain at this time, except for the Parker Ranch lands at Kamuela Airport which though now on hold may be developed during the projection period. Tenure concerns, master plan changes, entitlement issues and competitiveness make any significant competitive addition to regional industrial supply unlikely.

While there has been meaningful additional industrial land supply added in the past year, it has been readily sold and will serve to meet pent-up demand which has steadily grown over the past decade and as will be produced in the initial phases of the emerging economic upcycle. Thereafter, over the mid- to long-term there will be relatively limited amounts of additional lot inventory based on the proposed developments to date apart from the subject.

Correlation of Demand and Supply Indicators

The demand for additional industrial lands in West Hawaii over the coming two decades is estimated at 388 gross acres. There are some 65.8 acres of available existing competitive general industrial supply, or about four to five years worth of developable inventory.

Probable general-market development during the projection period, apart from the subject will total some 188 gross acres, with the majority being within the Kohanaiki to Honokohau neighborhood.

Our projections of finished industrial space demand, the maximum available acreage to meet demand and resulting gross oversupply/undersupply, are shown on Table 7.

Without the subject there will be insufficient supply to meet demand levels during the projection period, and there will be a shortfall in supply of up to 200 gross acres, or the equivalent of 140 to 160 net acres and 1.5-million-plus square feet of finished floor space. This insufficiency would undoubtedly result in an unnecessary disruption to the on-going evolution of the West Hawaii economy due to a lack of available lands to service market needs.

Analysis of Quarry and General Industrial Market Factors

The demand for the 102.249-acre quarry portion of the subject will be a product of material needs created in the West Hawaii construction industry in coming decades, and for the use of the lands as "heavy" (or general) industrial sites following the completion of mineral extraction. As the region continues in its drive towards urbanization

TABLE 7

SUMMARY OF PROJECTED ABSORPTION OF INDUSTRIAL SPACE IN WEST HAWAII 2000 TO 2020, EXCLUDING SUBJECT PROPERTY
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

Year	Finished Space Demand Annual (Sq. Ft.)	Finished Space Demand Cumulative (Sq. Ft.)	Estimated Vacancy Rate (% of Mkt.)	Effective Space Required (Sq. Ft.)	Gross Land Area Requirement Periodic (Acres)	Gross Land Area Requirement Cumulative (Acres)	Available Acreage	Oversupply or (Undersupply)
2000	124,850	2,036,500	5.50%	112,008	14.33	254.57	305.8	51.23
2001	124,850	2,161,350	5.25%	113,471	14.33	268.90	305.8	36.90
2002	124,850	2,286,200	5.00%	114,310	14.33	283.23	305.8	22.57
2003	124,850	2,411,050	5.00%	120,553	14.33	297.56	408.8	111.24
2004	124,850	2,535,900	5.00%	126,795	14.33	311.89	408.8	96.91
2005	141,179	2,677,079	5.00%	133,854	16.21	328.10	462.8	134.70
2006	141,179	2,818,258	5.00%	140,913	16.21	344.30	493.8	149.50
2007	141,179	2,959,437	5.00%	147,972	16.21	360.51	493.8	133.29
2008	141,179	3,100,616	5.00%	155,031	16.21	376.71	493.8	117.09
2009	141,179	3,241,795	5.00%	162,090	16.21	392.92	493.8	100.88
2010	171,168	3,412,963	5.00%	170,648	19.65	412.57	493.8	81.23
2011	171,168	3,584,131	5.00%	179,207	19.65	432.21	493.8	61.59
2012	171,168	3,755,299	5.00%	187,765	19.65	451.86	493.8	41.94
2013	171,168	3,926,467	5.00%	196,323	19.65	471.51	493.8	22.29
2014	171,168	4,097,635	5.00%	204,882	19.65	491.16	493.8	2.64
2015	198,612	4,296,247	5.00%	214,812	22.80	513.95	493.8	(20.15)
2016	198,612	4,494,859	5.00%	224,743	22.80	536.75	493.8	(42.95)
2017	198,612	4,693,471	5.00%	234,674	22.80	559.55	493.8	(65.75)
2018	198,612	4,892,083	5.00%	244,604	22.80	582.35	493.8	(88.55)
2019	198,612	5,090,695	5.00%	254,535	22.80	605.14	493.8	(111.34)
2020	198,612	5,289,307	5.00%	264,465	22.80	627.94	493.8	(134.14)
Annual Average 2000-2020	160,841		5.04%		18.46			

Note: Figures include some quasi-commercial space in industrial parks.
(1) Available acreage increases with the opening of new industrial/business subdivisions. Excludes OTEC and HOST Parks.

Source: Various, CB Commercial, and The Hallstrom Group, Inc.

and a standing as a typical modern community, significant quarry materials will be required. While there are many potential resource locations in the area, the actual active output is highly limited, and focused on the subject property.

We have not quantified the raw materials demand of the region, but recognize that fulfillment of the projected development levels will require the construction of nearly 20,000 resident homes, up to 5,000 non-resident second homes, and more than 6,000 visitor units, in addition more than four million square feet of commercial and industrial buildings. To service these project, new roads and public facilities must also be constructed.

At the very least, the demand for materials will rise slightly from current levels and continue unabated for more than twenty years. The need for a stable supply of consistent quality materials from an efficient quarry operator will be vital to the long-term health of the construction industry and the regional economy as a whole.

In recognition of this need, WHC, Ltd., has entered into a long-term agreement (potentially extending through 2025) with the subject landowners to mine, store and prepare quarry materials on some 50 to 60-plus acres of the Kaloko-Honokohau Business Park site. A series of secondary and sub-lease agreements have also been signed which provide for a concrete batching plant, concrete pre-fabrication casting, and asphalt mixing plant. These uses are a natural compliment to a quarry operation, and the need for these products will similarly increase as the region is urbanized over time.

In addition to its material resources, the subject is an excellent location for this use as it is close to the areas in which development is taking place (limiting transportation times and increasing general construction efficiencies) and has direct access onto the primary thoroughfare of the are (Queen Kaahumanu Highway).

We consider the existing, in-place operations and their expressed desires to continue their long-term leasing arraignments as the best market evidence of the appropriateness of the subject for quarrying uses and the evident demand for such uses.

After the quarry operations have consumed the resource materials, the level site will be an appropriate location for "heavy" (or general)

industrial uses. It is likely that some of the existing uses, which currently utilize about 20 acres of the site, would remain in-place and import materials from other locations.

Other uses which need large acreage, accessible sites, but not the finish or comparatively high-quality improvements found in industrial or mixed-use settings include:

- Truck/Heavy Equipment Baseyard and Maintenance Facilities
- Heavy Equipment Dealerships
- Bulk Storage Facilities (Including materials inappropriate for intense urban locations)
- Building Materials Storage and Sales
- Chemical/Materials Processing Plants
- Petroleum Products Processing and Storage
- Recycling and Scrap Yards
- Transhipment Storage Location
- Biomass Composting and Landscaping Materials Storage and Sales
- Meat/Fish/Produce Packing and Preparation Plants
- Manufacturing and Assembly Facilities
- Telecommunication and Energy Substations

Some of these uses are considered to be "poor" neighbors in the close proximity of a typical industrial park, particularly among businesses having a commercial-orientation. But it is necessary to provide for such uses in a diverse modern economy, especially one as the Big Island which is experiencing instability in the agricultural sector and (many feel) is becoming too dependant upon tourism.

The landowners have received inquiries from representatives of many of these use types who have expressed interest in locating in the quarry area of the subject site.

According to the DBEDT *Directory of Industrial and Technology Parks*, Oahu has some 1,720 acres of heavy/general industrial sites supporting these multi-acre tenant use-types, most located at or near the James Campbell Industrial Park, or in Iwilei/Mapunapuna. This equates to approximately one acre per 538 island residents.

While the level of such lands on Oahu would be expected to be high, as some of the lands are dedicated to maritime/waterfront-oriented uses and the island is the focal point of transhipment and manufacturing, an appropriate level for West Hawaii would be in the range of one acre per 750 to 1,000 persons upon full transition of the region into a standard urban economy.

Based on this comparison, the demand for heavy/general industrial lands in West Hawaii by the year 2020 will be in the range of 104 to 139 acres.

At present the only nominal concentration of such sites are located at Kawaihae Harbor (maritime-oriented) and a few users in the Kaei Hana II Industrial Park. For these uses to be competitive a more proximate location to the workers and end-users in the Keahole to Kailua-Kona corridor would be necessary, and there are few alternative currently being forwarded outside of the subject development.

We therefore conclude it is likely the 100-plus acres of heavy/general industrial sites which will be created following the completion of quarrying operations should be absorbed by the existing tenants and market in a reasonable period as the quarry operation utilizes the resource materials.

Appropriateness of the Subject for the Planned Use and Absorption Estimates

The subject site is a highly appropriate location for a mixed-use industrial and service/commercial development as proposed due to a variety of reasons, most notably:

- *It has easy direct onto the major regional thoroughfare.* The park will have excellent access via a dedicated intersection onto Queen Kaahumanu Highway, which is the main economic arterial along the West Hawaii coastline. The highway allows the most direct access to the transhipment infrastructure (notably Kawaihae Harbor and Kona International Airport) and the major business areas of the region (the coastal resorts and central Kailua-Kona). Also, it is likely that several of the interior roads will someday be extended into the bulk acreage holdings to the north and south of the site as a mauka reliever to the highway, placing the subject property at the junction of several critical secondary roads.

- *It is adjacent to existing development containing similar uses.* Industrial businesses typically rely on proximity to supporting services, suppliers and storage facilities, and often find their primary customers to be other industrial-oriented concerns. Proximity also lessens travel times, allows easy and frequent face-to-face contact among businesses, and provides outside customers with relatively "one stop" convenience for a variety of services and goods. Commercial businesses thrive in close proximity to one another, by providing a wide range of competitive options for customers, speedier deliveries due to the concentration effect, and the benefits of cumulative attractions (or "critical mass") in the marketplace.

- *It is within an area well-established in the marketplace as an industrial and mixed-use location.* Businesses and investors commonly hold the perception there are advantages to being within a recognized trade community, from an operating perspective (greater customer awareness and traffic) and in regards to potential property re-sale characteristics (higher values in higher demand areas). This allows for both collective promotion and ease in individual marketing. The marketplace viewpoint is that the Kohanaiki-Kaloko-Honokohau area has now become "the" location for major industrial development in West Hawaii (supplanting the Kona Industrial area), a concept unlikely to change during the foreseeable future, which will inherently increase the level of general demand for such development in the area.

- *The proposed subject use conforms with all relevant public and private land use master plans for the area.* The market has a strong tendency to be guided by long-range plans developed by governmental agencies and leading landowners, and make purchase and trade adjustments accordingly. In its West Hawaii Regional Plan (1989), the state Office of Planning identifies the subject as being within the Keahole to Kailua-Kona sub-regional planning area, is described as "in-filling the undeveloped area south of the airport... logical given its proximity to the existing urbanized area and that availability of infrastructure," with industrial uses cited as a specific favorable use type. The County of Hawaii Keahole to Kailua Development Plan (1989) similarly identifies the corridor as a prime urban expansion area and specifically calls for industrial type uses in the Kaloko neighborhood mauka of Queen Kaahumanu Highway. Several major landowners in the region have also produced master plans calling for additional industrial and service/commercial development along the highway. Business, investors and developers will look to these plans for guidelines, and this will be reflected in market activity.

- *Apart from the proposed use, there is no significant alternative economic use for the property in the foreseeable future.* The land has poor/limited agricultural potentials, being off-water it has no resort characteristics, it is in an elevational/climate band that is not considered desirable by permanent residents, and has no meaningful scenic beauty or archaeological sites which would create demand for a park or other public use of the holding. given these attributes (or lack thereof) the only reasonable use for the site from a market perspective is for some form of industrial and/or commercial uses.

- *The proposal brings the existing quarry into conformance with land use designation guidelines and will be an excellent site for needed "Heavy" (General) Industrial uses in West Hawaii.* Significant quarry materials will be needed in the study region over the coming decades as the area continues to be developed and move towards a typical modern, urban community. This trend will also create meaningful demand for heavy or general industrial uses in the area. Currently, the demand for such use types is limited due to the size and make-up of the area's economy, with most being met by Hilo or Kawaihae lands. However, as west Hawaii becomes more diverse and urbanized, a significant need for storage, processing and construction of atypical industrial uses will be created (as is seen on Oahu at the Campbell Industrial Park and at Kahului, Maui). The subject will provide a large, closed-in land area already in quarry and batch-plant use for these businesses to use. Alternatives will otherwise be limited, outlying, or otherwise out of character with surrounding uses.

Based on these attributes of the subject property, the industrial sector demand/supply indicators, and the historic experience of other projects in the regional marketplace, we have estimated the probable absorption velocity for the subdivided subject lots using three methodologies:

Basic Demand/Supply Comparison -- This straight-forward technique assumes that if there is insufficient existing and planned supply to meet projected market gross demand levels during the projection period, the proposed subject lots will be absorbed in a reasonable manner, regardless of competitive qualities, as there are no other alternatives available. As previously noted, such a nominal condition will likely transpire in West Hawaii during the study period, and the undersupply condition will be sufficient to absorb the project within the projection timeframe.

The Residual Method -- In this technique, all of the major proposed industrial commercial projects are placed on a time-line depicting the sales absorption either anticipated by the developers (as stated in EIS, reported in the media or through interviews) or assuming a reasonable market share. To the extent these projects and the remaining existing market land/space supply fall short of the forecast demand for space in the study region or exceed the total, a respective undersupply or oversupply situation is present.

Having accounted for all of the proposed space in the market, and acknowledging the unlikelihood of otherwise buildable sites in the region, it can be asserted the subject development will capture a significant portion of any residual demand. This approach is generally conservative, as it assumes the subject

will capture only what is left over after all other projects garner their share. Given the nature of the subject holding we believe it could be a regional market leader, not a follower.

As there are limited number of projects which will be providing competitive lots during the subject sell-out period, we project the total absorption using this method will require about 10 to 11 years for the first phase of the development, four to six years for the second phase, as it would virtually capture all the market, and two to four additional years for the third phase.

The Market Shares Method -- This approach accounts for the probable competitiveness of the subject inventory regardless of the total level of product being otherwise offered on the market. In essence, it is an estimate of how much of the total forecast demand in the West Hawaii industrial and mixed-use markets the subject could expect to achieve on an annual basis in light of its locational, pricing and amenity characteristics.

Generally moderate in application, this technique tests "pure" competitiveness and is considered the classic methodology, but does require subjective selection of factors. We conclude the subject will have average to good competitive features, and forecast the absorption of the first phase will require from 10 to 13 years using this method. The second phase would need from six to nine years, and the third phase will require an additional three to five years.

Correlation

Given the favorable attributes of the subject property (primarily access/frontage on Queen Kaahumanu Highway), and the market acceptance of the adjacent existing industrial parks, the subject is likely to gain a favorable share of the regional market demand. **We therefore project the first phase subject lots will be absorbed by the market within an approximately 10-year period from the beginning of initial sales. The second phase will require nine to ten years, and the third phase another four to six years.**

The demand for the quarry materials and concurrent and subsequent "heavy" (general) industrial uses is more difficult to quantify using these methods. Most importantly, there is existing and projected demand for the materials and in-place production as evidenced by the

success of the on-going businesses and their efforts to secure the long-term access to and use of the site. If there were other more suitable alternatives, they would be in use at this time. Similarly, there are no near to mid-term competitive alternatives available for heavy industrial uses. Thus, in regards to the three methods, the indicators for the subject are highly favorable as the limited amount of competing supply means the base comparison, residual and market shares indicators would all be extremely high. We conclude the subject quarry/heavy industrial area would be mined and developed (absorbed) over about 20 years based on comparison with other island locales. Or, some ten years each for the 50-acre portions included in the first and second phases.

Economic Impact Analysis of the Proposed Development

The development of the Kaloko-Honokohau Business Park will result in significant expenditures that will favorably impact the West Hawaii economy on both a direct and indirect basis, increasing the level of capital investment and capital flow in the region, which will in turn create employment and widen the tax base.

From a direct perspective, the proposed 150 to 200 industrial and mixed-use lots, and 15 to 30 quarry/heavy industrial sites, will create numerous construction, equipment operator and specialty trade jobs on- and off-site during the planning and emplacement of the infrastructure and building of the improvements. After completion of the industrial and commercial buildings and related and facilities over an estimated 13-year total development period, there will be additional employment positions created in the operating industrial and commercial business, and in the upkeep of the structures (landscape service, maintenance, and renovation needs in the course of their use).

Numerous local businesses will enjoy significant profit opportunities arising for contracting companies constructing the improvements, and for local businesses which would supply a substantial portion of the materials needed in the building efforts.

Indirectly, as these wages, profits, and expenditures move through the regional economy, they will have a ripple, or "multiplier," effect--increasing the amount of capital flowing to the entire community as a result of the subject.

Construction, operational and other workers earning wages from the subject and associated off-site efforts will spend the majority of their income on living and entertainment expenses while supporting and patronizing other island businesses. Much of this spending would be re-directed by these businesses to other island industries, and significant portions of these secondary profits would in turn be put back through the region's economic and tax structure.

These substantial direct and indirect economic impacts associated with the proposed subject project are all the result of the capital investment and entrepreneurship necessary to convert undeveloped and limited-use agricultural lands into a competitive, modern industrial and business park. The Big Island economy will be meaningfully stimulated by the capital investments and business operations within the Kaloko-Honokohau Business Park development.

Among the primary conclusions from our economic impact study, as summarized on Tables 8, 9 and 10, are:

- The project will be a significant source of employment for the region, during both construction and on-going operation. We have projected it will require approximately 34 years from ground-breaking to total community build-out. During this time, there will be an estimated 116,455 full-time equivalent worker years of employment created on-site, with an additional 58,228 worker years in off-site positions. After completion, there will be some 6,715 permanent on-site jobs in the various businesses housed in an estimated 2,420,000 square feet of finished floor space and an additional 3,357 off-site support positions.

- Total wages paid into the region as a result of the subject development during the 34-year construction and initial business operation period will be in excess of $5.2 billion in constant year 2000 dollars, including the on-going business operations, with a stabilized operating payroll (on and off-site positions) of about $298.75 million. The total direct costs capital investment required for the project will be about $329.6 million, or the equivalent of more than three resort hotels. Area contractors and suppliers should reap profits approaching $46 million from the project.

TABLE 8

CONSTRUCTION COSTS AND CONTRACTOR AND SUPPLIER PROFIT ESTIMATES
Market Study, Economic Impact Analysis, and Public Consultation Assistance
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	11	12
Construction Costs:												
Infrastructure (1)	$2,750,000	$2,250,000	$4,500,000	$4,125,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000
LIA/Retail-Inn Construction (2)					$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
OMI Construction (3)			$4,500,000	$4,125,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000
TOTAL CONSTRUCTION COSTS	$2,750,000	$2,250,000	$9,000,000	$8,250,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000
CONTRACTOR'S PROFIT	$275,000	$225,000	$450,000	$412,500	$1,125,000	$1,125,000	$1,125,000	$1,125,000	$1,125,000	$1,125,000	$1,125,000	$1,125,000
SUPPLIER'S PROFIT	$82,500	$67,500	$135,000	$123,750	$337,500	$337,500	$337,500	$337,500	$337,500	$337,500	$337,500	$337,500

Development Year	13	14	15	16	17	18	19	20	21	22	23	24	Totals
Construction Costs:													
Infrastructure (1)	$1,250,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$11,250,000		$99,000,000
LIA/Retail-Inn Construction (2)	$9,750,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000		$21,000,000
OMI Construction (3)	$11,000,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$11,750,000	$13,250,000	$270,000,000
TOTAL CONSTRUCTION COSTS	$22,000,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$22,500,000	$24,000,000	$13,250,000	$390,000,000
CONTRACTOR'S PROFIT	$2,200,000	$2,250,000	$2,250,000	$2,250,000	$2,250,000	$2,250,000	$2,250,000	$2,250,000	$2,250,000	$2,250,000	$2,400,000	$1,325,000	$39,000,000
SUPPLIER'S PROFIT	$660,000	$675,000	$675,000	$675,000	$675,000	$675,000	$675,000	$675,000	$675,000	$675,000	$720,000	$397,500	$11,700,000

(1) Total direct costs only for infrastructure estimated at $99,000,000. Phase I costs of $11,000,000 incurred in Years 1 & 2. Phase II costs of $11,000,000 incurred in Years 12 & 13, and Phase III costs of $11,000,000 in Year 22.
(2) Light Industrial and Mixed-Use Industrial/Commercial construction estimated average improvement cost of $11,025,000 per increment, 12,000 square feet at $133 per square foot, plus $133,000 for site work, rock walls, parking & landscaping.
(3) Quarry and "Heavy" Industrial construction estimated at one structure per four acres with average total cost of $1,000,000 per building. Phased to occur after site is quarried.

Source: Various, and The Hallstrom Group, Inc.

TABLE 10

SUMMARY OF ECONOMIC IMPACTS ASSOCIATED WITH DEVELOPMENT
Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	11	12
ANNUAL WAGES	$1,150,000	$920,000	$11,066,063	$19,347,625	$30,500,625	$40,507,625	$50,506,625	$60,509,625	$70,512,625	$80,515,625	$90,518,625	$101,211,625
CONTRACTOR'S PROFIT	$775,000	$225,000	$630,000	$812,500	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,250,000
SUPPLIER'S PROFIT	$82,500	$67,500	$360,000	$325,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$482,500
TOTAL BASE IMPACT	$1,307,500	$1,212,500	$11,976,063	$20,485,125	$32,005,625	$42,000,625	$52,011,625	$62,014,625	$72,017,625	$82,020,625	$92,023,625	$103,944,125
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$3,015,000	$2,425,000	$23,952,125	$40,970,250	$64,011,250	$84,017,250	$104,023,250	$124,029,250	$144,035,250	$164,041,250	$184,047,250	$205,888,250

Development Year	13	14	15	16	17	18	19	20	21	22	23	24
ANNUAL WAGES	$110,637,125	$120,327,625	$130,330,625	$140,333,625	$150,336,625	$160,339,625	$170,342,625	$180,345,625	$190,348,625	$200,954,125	$208,321,813	$218,324,813
CONTRACTOR'S PROFIT	$1,200,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,175,000	$1,075,000	$1,075,000
SUPPLIER'S PROFIT	$467,500	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$460,000	$430,000	$430,000
TOTAL BASE IMPACT	$112,304,625	$121,832,625	$131,835,625	$141,838,625	$151,841,625	$161,844,625	$171,847,625	$181,850,625	$191,853,625	$202,589,125	$209,826,813	$219,829,813
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$224,609,250	$244,865,250	$264,871,250	$284,877,250	$304,883,250	$324,889,250	$344,895,250	$364,101,250	$384,107,250	$405,178,250	$419,653,625	$439,659,625

Development Year	25	26	27	28	29	30	31	32	33	34	Totals Year 1-34	Incubator
ANNUAL WAGES	$226,974,688	$230,004,563	$243,194,438	$254,304,313	$263,414,188	$272,524,063	$281,633,938	$290,743,813	$299,853,688	$302,990,313	$3,213,423,563	$298,750,313
CONTRACTOR'S PROFIT	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$325,000	$32,962,500	
SUPPLIER'S PROFIT	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$130,000	$13,095,000	
TOTAL BASE IMPACT	$228,339,688	$231,449,563	$244,559,438	$255,669,313	$264,779,188	$273,889,063	$283,998,938	$292,108,813	$301,218,688	$303,445,313	$3,259,481,063	$298,750,313
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$456,679,375	$474,899,125	$493,118,875	$511,338,625	$529,558,375	$547,778,125	$565,997,875	$584,217,625	$602,437,375	$606,890,625	$18,518,962,125	$597,500,625

Source: Various, and The Hallstrom Group, Inc.

TABLE 9

EMPLOYEE JOB COUNT AND WAGE ESTIMATES
Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	11	12
Worker Requirements (1)												
Infrastructure	20	16										12
Building Construction			48	60	80	80	80	80	80	80	80	80
Business Operations			186	256	300	804	1,028	1,252	1,476	1,700	1,924	2,148
Bldg. Maint. & Services			1	1	2	3	4	5	6	7	8	8
Off-Site Employees (2)	10	8	117	300	331	445	536	660	781	997	1,006	1,124
TOTAL EMPLOYMENT	30	24	352	636	993	1,330	1,648	2,005	2,342	2,679	3,017	3,372
Worker Wages												
Infrastructure	$900,000	$720,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$360,000
Building Construction	$0	$0	$2,160,000	$2,700,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000
Business Operations	$0	$0	$3,952,000	$11,392,000	$16,560,000	$23,726,000	$32,096,000	$40,064,000	$47,272,000	$54,400,000	$61,568,000	$68,736,000
Bldg. Maint. & Services	$0	$0	$30,519	$29,263	$63,971	$65,676	$119,582	$138,088	$162,794	$187,500	$212,206	$236,912
Off-Site Employees (2)	$234,000	$200,000	$2,933,544	$5,216,346	$8,276,654	$11,006,949	$13,997,343	$16,707,937	$19,219,831	$22,128,125	$25,156,819	$28,008,713
TOTAL ANNUAL WAGES	$1,134,000	$920,000	$11,066,063	$19,347,625	$28,500,625	$38,507,625	$50,506,625	$60,509,625	$70,512,625	$80,515,625	$90,518,625	$101,211,625

Development Year	13	14	15	16	17	18	19	20	21	22	23	24
Worker Requirements (1)												
Infrastructure	9									7		
Building Construction	80	80	80	80	80	80	80	80	80	80	80	80
Business Operations	2,372	2,596	2,820	3,044	3,268	3,492	3,716	3,940	4,164	4,388	4,562	4,786
Bldg. Maint. & Services	9	10	10	11	12	13	14	14	15	16	17	18
Off-Site Employees (2)	1,335	1,341	1,515	1,568	1,680	1,792	1,905	2,017	2,130	2,346	2,379	2,542
TOTAL EMPLOYMENT	3,705	4,030	4,366	4,703	5,040	5,377	5,714	6,051	6,389	6,737	6,900	7,235
Worker Wages												
Infrastructure	$0	$0	$0	$0	$0	$0	$0	$0	$0	$315,000	$0	$0
Building Construction	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000
Business Operations	$75,904,000	$83,072,000	$90,240,000	$97,408,000	$104,576,000	$111,744,000	$118,912,000	$126,080,000	$133,248,000	$140,416,000	$145,984,000	$153,152,000
Bldg. Maint. & Services	$261,615	$286,374	$311,829	$335,713	$360,441	$383,147	$407,853	$434,339	$459,265	$483,971	$503,162	$527,868
Off-Site Employees (2)	$36,071,507	$31,360,301	$34,379,996	$39,109,998	$42,008,184	$44,810,678	$47,630,777	$50,431,066	$53,241,360	$56,139,156	$58,236,651	$61,044,945
TOTAL ANNUAL WAGES	$115,837,122	$119,317,675	$130,530,625	$140,533,625	$150,536,625	$160,539,625	$170,543,625	$180,545,625	$190,548,625	$200,954,125	$208,324,813	$218,324,813

Development Year	25	26	27	28	29	30	31	32	33	34	Totals Year 1-34	Incubator
Worker Requirements (1)											64	
Infrastructure	72	72	72	72	72	72	72	72	72	72	2,928	
Building Construction	4,990	5,194	5,398	5,602	5,806	6,010	6,214	6,418	6,622	6,690	113,546	6,990
Business Operations	18	19	20	21	21	22	23	24	24	25	417	25
Bldg. Maint. & Services	3,268	3,643	3,945	3,847	2,950	3,072	3,154	1,257	1,359	1,393	58,229	1,357
Off-Site Employees (2)	7,821	7,918	8,219	8,547	8,849	9,156	9,463	9,770	10,075	10,108	174,683	10,873
TOTAL EMPLOYMENT												
Worker Wages	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,475,000	$0
Infrastructure	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$109,260,000	$0
Building Construction	$159,640,000	$166,208,000	$172,776,000	$179,264,000	$185,792,000	$192,320,000	$198,848,000	$205,376,000	$211,904,000	$214,080,000	$3,833,472,000	$214,080,000
Business Operations	$330,360	$372,363	$395,360	$419,344	$440,360	$462,365	$483,363	$787,068	$730,360	$737,068	$12,123,436	$737,068
Bldg. Maint. & Services	$63,304,320	$66,863,695	$68,673,878	$71,183,445	$73,741,820	$76,301,195	$78,860,570	$81,419,945	$83,979,320	$84,833,643	$1,451,603,587	$83,972,645
Off-Site Employees (2)	$223,774,680	$236,684,363	$245,154,438	$254,234,211	$263,414,186	$272,594,063	$281,633,938	$290,743,813	$299,853,688	$302,990,313	$5,213,423,563	$298,750,313
TOTAL ANNUAL WAGES												

(1) All job counts expressed as "full-time" equivalent positions.
(2) Includes all off-site jobs created by work efforts at the project, direct and indirect.

Source: Various, and The Hallstrom Group, Inc.

- The total direct "overall" community impact from the project during its 34-year construction and initial operating period will be $5.26 billion, exclusive of the $839 million in operating revenues generated by the tenant businesses.

- At build-out the average daily working population of the Kaloko-Honokohau Business Park will be about 6,700-plus persons, with an additional 5,000 to 7,500 consumers and suppliers visiting the location each day. There will be no permanent residents in the project (no residential units) and no school age children.

- We do not foresee any significant off-site socio-economic impacts resulting from the project. There are no immediately proximate residential, resort or residential uses which could be adversely effected and the industrial mixed-use nature of the surrounding neighborhood will only benefit from the expansion of such uses. We do not foresee any increases in area property values, creation of demand for affordable housing units, or that the project will result in any meaningful amount of in-migration into the community.

Assessment of the Public Costs/Benefits Associated With the Project

We have quantified the direct areas in which the proposed subject industrial and mixed-use industrial/commercial development will potentially impact the sphere of public agency resources, and quantify (where possible) the costs of providing expanded services to the project, versus the economic benefits that accrue to the community through an increase in local and state tax payments.

As a privately built industrial project most public costs will not be increased on the state or county levels as a result of the proposed Kaloko-Honokohau Business Park. There will be no increased educational or recreational needs directly attributable to the subject development, the major public infrastructure items (highway and primary water/sewer mains) are already in place, and the development will require no specific public subsidies, welfare services, bonding or capital improvements. Primarily costs will be for emergency services, oversight and road maintenance.

TABLE 8

CONSTRUCTION COSTS AND CONTRACTOR AND SUPPLIER PROFIT ESTIMATES
Market Study, Economic Impact Analysis, and Public Cost/Benefit Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	11	12
Construction Costs:												
Infrastructure (1)	$2,750,000	$2,250,000	$4,500,000	$2,132,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000
LI/Mixed-Use Construction (2)					$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
OMI Construction (3)					$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000
TOTAL CONSTRUCTION COSTS	$2,750,000	$2,250,000	$4,500,000	$2,132,000								
CONTRACTOR'S PROFIT	$275,000	$225,000	$450,000	$213,200	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000
SUPPLIER'S PROFIT	$82,500	$67,500	$135,000	$63,960	$322,500	$322,500	$322,500	$322,500	$322,500	$322,500	$322,500	$322,500

Development Year	13	14	15	16	17	18	19	20	21	22	23	24	Totals
Construction Costs:													
Infrastructure (1)	$1,250,000												$97,500,000
LI/Mixed-Use Construction (2)	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000		$130,000,000
OMI Construction (3)	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000		$10,750,000
TOTAL CONSTRUCTION COSTS	$12,000,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000		$237,500,000
CONTRACTOR'S PROFIT	$1,200,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000		$23,750,000
SUPPLIER'S PROFIT	$360,000	$322,500	$322,500	$322,500	$322,500	$322,500	$322,500	$322,500	$322,500	$322,500	$322,500		$7,125,000

Development Year	25	26	27	28	29	30	31	32	33	34	Totals
Construction Costs:											
Infrastructure (1)	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000		$97,500,000
LI/Mixed-Use Construction (2)							$1,000,000	$9,750,000	$9,750,000	$9,750,000	$39,000,000
OMI Construction (3)	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$1,000,000	$1,000,000	$1,000,000	$53,000,000
TOTAL CONSTRUCTION COSTS	$19,500,000	$19,500,000	$19,500,000	$19,500,000	$19,500,000	$19,500,000	$20,500,000	$20,500,000	$20,500,000	$10,750,000	$189,500,000
CONTRACTOR'S PROFIT	$1,950,000	$1,950,000	$1,950,000	$1,950,000	$1,950,000	$1,950,000	$2,050,000	$2,050,000	$2,050,000	$1,075,000	$18,950,000
SUPPLIER'S PROFIT	$585,000	$585,000	$585,000	$585,000	$585,000	$585,000	$615,000	$615,000	$615,000	$322,500	$5,685,000

Totals
$97,500,000
$390,000,000
$53,000,000
$537,500,000
$53,750,000
$16,125,000

(1) Total direct costs only for infrastructure amounted at $75,000,000. Phase I costs of $15,000,000 incurred in Years 1 & 2. Phase II costs of $15,000,000 incurred in Years 12 & 13, and Phase III costs of $15,000,000 in Year 22.

(2) Light Industrial and Mixed-Use Industrial/Commercial construction estimated average construction cost of $1,625,000 per premises, 12,000 square feet at $135.5 per square foot, plus $325,000 for site work, rock walls, paving & landscaping.

(3) Quarry and "Heavy" Industrial construction estimated at one structure per four acres with average total cost of $1,500,000 per building. Timed to occur after site is quarried.

Source: Vickers, and The Hallstrom Group, Inc.

TABLE 10

SUMMARY OF ECONOMIC IMPACTS ASSOCIATED WITH DEVELOPMENT
Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	11	12
ANNUAL WAGES	$1,150,000	$920,000	$11,864,063	$19,547,625	$30,500,625	$40,503,625	$50,506,625	$60,509,625	$70,512,625	$80,515,625	$90,518,625	$101,211,625
CONTRACTOR'S PROFIT	$275,000	$225,000	$650,000	$812,500	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,250,000
SUPPLIER'S PROFIT	$82,500	$67,500	$260,000	$325,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$482,500
TOTAL BASE IMPACT	$1,507,500	$1,212,500	$12,774,063	$20,685,125	$32,005,625	$42,008,625	$52,011,625	$62,014,625	$72,017,625	$82,020,625	$92,023,625	$102,944,125
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$3,015,000	$2,425,000	$25,552,125	$40,370,250	$64,011,250	$84,017,250	$104,023,250	$124,029,250	$144,035,250	$164,041,250	$184,047,250	$205,888,250

Development Year	13	14	15	16	17	18	19	20	21	22	23	24
ANNUAL WAGES	$110,637,125	$120,327,625	$130,530,625	$140,533,625	$150,536,625	$160,539,625	$170,542,625	$180,545,625	$190,548,625	$200,954,125	$208,321,813	$218,324,813
CONTRACTOR'S PROFIT	$1,200,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,175,000	$1,075,000	$1,075,000
SUPPLIER'S PROFIT	$467,500	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$460,000	$430,000	$430,000
TOTAL BASE IMPACT	$112,304,625	$121,832,625	$132,035,625	$142,038,625	$152,041,625	$162,044,625	$172,047,625	$182,050,625	$192,053,625	$202,589,125	$209,826,813	$219,829,813
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$224,609,250	$244,865,250	$264,071,250	$284,077,250	$304,083,250	$324,089,250	$344,095,250	$364,101,250	$384,107,250	$405,178,250	$419,653,625	$439,659,625

Development Year	25	26	27	28	29	30	31	32	33	34	Totals Year 1-34	Buildout
ANNUAL WAGES	$226,974,688	$230,064,563	$245,194,438	$254,304,313	$263,414,188	$272,524,063	$281,633,938	$290,743,813	$299,853,688	$303,890,313	$5,211,423,563	$290,750,313
CONTRACTOR'S PROFIT	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$325,000	$32,962,500	
SUPPLIER'S PROFIT	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$130,000	$13,095,000	
TOTAL BASE IMPACT	$228,339,688	$231,449,563	$246,559,438	$255,669,313	$264,779,188	$273,889,063	$282,998,938	$292,108,813	$301,218,688	$304,345,313	$5,239,481,063	$290,750,313
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$456,679,375	$474,899,125	$493,118,875	$511,338,625	$529,558,375	$547,778,125	$566,997,875	$584,217,625	$602,437,375	$608,690,625	$10,518,962,125	$597,500,625

Source: Various, and The Hallstrom Group, Inc.

TABLE 9

EMPLOYEE JOB COUNT AND WAGE ESTIMATES
Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	11	12
Worker Requirements (1)												
Infrastructure	20	16										12
Building Construction			43	68	98	98	98	98	98	98	98	98
Business Operations			186	336	585	894	1,029	1,233	1,476	1,709	1,934	2,148
Bldg. Maint. & Services			1	1	2	3	4	5	6	7	7	8
Off-Site Employees (2)	10	6	117	209	311	443	356	444	791	993	1,086	1,136
TOTAL EMPLOYMENT	30	34	352	616	993	1,338	1,668	2,005	2,343	2,679	2,819	3,372
Worker Wages												
Infrastructure	$900,000	$720,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$360,000
Building Construction	$0	$0	$2,160,000	$2,700,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000
Business Operations	$0	$0	$9,952,000	$11,392,000	$18,560,000	$23,720,000	$32,896,000	$40,064,000	$47,232,000	$54,400,000	$61,568,000	$68,736,000
Bldg. Maint. & Services	$0	$0	$30,513	$79,263	$63,971	$80,676	$118,382	$134,088	$142,794	$187,500	$211,206	$234,912
Off-Site Employees (2)	$250,000	$200,000	$2,933,548	$5,234,360	$8,276,654	$11,066,949	$13,997,243	$16,787,537	$19,117,831	$22,238,125	$23,138,419	$28,008,713
TOTAL ANNUAL WAGES	$1,150,000	$920,000	$11,864,063	$19,547,625	$30,500,625	$40,503,625	$50,506,625	$60,509,625	$70,512,625	$80,515,625	$90,518,625	$101,211,625

Development Year	13	14	15	16	17	18	19	20	21	22	23	24
Worker Requirements (1)												
Infrastructure	9									7		
Building Construction	98	98	98	98	98	98	98	98	98	98	98	98
Business Operations	2,371	2,596	2,830	3,044	3,268	3,492	3,716	3,940	4,164	4,388	4,562	4,786
Bldg. Maint. & Services	9	10	10	11	13	13	14	14	15	16	17	18
Off-Site Employees (2)	1,221	1,343	1,453	1,568	1,690	1,772	1,905	2,017	2,130	2,244	2,339	2,442
TOTAL EMPLOYMENT	3,705	4,058	4,366	4,703	5,068	5,377	5,714	6,052	6,369	6,727	6,988	7,319
Worker Wages												
Infrastructure	$0	$0	$0	$0	$0	$0	$0	$0	$0	$315,000	$0	$0
Building Construction	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000	$3,600,000
Business Operations	$72,904,000	$81,072,000	$90,240,000	$97,408,000	$104,576,000	$111,744,000	$118,912,000	$126,080,000	$133,248,000	$140,416,000	$145,984,000	$153,152,000
Bldg. Maint. & Services	$261,618	$286,224	$314,829	$331,753	$348,441	$363,147	$409,853	$434,559	$459,265	$483,971	$503,162	$527,868
Off-Site Employees (2)	$36,071,307	$37,546,301	$36,379,996	$39,199,890	$42,000,184	$44,110,471	$47,630,772	$50,431,066	$53,241,360	$56,179,154	$58,236,631	$61,044,945
TOTAL ANNUAL WAGES	$112,837,125	$120,327,625	$130,530,625	$140,533,625	$150,536,625	$160,539,625	$170,542,625	$180,545,625	$190,548,625	$200,954,125	$208,324,813	$218,324,813

Development Year	25	26	27	28	29	30	31	32	33	34	Totals Year 1-34	Buildout
Worker Requirements (1)												
Infrastructure											64	
Building Construction	72	72	72	72	72	72	72	72	72	72	2,420	
Business Operations	4,990	5,194	5,398	5,602	5,806	6,010	6,214	6,418	6,622	6,690	113,546	6,690
Bldg. Maint. & Services	18	19	20	21	21	22	23	24	24	25	417	25
Off-Site Employees (2)	2,540	2,641	2,745	2,847	2,950	3,051	3,154	2,217	3,279	3,393	58,229	3,193
TOTAL EMPLOYMENT	7,621	7,926	8,235	8,543	8,849	9,156	9,463	8,770	10,078	10,180	174,663	10,072
Worker Wages												
Infrastructure	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$2,475,000	$0
Building Construction	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$3,240,000	$109,260,000	$0
Business Operations	$159,600,000	$166,208,000	$172,736,000	$179,264,000	$185,792,000	$192,320,000	$198,848,000	$205,376,000	$211,904,000	$214,096,000	$3,633,472,000	$214,096,000
Bldg. Maint. & Services	$530,368	$573,868	$592,368	$617,868	$648,368	$662,868	$683,368	$707,868	$730,368	$737,868	$12,323,136	$737,868
Off-Site Employees (2)	$63,304,720	$66,063,695	$68,623,878	$71,181,645	$73,741,838	$76,301,195	$78,860,570	$81,419,945	$83,979,320	$84,812,645	$1,455,603,107	$53,922,645
TOTAL ANNUAL WAGES	$226,675,088	$236,085,563	$245,194,438	$254,304,313	$263,414,188	$272,524,063	$281,633,938	$290,743,813	$299,853,688	$302,890,313	$5,213,423,563	$290,750,313

(1) All job counts expressed in "full-time" equivalent positions.
(2) Includes all off-site jobs created by work efforts at the project, direct and indirect.

Source: Various, and The Hallstrom Group, Inc.

- The total direct "overall" community impact from the project during its 34-year construction and initial operating period will be $5.26 billion, exclusive of the $839 million in operating revenues generated by the tenant businesses.

- At build-out the average daily working population of the Kaloko-Honokohau Business Park will be about 6,700-plus persons, with an additional 5,000 to 7,500 consumers and suppliers visiting the location each day. There will be no permanent residents in the project (no residential units) and no school age children.

- We do not foresee any significant off-site socio-economic impacts resulting from the project. There are no immediately proximate residential, resort or residential uses which could be adversely effected and the industrial mixed-use nature of the surrounding neighborhood will only benefit from the expansion of such uses. We do not foresee any increases in area property values, creation of demand for affordable housing units, or that the project will result in any meaningful amount of in-migration into the community.

Assessment of the Public Costs/Benefits Associated With the Project

We have quantified the direct areas in which the proposed subject industrial and mixed-use industrial/commercial development will potentially impact the sphere of public agency resources, and quantify (where possible) the costs of providing expanded services to the project, versus the economic benefits that accrue to the community through an increase in local and state tax payments.

As a privately built industrial project most public costs will not be increased on the state or county levels as a result of the proposed Kaloko-Honokohau Business Park. There will be no increased educational or recreational needs directly attributable to the subject development, the major public infrastructure items (highway and primary water/sewer mains) are already in place, and the development will require no specific public subsidies, welfare services, bonding or capital improvements. Primarily costs will be for emergency services, oversight and road maintenance.

Direct tax benefits to the state and county coffers will primarily flow from the project and its operation over time in the form of real property taxes, gross excise taxes, and state income taxes.

Some cost/benefit issues are considered as off-setting, or "a wash," as the cost of the services to the government is theoretically directly reimbursed in the form of user fees. Building permits and utility hook-up fees are two prime examples. Other such items include workers compensation premiums and benefits, utility operations and billing rates, and business oversight/registration and licensing fees. These items were excluded from this study.

Our analysis of Hawaii County and state budgets indicate the actual effect of governmental services relating to Kaloko-Honokohau Business Park would not create the need to expand county and state services.

As an alternative to actual cost estimates, which are often disparate as it inherently cannot provide for unexpected and/or atypical items, it is most common to project public costs on a per capita formula.

Yet, this is wholly appropriate only for residential developments, as public costs and services generally accrue to where a person lives (or in the case of a tourist, where they are lodging). By their very nature, industrial/commercial businesses are private enterprises responsible for their own costs and benefits.

Conversely, government services are holistic in nature, providing a constant foundation throughout a community, regardless of actual, specific impact. A business may not have a need for parks or schools, but they are essential to the patrons and workers and create the climate in which the business operates. Similarly, government administration, capital projects and public welfare items may have no direct relation to a given project, but provide the economic underpinnings that enhances overall commercial success.

We have therefore looked at the public costs issue from both perspectives, on an actual cost basis, which we believe to be most appropriate for the subject project and is the focus of our conclusions, and on a pro rata basis.

Quantification of Costs

The county of Hawaii will directly incur several areas of cost increases as a result of the Kaloko-Honokohau Business Park, primarily in regards to emergency services. Based on analysis of response frequencies, time/cost data and discussions with affected agencies we have made general allowances for these items.

The total annual cost to the county on a stabilized basis at build out of the subject development would be $505,750. This cost was reached on an escalating basis over time, beginning at 10 percent in year 3 in accordance with the number of operating businesses in the business park.

State of Hawaii costs would include highway frontage work, health inspections of food service establishments and other minor oversight duties. An allowance of $200,000 per year was made for these items, increasing to the stabilized level as the park is built out.

An alternative method for determining public costs is through per capita expenditures incurred by the State of Hawaii and Hawaii County in accordance with the de facto population area of the jurisdiction. This is founded on the principal that each individual on the island equitably benefits from all governmental costs, regardless of type or focus throughout the day, with each new member of the community (whether resident or visitor) creating a proportionate new cost burden in their daily home and working life.

The average daily worker population at the subject at build-out will be 6,715 persons, a figure reached in year 34 of the development process. Assuming that each worker spends about one-quarter of their life on the job (or at their place of employment), the allocated state cost per worker would be $1,214 per year. The total "costs" to the public purse at stabilization by the project using the per capita allowance method would be $8.152 million.

At build-out, the first phase of development would have some 2,830 permanent workers (non-construction) equating to a total cost to the state of $3.44 million. The second phase an additional 2,383 workers and an associated cost of $2.89 million, and the third phase, an additional 1,502 workers and cost of $1.82 million.

Using a 25 percent of total county cost share as being attributable to each worker while on the job, the average annual amount spent by

Hawaii County to support the workers at the proposed Kaloko-Honokohau Business Park is $289.

Application of this figure to the total on-site worker population at subject build out would be $1,940,635 annually in costs to the county government on a stabilized basis (6,715 workers x $289). This would be comprised of Phase I costs of $817,870, Phase II costs of $688,687 and Phase III allocated expenses of $434,078.

Quantification of Benefits (Revenues)

Real Property Taxes -- Property taxes paid by landowners in the subject project were calculated using the 1999-2000 tax rates for both land and buildings, improved and unimproved.

Assessed values for the lots are based on an average sales prices of $4 per square foot for quarry/heavy industrial lots, and a range of $8 to $17 per square foot for the industrial and mixed-use industrial/commercial lots in the three phases, with the most valuable being those having highway frontage or located near the main entrance. The improvement assessments are based on the projected development/construction costs of the finished buildings (at $1,625,000 for the industrial and mixed-use structures and $1,000,000 for the heavy industrial buildings). This may result in a slight understatement of assessments on the improvements, as market value often exceeds reproduction expense.

It was assumed the land would be classified as industrial or mixed use commercial and be taxed at the rate of $10.00 annually per $1,000 of assessed value. The improvements would be classified as industrial or commercial with a tax rate of $8.50 per $1,000 of assessment.

The total real property tax to be paid to Hawaii County in 2000 dollars ranges from $168,500 in year 1 of development, to a stabilized level of $6,990,019 at build-out in year 34 and beyond. Phase I will generate $3.41 million annually in property taxes, Phase II an additional $2.26 million, and Phase III another $1.32 million. The aggregate taxes paid over the 34-year study time-frame will be $128.59 million.

State Income Tax -- The state will receive income taxes from two sources:

- the wages of the workers associated with the construction, maintenance, and operation of the Kaloko-Honokohau Business Park components; and

- the corporate profits from contractors and suppliers serving the construction and maintenance phases of the development, and generated by on-going industrial, commercial, and quarrying operations.

The total income tax revenues to be received by the state are projected at $76,850 in the first year of construction increasing to a maximum level at year 34 of $18.42 million annually in constant 2000 dollars.

On a stabilized basis, after build-out, the permanent worker incomes, building maintenance and off-site workers, and operating businesses, would pay an annual state income tax of $18.42 million.

On a phase-by-phase breakdown, the initial increment annual income taxes paid would stabilize at build-out at $7.96 million, the Phase II taxes would be $6.42 million, and the Phase III income taxes are estimated at $4.04 million.

State Gross Excise Tax – This 4.166 percent of expenditures tax was applied against:

- the total estimated construction contract costs;

- the total gross sales of the industrial, mixed-use commercial and quarrying businesses; and

- the discretionary expenditures of the worker population of the subject (estimated at 40 percent of total wages).

The anticipated state excise tax receipts arising from the subject development grow from an estimated $201,426 in the first year of development to a peak of $40,068,223. Over the 34-year study period, the receipts total $688.9 million and stabilize at circa $40.0 million per year.

The Phase I stabilized excise tax revenues will be an estimated $16.92 million (excluding construction items); Phase II at $14.28 million; and Phase II at $8.79 million.

Total Public Benefits (Revenues) – In constant 2000 dollars, the aggregate annual tax revenues flowing from the subject development at full project build-out range from:

- $168,500 to $6,990,019 per year for the county of Hawaii, stabilizing over time at the higher figure, totaling $128.59 million over the 34-year development projection time-frame;

- $278,276 to $58,483,971 annually for the State of Hawaii, stabilizing at $58,416,274 million per year, and cumulatively at $1.006 billion over the 34-year projection period; and

- $446,776 to $65,473,900 per year for total tax receipts (county and state), totaling $1.135 billion for the first three-plus decades of the Kaloko-Honokohau Business Park community.

Correlation

Table 11 summarizes our public costs/benefits findings on both an actual cost and per capita allowance basis for the entire project and each constituent phase.

As can be seen, regardless of the cost methodology adopted, in no single year does public coffers suffer a net loss.

ADDENDA I: SUBJECT PROPERTY DATA AND DESCRIPTION

Tax Map Key/Legal Description

The subject property is designated on State of Hawaii Tax Maps as Third Division Tax Map Key 7-4-08, Parcels 13 (portion) and 30.

A State of Hawaii tax map showing the approximate location of the subject is displayed on the following page.

We have not been furnished with a comprehensive metes and bounds legal description for the subject holding.

Easements and Restrictions

There are several easements and restrictions worthy of note regarding the subject property:

1. A section of an historic footpath/trail crosses the holding along the extreme southerly-makai area. For the most part, the corridor is within the setback strip along the highway, and it will not pose an issue to the proposed development or other reasonable use of the property.

2. Preliminary surveys have identified one meaningful archeological site and several minor objects worthy of investigation. The primary site is adjacent to the aforementioned trail and will either be preserved on a separate lot or studied and appropriately relocated. Apart from this site, the historical significance of the subject is limited and not likely to be restrictive of reasonable use or development.

3. There are a series of de facto unimproved roadway easements used by quarry traffic accessing from Queen Kaahumanu Highway via an intersection developed by the subject landowners. This traffic will be redirected to finished subdivision roadways having improved access points. Appropriately improved industrial-grade streets can handle the

TABLE 11

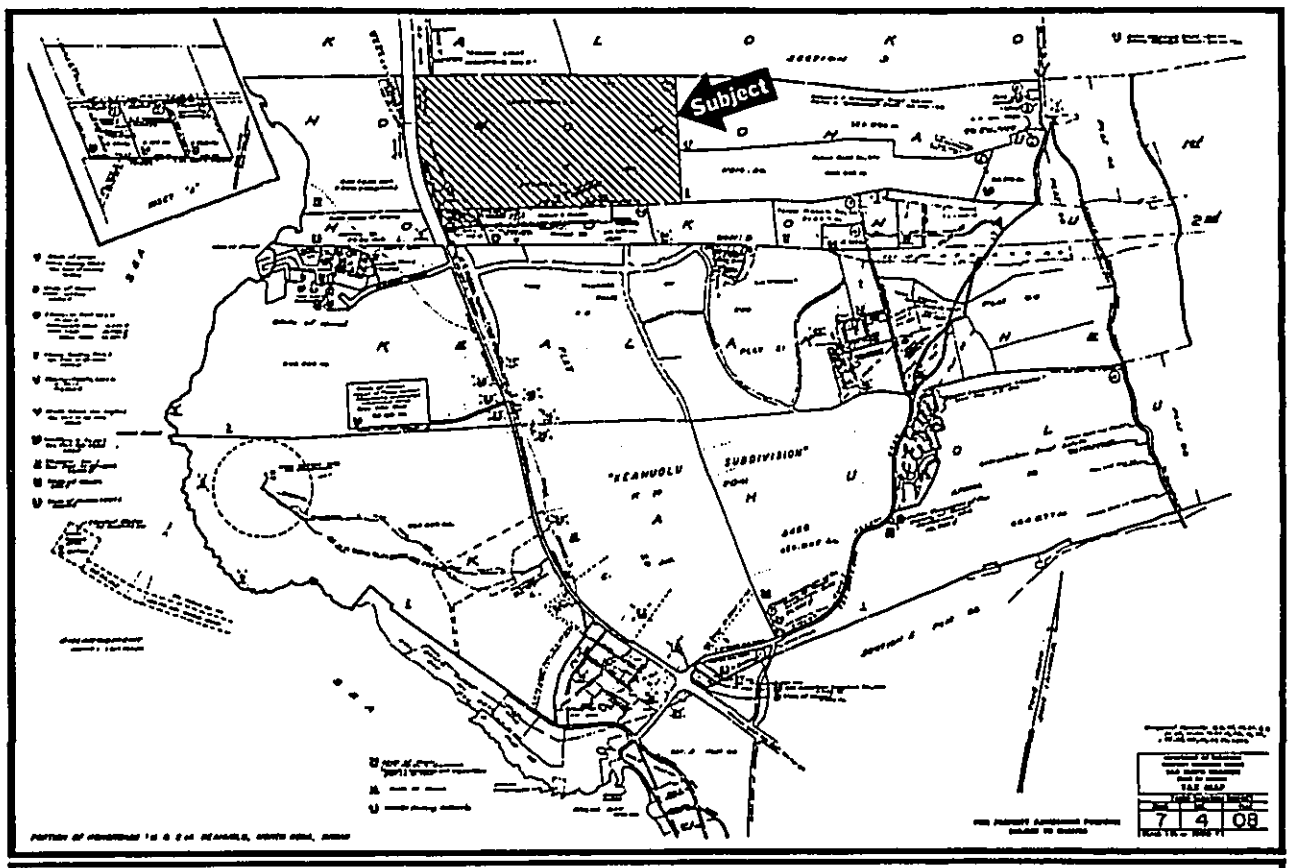
SUMMARY OF PRIMARY GOVERNMENTAL TAX RECEIPTS AND PUBLIC SERVICE COSTS
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

	Actual Cost Comparison			Net Benefits
On Site/Mixed Basis	Receipts	- Costs	=	or (Costs)
At Build-Out				
Phase I	$25,109,108	($120,000)	=	$24,989,108
Phase II	$20,637,100	($50,000)	=	$20,587,100
Phase III	$12,650,066	($50,000)	=	$12,650,066
Total Project	$58,416,274	($200,000)	=	$58,216,274

	Per Capita Allocation Comparison			Net Benefits
On Site/Mixed Basis	Receipts	- Costs	=	or (Costs)
At Build-Out				
Phase I	$1,409,876	($817,870)	=	$2,592,006
Phase II	$2,237,393	($448,487)	=	$1,548,706
Phase III	$1,322,750	($434,078)	=	$888,672
Total Project	$4,990,019	($1,940,435)	=	$3,049,384

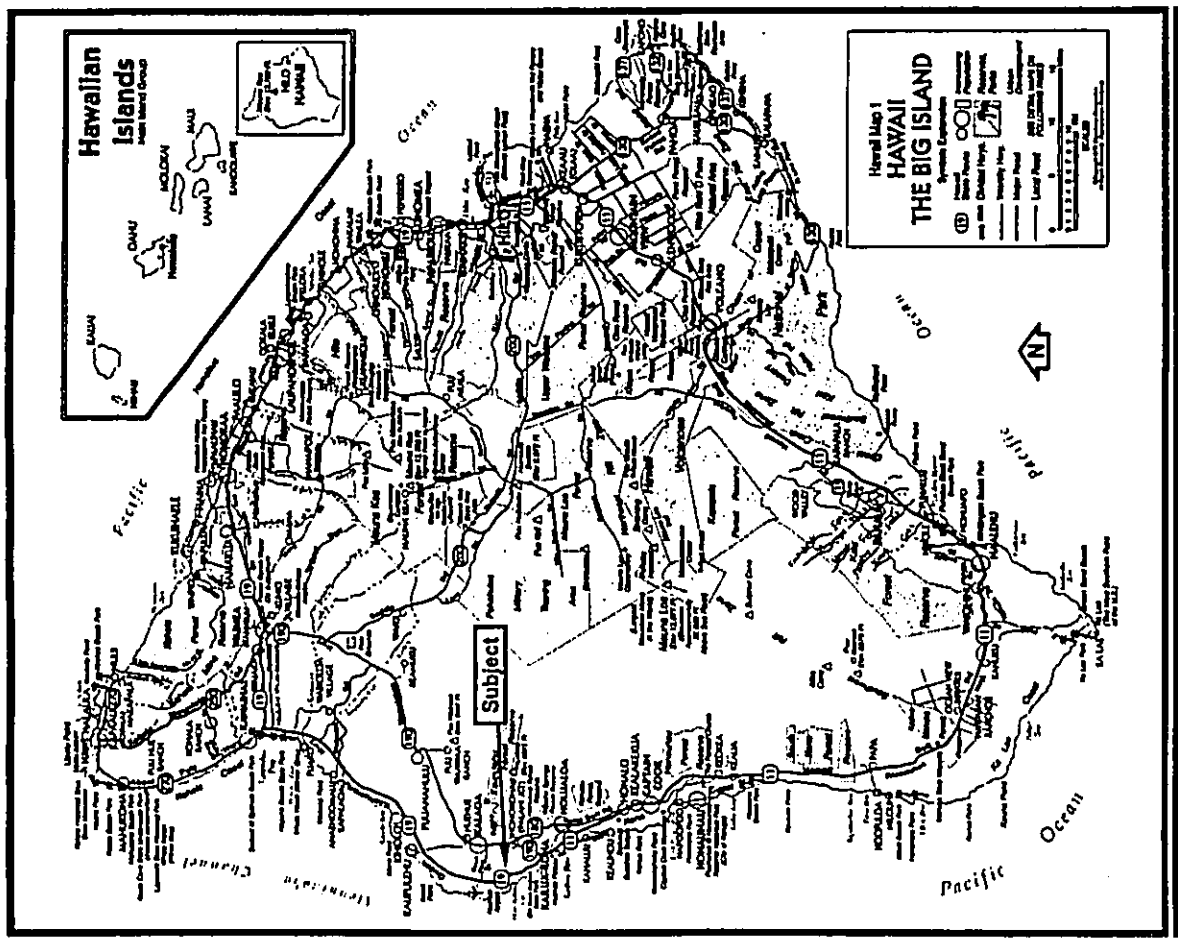
	Actual Cost Comparison			Net Benefits
On Site/Mixed Basis	Receipts	- Costs	=	or (Costs)
At Build-Out				
Phase I	$3,409,876	($379,313)	=	$3,030,563
Phase II	$2,237,393	($124,437)	=	$2,130,956
Phase III	$1,322,750	$0	=	$1,322,750
Total Project	$6,990,019	($503,750)	=	$6,484,269

Source: The Hallstrom Group, Inc.



PROPERTY LOCATION MAP
Market Study of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

Third Division Tax Map Key
7-4-08, Parcels 13 (portion) and 30



ISLAND LOCATION MAP
Market Study of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

"heavy" quarry traffic without deleterious effect on other project users.

A map of the identified easements/restrictions is shown on the following page. State tax maps do not show, and we are not aware of, any other meaningful development/use issues.

State Land Use Classification

The State Land Use (SLU) classifications, administered by the State Land Use Commission, establish the basic legal framework of land uses in the State of Hawaii. The SLU categorizes real property into four broad "Districts"--**Conservation, Agriculture, Rural** and **Urban**.

The counties are required to confine their land use designations (General Plan and Zoning) within the stated intents of the SLU district constraints.

The subject acreage is currently within the **Conservation District.**

This designation is typical of the lower elevation lands in the Queen Kaahumanu Highway corridor prior to urbanization efforts. Most of the mauka-fronting holdings along the highway have minimal attributes worthy of strict conservation guidelines, and area agricultural lands are considered as minimally productive.

The existing designation must be changed to **"Urban"** before the proposed subdivision can be developed. Such use would concur with the **West Hawaii Regional Plan** formulated by the state, which calls for expansion of the greater Kailua-Kona urban pod northerly toward the airport, focusing on commercial and industrial exploitation of the highway corridor.

Hawaii County General Plan

The Hawaii County General Plan is implemented to control the overall growth pattern of the Big Island, and is intended to provide general guidelines for the county zoning designations. The plan is to serve as a long-term (10 to 25 year) master-planning resource identifying and servicing evolving land use needs.

On the existing plan, Keahole Point to Kailua-Kona area (including the subject parcel) is designated for **Alternate Urban Expansion**, in support of a growing Kailua-Kona community. These revisions, initially approved in the 1990 plan, changed the historic conservation and agricultural classifications, allowing for additional development in the corridor.

The current General Plan Land Use Map identifies the subject lands for "Industrial" and "Urban Expansion," designations which permit the proposed subject development.

The County Planning Department prepared the **Keahole to Kailua Development Plan** in 1989 to comprehensively identify long-term use guidelines for the vital corridor. The subject lands were shown as having significant existing portions with "quarry" use and proposed classification for "Limited Industrial," within a 300-acre highway fronting pod almost fully comprised of subject lands. This extended range plan specifically calls for the type of development being proposed for the Honokohau Business Park, and is supportive of the use.

County Zoning

The Hawaii County Zoning Ordinances are designed to standardize the improvements of residential, agricultural, industrial, and other proposed uses in accordance with accepted planning guidelines and community standards. Allowable densities, building heights, set backs, and parking requirements are among the issues addressed.

The subject property is now zoned; **"Open,"** a generally restrictive classification typical of the lower elevation lands in the highway corridor. Historically used to set aside vast tracts of land until fully planned or having a demonstrated market demand.

This designation would need to be changed to a mixture of industrial and commercial zonings to be developed. We do not perceive this re-classification to be problematic to eventual development if other county and state approvals occur.

Utilities and Access

Our study assumes appropriate utility systems and access points will be incorporated into the project. These specifics are addressed by others in the entitlement review process, and it is our understanding every effort will be made to utilize and extend the existing infrastructure in the corridor in order to create a more seamless community in the Kaloko-Honokohau area.

Primary access will come from a single entrance from an improved intersection on Queen Kaahumanu Highway. The current quarry access point will likely be closed at some time in the development process. A series of 60- and 80-foot wide roads would spread through the subdivision and link (at about the 160-foot elevation) with extensions from the Kaloko Industrial Park and the Honokohau II project to provide an alternate, up-slope north/south route through the area.

Most utilities, including water, sewer, electrical and telephone mains are within the highway right-of-way.

Property Description

The subject property is generally a 3,450- by 4,100-foot rectangle, containing 326 acres, with the longer dimension being the upslope measurement. An additional 10.5-acre parcel (459 by 1,000 feet deep) is appended to the southerly/makai corner of the site along the highway. The holding is located circa four miles north of urban Kailua-Kona and four miles south of the Keahole Airport, in the North Kona District of Hawaii County, State of Hawaii. The entire 336.9-acre site has 3,900 lineal feet of frontage along Queen Kaahumanu Highway.

Sloping upwards to mauka, the site begins at highway level at about 70 feet above sea level and extends to the 300-foot elevation. The overall topography is generally even given the extended angle of slope, but there is a bulge in the central/northerly area and a dip in the southern area. Geological strata is comprised of a'a and pahoehoe lava, and the parcel is generally barren with the exception of scattered bunch grass pockets (throughout) and bougainvillea bushes which have been planted within the highway right-of-way. Soil conditions are very poor, as is typical for the region.

As noted, Keahole Point is within a "kekaha," or desert, and the climate is hot and dry. Hualalai provides an excellent barrier from the tradewinds that plague more northerly coastal areas.

Superior panoramas are available from the site towards the ocean and across Honokohau Bay. The lush upper slopes of Hualalai are also visible.

The nearby lands are rapidly changing from historically feral condition to extensive urban support uses, with most sites in the region having been considered for some development type.

The predominant uses in the area are industrial-oriented, including public developments at the airport, small boat harbor, Kealakehe and the HOST and NELH parks. Private industrial projects have been undertaken at Kaloko, Honokohau II, Kohanaiki and at the QLT lands forming the southerly boundary to the primary study region. A national park enclave, on makai lands at Kaloko and Honokohau, and state park lands extending north of the airport dominate the oceanfront.

Mauka of the subject is residential development gradually extending makai (downslope) from the Palani Road/Belt Highway corridor into the drier/sunnier lower elevations favored by new residents to the area. Major residentially oriented projects have been proposed for the lands on either side of the subject. At Kaloko (north), a 983-acre project with 3,200 homes was in the entitlement process, but is uncertain at this time. A new mauka/makai road was an integral part of the project and is still being pursued on a sectional basis. The state is continuing to move forward on its 960-acre, 4,100-unit Kealakehe (south) project which will contain a broad spectrum of public facilities and private homes.

Long-term proposals within the Keahole to Kailua Development Plan call for a "second city" urban center in the middle elevations of the mountainside, focusing on commercial and public uses. Other mauka holdings are to be developed with a golf course and residential and ancillary subdivision.

Proposed Development

The proposed Honokohau Business Park will be built in three phases as follows:

Phase I: 101.845 gross acres of mixed use (light) industrial lands in an "L" shape encompassing the highway frontage and along the northerly property boundary adjacent to the Kaloko Industrial Park; and 102.49 gross acres of quarry (heavy) industrial lands in the central/northerly and mauka areas of the site. This would contain the existing uses comprising some 30 acres in use (about 60 acres leased) and provide for quarry operations into the coming decades. (About one-half the quarry area would not be utilized until the second phase of the development.)

Phase II: 87.859 gross acres of mixed use (light) industrial lands in an "L" shape extending from between the quarry and initial park subdivision and upslope along the southerly boundary of the site.

Phase III: 44.851 gross acres of mixed use (light) industrial lands mauka of the quarry and Phase II sections.

It is estimated about 80 percent of the mixed use industrial acreage will be net sub-dividable acreage, resulting in about 185 acres of finished lots. Parcel size of about one acre to several acres are envisioned, or some 150 to 200 total lots. The quarry area will have a usability factor above 95 percent and will be subdivided into larger, nominally improved heavy industrial and quarry-related lots of three to eight-plus acres, or 15 to 30 total sites.

The interior roadways (except within the quarry) will be 60- to 80-foot wide paved and improved streets with underground utilities in or adjacent to the right-of-way. Generally, the lots will be double-loaded off the roadway system.

The project will provide for an appropriate landscaped buffer from the highway (as at the Kaloko Industrial Park). The quarrying effect will limit the visibility of buildings in the central portions of the project from downslope and near-shore areas of the national park and nearby resort lands. The first phase will have about 20 highway fronting lots.

ADDENDA II: ENVIRONS AND ECONOMIC BACKGROUND

General Description - The Big Island (Hawaii County)

The county of Hawaii consists of the island of Hawaii (Big Island), the southernmost major island in the Hawaiian chain. Hawaii County is the second most populous of the four counties that make up the State of Hawaii, with the year-end 1999 resident population estimated at 145,000, representing just under 12 percent of the total state population. By far the largest island in the chain, the land area of Hawaii is 4,038 square miles, more than twice the size of the other islands combined.

The subject property is located on the lower flanks of Hualalai (one of the five mountain masses forming the Big Island) approximately one-half mile inland from the North Kona coastline within the Honokohau ahupuaa.

The island is characterized by many small towns dispersed along the coastline. The island has been divided into nine districts--Puna District, the North and South Hilo Districts, Hamakua District, North and South Kohala Districts, North and South Kona Districts, and Ka'u District.

Two volcanic mountain peaks, the 13,796-foot Mauna Kea and the 13,679-foot Mauna Loa, dominate the central portion of the island. Three other major volcanic emergences combine with Mauna Kea and Mauna Loa to form the island of Hawaii. They are the Kohala Volcano, which is more commonly referred to as Kohala Mountain, the oldest volcanic land mass on the island that forms the extreme northern portion of Hawaii. Hualalai in the west, located northeast of Kailua-Kona. The final volcanic presence is Kilauea Crater, with its associated and yet active East Rift Zone at the far southeastern end of the island.

Hilo, located along the eastern coast, is the principal population, administrative, and civic center on the island. Other population centers include Kailua-Kona on the island's west coast and Waimea

situated inland within the northern saddle between Mauna Kea and the Kohala Mountain.

Economic Base

Agriculture

Agriculture is currently one of the island of Hawaii's prime economic industries. Sugar, macadamia nuts, and coffee have historically been the major agricultural products (however, the last of the Big Island's sugar operations shut-down during early 1996). Significant and growing contributions are being made by the state's diversified agricultural crops including papayas, vegetables, cut flowers, and nursery products. Livestock is raised on Hawaii and represents an important contribution to the economy.

Kamehameha Schools/Bernice Pauahi Bishop Estate over the last five years has leased 20,000 acres to Prudential Timber for production of timber/forest products, primarily fast growing eucalyptus trees to be used in plywood, and other wood and wood fiber products. 15,000 of those acres are located within the Hamakua district, while an additional 5,000 acres in Ka'u were leased in June 1998.

Two noteworthy agriculturally related have occurred in the past two years. The University of Hawaii developed a ringspot resistant super papaya variety; this suggests the hopeful re-emergence of the papaya industry on the Big Island. And, Hawaii County recently opened the first operating agricultural crop irradiation plant, which kills a variety of infestations commonly found on Hawaii produce, that will allow greater export potential for Big Island crops.

Employment

Historically, the Big Island's primary employment sector has been associated with the island's agriculturally oriented economy. During the 1980s, with the construction of major resort and hotel properties in West Hawaii, employment opportunities moved into construction and service sector jobs created with the growth of the tourist industry.

With the demise of sugar and the recent loss of major agricultural employment, tourism is becoming increasingly vital to the economy of Hawaii. The prolonged downturn of the early to mid-1990s produced a slump even in this vigorous industry. The number of persons employed at hotels on the Big Island decreased from 6,600 in 1991 to 5,550 by 1995.

The sector has experienced meaningful recovery since late 1996, and is within a definite upcycle, particularly the Kohala Coast, one of the hottest areas in the statewide market.

The infusion of West Coast dollars (much high-tech or stock oriented) into the resort economy has spurred employment in the service and construction sectors.

East Hawaii remains hard hit from the recession, along its Hilo/Hamakua coast, with over 1,000 sugar industry-related jobs lost since 1993. Over 45,000 acres have been taken out of sugar production, with only a small portion to date having been utilized for truck farming (most prominent in the North and South Hilo districts); cattle grazing; and a variety of other start-up, experimental or low capital requirement activities. Few of these efforts employ meaningful numbers of having former sugar workers. These activities account for only a small percentage of the former sugar cane acreage, which now generally lies fallow.

In March 1996, Ka'u Sugar shut down its operation, idling its entire workforce on the southwestern end of the island.

In early March 1996, Bishop Estate announced that it would be leasing 24,000 acres (primarily in the North Hilo and Hamakua districts) of former sugar cane land for a tree farming venture to be operated by Prudential Timber Investment, a subsidiary of Prudential Insurance. Eucalyptus trees will be grown, with the first trees to be harvested in six to seven years.

During 1997 the State of Hawaii and Hawaii County negotiated an agreement that would have allowed Oji Paper Company of Japan to plant and harvest nearly 10,000 acres along the Big Island's Hamakua coast with trees that would be chipped and sent to Japan. However, late in negotiations, public sentiment turned against the project, and in November, the state Board of Land and Natural Resources did not ratify the proposed 55-year lease.

The following table cites historic unemployment on the Big Island. It is estimated that unemployment has dropped to below nine percent during the first quarter of 2000.

UNEMPLOYMENT FIGURES
State and Hawaii County 1993 to Present

	1993	1994	1995	1996	1997	1998	1999
Hawaii State	3.8%	5.2%	6.0%	5.7%	6.4%	5.4%	5.6%
Hawaii County	5.9%	9.6%	7.8%	8.6%	10.2%	8.0%	9.6%

All figures year end.
Source: State of Hawaii Department of Labor and Industrial Relations.

Housing

Based on the number of dwellings and the number of vacant dwellings, also products of the 1990 U.S. Census, we have estimated the percentage of total dwellings occupied and those that are vacant. By dividing the number of dwellings into the total population, we establish the number of individuals per dwelling.

Data on owner occupancy and age have been extrapolated from Hawaii County tax office records on real property tax exemption (homeowners and homeowner's 60 years or older) applications. In Hawaii County, it is estimated that 45.15 percent of all homes are occupant owned, while an estimated 41.83 percent of all owner-occupants are at least 60 years old or physically disabled. Only 12,672 dwellings, or slightly over 26 percent, of all houses in Hawaii County are occupant owned by individuals under 60 years old.

A significant trend illustrated in the population and housing data, highlights the areas within the county that have experienced significant new housing development. All Hawaii County dwellings over 30 years old in the year 1985 are quantified as a percentage of total dwellings, as published by Hawaii County in its update General Plan (1989). The following table helps visualize this trend.

HOUSING UNITS OVER 30 YEARS OLD IN 1985
By District

District	Percentage
North Kohala	61.08
South Kohala	19.63
North Kona	16.91
South Kona	41.64
Ka'u	46.76
Puna	26.79
South Hilo	43.63
North Hilo	68.38
Hamakua	68.53
Hawaii County	**37.48**

The table clearly illustrates that most new housing have been developed in the South Kohala, North Kona, and Puna districts, which has definitely been the case according to county building permit records. Other districts, meanwhile, have recorded little new residential construction activity over the past several decades. This is a trend that is expected to continue over the next several decades. Puna will continue to grow, because of its excess of affordable land in the form of numerous non-conforming one- to five-acre lot subdivisions created during the 1960s and early 1970s. North Kona and South Kohala will continue to grow given the promising long-term outlook for the area as the core of Hawaii County's tourism industry.

State and Hawaii County housing agencies have recognized that affordable housing requirements mandated in the late 1980s and early 1990s are onerous in today's economy/marketplace and have been a substantial barrier to new construction. In January 1996, Governor Ben Cayetano announced that the state would no longer enforce a requirement that 40 percent of new housing project inventory be classified "affordable."

Likewise, Hawaii County announced in November 1997 proposed changes in the county's affordable housing requirements for developer's seeking rezoning. These changes have been anticipated and discussed for the better part of 1997. Under the rules, developers were required to sell as much as 60 percent of new homes at reduced prices to low-income buyers in compliance with a 1990 affordable housing policy. The County Council lowered the requirement in

January 1998 to 10 percent (a figure commensurate with affordable housing requirements of the early 1980s prior to the development boom of the late 1980s and early 1990), exempting any requirement on projects of less than 10 homes.

Another key change to the existing Hawaii County housing policy is adjusting the in-lieu fee developers may pay as an option to building affordable homes. The $10,601-per-home fee under the 1990 rules was replaced with an average in-lieu fee of $4,720 in 1997 dollars.

Construction

During 1998, government agencies spent $95,115,000 (roughly 50 percent more than 1997) on Big Island construction.

County records indicate that private construction building permits grew to $178,758,000 during 1998. $147,828,000 of the private construction figure represents residential housing. A full 61 percent of that value is concentrated within South Kohala ($20,309,000) and North Kona ($69,998,000). The remaining $30,930,000 in private expenditures was associated with commercial construction; again the majority was concentrated within South Kohala and North Kona (72.4 percent).

The following table cites the total value of Big Island building permits (government and private) by year from 1991 through 1998, with commensurate percent changes from previous years.

CONSTRUCTION PERMITS
Hawaii County 1991 to 1998*

	1992	1993	1994	1995	1996	1997	1998	1999
Dollar Value (in Millions)	$419	$273	$205	$290	$216	$219	$208	$178
Percent Change	4.0%	-34.8%	-24.9%	41.5%	-25.5%	1.4%	-5.02%	-14.42%

* Most recent full year data available.
Source: County of Hawaii Department of Research and Development.

Tourism

Major West Hawaii resort developments include Mauna Kea Beach Resort, South Kohala Resort, Waikoloa Beach Resort, Mauna Lani Resort, Kona Village Resort, and Keauhou Resort. Kailua-Kona also

boasts a number of freestanding hotel properties along Alii Drive. Hilo has several older hotel properties, which have seen increased patronage since the near continuous eruption of Kilauea in the early 1980s.

By 1999, Hawaii County had just under 10,000 guest units, divided between hotel rooms (71 percent) and condominium/other (29 percent), available to tourists. During 1999 the units experienced an average occupancy of 67.43 percent, a slight decrease from the 68.19 percent reached the year before, according to Pannell Kerr Forster (PKF), Trends in the Hotel Industry, Hawaii.

The following table summarizes the four major existing resort holdings on Hawaii, three of which are situated in South Kohala; the Kona Village is in North Kona.

	Kaupulehu/ Kona Village	Waikoloa Beach Resort	Mauna Lani Resort	Mauna Kea/ South Kohala Resorts
Size in Acres	684*	1,383	3,200	1,000
Year Opened	1966/96	1981	1982	1965
Hotel Rooms				
Existing	368	1,786	893	660
Under Construction/ Proposed	--	--	--	--
Condominium Units				
Existing/Proposed	585	415	242	82

* Up to 600 nearby acres have been approved for resort development. The Kona Village Resort contains 125 low density bungalow-type units and The Four Seasons Kaupulehu completed 243 low density hotel units in October 1996.

Visitor arrival data is an important economic indicator.

VISITOR ARRIVALS - ISLAND OF HAWAII		
Year	Visitor Arrivals	Percent Change
1990	1,030,900	+3.18
1991	1,020,390	-1.02
1992	972,720	-4.67
1993	978,440	0.59
1994	933,700	-4.57
1995	917,610	-1.72
1996	1,031,550	12.42
1997	1,102,200	6.85
1998	1,150,000	4.34
1999	1,260,000	9.57

The data in the preceding table indicates a gradual overall decline in visitors to the Big Island between 1990 and 1994, with the downward trend reversing itself in 1996, leading to a strong later decade upcycle. However, virtually all of the growth has been focused towards the up-scale resorts along the Kohala Coast and into the Kailua-Kona to Keauhou corridor. The Hilo side of the island has seen continuing long-term declines as it loses market share to the Kona side projects while the windward side inventory continues to age. Unlike most statewide destinations, eastbound arrivals to West Hawaii remain strong, and the tourism economy has been strengthened by a booming West Coast demographic fueled by high-tech and stock money. The years 1996 through 1999 have been strong years for the Big Island with visitor count increasing by a total of 37.3 percent, much due to the introduction of direct flights from Japan.

Visitor length of stay on the Big Island, another important indicator, has shown a general strengthening since a mid-decade slip, and is now nearly a day above the length of a decade ago at 7.39 days.

Overall, 1999 was a strong year for Hawaii hotels. Occupancy rates have climbed from at or below the 60 percent level from the early 1980s through 1993, to current rates in the upper-60's percentile (67.43 percent in 1999). Average Daily Room Rates (ADRs) increased a robust 5.35 percent last year to $165.92, up $8-plus from 1998. Kohala now has the highest average ADR among the 14 state sectors, and continues to exhibit positive growth in occupancy.

Energy

The county's infrastructure has not kept pace with rapid development during the late 1980s. During the early 1990s HELCo experienced

increasing difficulties keeping the Big Island's power grid on line. Rolling (scheduled and non-scheduled) blackouts became more common as the company's ability to supply power was compromised by small interruptions in production capacity. HELCo indicated that it had planned on geothermal production supplementing its power production capacity by early 1990. In late April 1993, the Puna Geothermal Venture (PGV) began producing over 10 megawatts of geothermal energy. By mid-May, PGV was producing approximately 25 megawatts of electricity. With the addition of PGV power, blackouts have decreased in number and duration. In mid-1995, there had been renewed talk of rolling blackouts by HELCo; however, there has not been rolling blackouts since July 13, 1992.

During the early 1990s, Waimana Enterprises stated its intention to develop a private 56-megawatt power generation facility on Hawaiian Home Lands at Kawaihae--little has been done to develop this potential energy source. About the same time, Encogen Hawaii LP (dba Ensearch Development Corporation), another private concern, proposed a 60-megawatt facility in Honokaa, which began construction in September 1999.

HELCo has been less than enthusiastic in its acceptance of these proposed private power generation sources, arguing that these private enterprises will have an unfair cost advantage and, therefore, should be paid lower rates by the utility for power accepted unto its power grid. Approximately 38 percent of the Big Island's power supply comes from independent power producers.

In May 1997 HELCo reached an agreement with Ensearch to provide power, details of the plan or when the Ensearch plant will be on-line were not revealed. HELCo plans to expand its 30-megawatt generator station mauka of the Keahole-Kona Airport by an additional 56 megawatts. There has been considerable opposition to expansion of the Keahole site by local residents, who fear that the added pollution generated by the site (no matter how small) is unjustified given VOG (volcanic smog) levels in West Hawaii over the last decade.

Transportation

Two major interisland airlines and several air taxi services provide transportation to and from Hawaii.

East and West Hawaii air traffic is serviced at Hilo International Airport (formerly known as General Lyman Field) and Kona

International Airport (formerly Keahole-Kona Airport), respectively. Direct U.S. Mainland and Japan/Asia service is available from Kona International Airport. Construction of a 4,500-foot runway extension (to 11,000 feet) was completed in October 1993 at a cost of $29.7 million. Airport facilities (increased parking, widened access roadways, and new baggage handling and distribution facilities) have recently been upgraded to accommodate international flights.

Freight service is principally provided by container ships and barges received at deep water ports at Hilo and Kawaihae.

There are approximately 1,450.95 miles of public roadways on the Big Island. The most significant roadway is the Hawaii Belt Highway (aka Mamalahoa Highway and by various highway numbers at differing locales throughout the island). This highway circles the island generally near the coastline and connects East and West Hawaii.

Regional Description - The Kona District

The subject holding is located in the makai, central/northerly area of the Kona District, an expansive region which occupies some 700 square miles in West Hawaii and is the economic focal point of the leeward sections of the island.

The Kona (comprised of the North and South Kona districts) and Kohala (comprised of the North and South Kohala districts) areas, together constitute West Hawaii, the area on the west side of the mountain chain that forms the Big Island. Our primary study emphasis is the Kona area, the North and South Kona districts, which stretch along the coastal plain and western flanks of Mauna Loa and Hualalai for nearly 80 miles. Relatively young geologically, the topography is characterized by lava flows gently sloping from the shoreline to the upper elevations of the inland mountains. Mauna Loa, seasonally snow capped and an active volcano, is the second highest Pacific-island peak with a 13,677-foot summit.

Generally, temperatures in North Kona decrease and rainfall and vegetation increase the further mauka the location. Along the relatively barren coastal plain, temperatures average from 72 to 80 degrees, with rainfall between 20 and 50 inches annually. In the central elevations of the district, from 500 to 2,300 feet above sea level, temperatures are approximately five degrees cooler than at the coastline, with 60 to 70 inches of rain per year. The sunny Kona coastline mainly appeals to tourists and retirees, resulting in intensive

resort-type development between Kailua-Kona and the Keauhou Resort, while the large majority of permanent residents historically have preferred the cooler, agriculturally oriented central elevation areas. Land above the 4,000-foot level is typically ohia lehua and fern rain forest, and sparsely populated.

Kailua-Kona and Kealakekua, the major communities in North Kona today, were significant native Hawaiian settlements--central villages of the large indigenous population, which once resided along the Kona Coast. Captain Cook first landed on Hawaii at Kealakekua Bay in January 1779, and was later killed there during a subsequent visit to the islands.

The town of Kailua (recently renamed Kailua-Kona) was made capital of Kamehameha the Great's kingdom in 1812. In 1820, the first missionaries arrived, and soon oranges, grapes, cattle, horses, and other crops were established. The safe harborage available in the numerous coastal coves resulted in much whaling trade during the early decades of the 19th century.

Tourism is the primary business activity in North Kona, and the major economic stimulus for the entire district. Agriculture, still the main focus of South Kona, has been relegated to a secondary status in the north. Currently, there are approximately 5,100 transient dwelling units available in North Kona, comprising over 50 percent of the island's total inventory.

Many industries, including real estate, commercial, service oriented, and retail in particular, have benefited and expanded due to the income generated through tourism. Through mid-1990, property values in general increased significantly over the preceding decade--a result of the influx of visitor, resident, and retiree capital. This sharp rise in land prices had created concern in the agricultural community; however, over the past five years, real estate prices have generally dropped significantly between 20 and 75 percent, depending on the real estate submarket, with resort oriented and bulk acreage market segments severely impacted.

While the historic base of North Kona has been ranching, fishing, and diversified agriculture, the past three decades have seen a transition in the socioeconomic character of the region from an agrarian lifestyle to a resort and residentially oriented community designed to meet the

increasingly urbanized employment needs in the tourism-spurred Kailua-Kona to Keauhou and South Kohala development corridors. Yet, as tourism is generally oriented toward the warm sea coast area, away from upland residential/agricultural neighborhoods, a continued harmony between agricultural and urban/resort development is anticipated.

While many economic sectors in West Hawaii have languished since mid-1990, non-traditional retail shopping has changed dramatically. In late 1993, Price/Costco opened the area's first big-box discounter. Other discounters quickly followed suit, with Kmart and Wal-Mart now available to West Hawaii. This change has positively impacted consumers' purchasing power, but has thrown many traditional area retailers into competition shock, while they attempt to identify niche markets. Many smaller retailers have already been chased from the market.

Ranching, generally considered a poor use of the rocky and relatively expensive land in the district, has given way to a variety of sub-tropical and temperate crop production agricultural uses, although (for tax purposes) many bulk acreage holdings are still marginally classified as grazing. There are expansive macadamia nut orchards in both North and South Kona, with avocados, coffee, citrus, and floral/nursery products also cultivated. Commercial and charter fishing is a traditional and continuing economic activity, and a strong identification source for the Kailua-Kona community.

Kona International (nee Keahole) Airport is located approximately nine miles north of Kailua-Kona and has been handling direct mainland flights (via United Airlines) since July 1983 and direct flights from Japan since 1997. Expanded boat anchorage has been made available at Honokohau Small Boat Harbor. Adjacent to the airport is the Hawaii Ocean Sciences and Technology (HOST) Park. This project, funded by the state, offers private enterprises the opportunity to exploit the potentials of the North Kona coastal waters.

The State of Hawaii Housing, Finance and Development Corporation (HFDC) plans on developing approximately 990 acres makai of Palani Road at Kealakehe (at the northern fringe of Kailua-Kona). The acreage is to be acquired from the state Department of Land and Natural Resources (DLNR) at fair market value as mandated by state law.

The project entitled the Villages of Laiopua calls for the development of a planned community over the next 15 to 20 years. The 4,358-unit master planned community with a golf course emphasizes the development of "affordable" housing with a 60/40 percent mix of "affordable" and market rate housing, combined with neighborhood commercial and governmental facilities. Current projections estimate that 250 housing units constructed on approximately 60 acres will be developed annually. This project has stalled over the last several years because of a dispute between HFDC, the state's development entity, and the state's Office of Hawaiian Affairs (OHA) over compensation for use of state lands and the use of ceded lands (state-owned lands that were once owned by the Hawaiian monarchy).

The first residents of a 225-home Department of Hawaiian Home Lands (DHHL) subdivision (Village III), now called Kaniohale at the Villages of Laiopua development, moved into their completed homes during August 1998. Six different models were offered, with prices ranging from $49,500 for a two-bedroom self-help model to $125,500 for a four-bedroom developer built model. Average lot size is 6,000 square feet. More than 200 native Hawaiian families selected their home sites in a February 1998 lottery. Most of the applicants came from either the Big Island or Oahu.

Educational facilities include elementary and secondary schools located immediately north of Kailua-Kona, with an additional school midway between Kailua-Kona and Keauhou. Konawaena High School is located approximately 12 miles south of the village. Kealakehe High School, situated within the Villages of Laiopua development, was completed during 1997. Its first class of freshmen entered the school in the fall of 1997. A new class has been added to the school in each of the last three years.

All schools have bus service. Police and fire protection is located in Kailua-Kona.

The North Kona water system is primarily supplied by five wells at Kahaluu and Waiaha Streams, with Kahaluu wells providing the bulk of the water. Additional wells are currently in the drilling and testing stages. At present, source output capacity is approximately 9 to 11 million gallons per day; a figure which has grown with the addition of a new well in the area. However, a recent attempt at another well drilling in the field was unsuccessful. Most residences in the Kona

area are serviced by individual sewerage (cesspool) facilities, with urban Kailua-Kona and Keauhou being serviced through municipal sewerage systems. Power and telephone utilities are available along major roadways throughout the district.

Tourism is a major contributor to the North Kona economy with a tourism plant that is beginning to age and was generally conceived prior to implementation of the resort concept. For that reason, North Kona only has two resort locales; i.e., the Keauhou Resort south of Kailua-Kona proper and the Kona Village Resort north of the airport designed as a get-away experience. Most hotels in the Kailua-Kona area have been developed as freestanding properties, with little regard to overall planning and ambiance of individual neighborhoods.

Kona Village/Hualalai Resorts

The Kona Village Resort, a 62-acre holding currently improved with a 125-room hotel, 12 miles north of Kailua, is the only developed resort area outside of the Kailua-Kona to Keauhou Corridor within the North Kona district. The isolated village, which has historically achieved high occupancy rates, is a Polynesian-style, low-intensity retreat facility. The village is located within the Kaupulehu ahupua'a along the shores of Kahuwai Bay.

The Hualalai Resort has set a new standard along West Hawaii's "Gold Coast." The resort property has attracted a "well-to-do" clientele and has successfully marketed oceanfront residential sites and condominium units, in an otherwise weak economic climate. Such has been the success of the resort's initial offerings, unlike other upscale Kohala Coast resort recent sales efforts.

A 243-unit low-rise hotel complex consisting of 37 bungalows was completed in October 1996. The new hotel was developed adjacent to the Kona Village Resort and has been named The Four Seasons Resort Hawaii at Hualalai. The new property was developed by Hualalai Development Company, which is owned by Kaupulehu Makai Venture, an affiliate of Tokyo-based Kajima Corporation. The single-family lots and villa units have been exceptionally well-received at very high prices, with most purchasers being West Coast residents. All available inventory has been quickly sold.

The resort is serviced by an 18-hole Par-72 Jack Nicklaus-designed golf course. Plans exist for expansion to a 27-hole course as the need

arises. The resort course is well-situated and private for use of resort unit owners and guests only.

Central Urban Area Kailua-Kona to Keauhou Corridor

Kailua-Kona, the population center of West Hawaii, is developed with hotels, condominiums, and commercial services generally directed toward the visitor industry. In addition to tourism, the village is the commercial hub for residential and agricultural developments in the surrounding area.

The corridor between Kailua Village and Keauhou, stretching from the shoreline up-slope to Mamalahoa Highway, is in a state of evolution, with properties along the ocean being improved with condominiums and high density residential projects. The cooler mauka areas are being developed into single-family residential subdivisions as State Land Use (SLU) and county zoning designations are changed to permit such improvement, and water is made available. Commercial frontage improvements have been made along Alii Drive, Palani Road, and Kuakini Highway.

The recent construction of the Crossroads Shopping Center along Henry Street, has shifted the commercial center of town to a more mauka orientation and away from Kuakini Highway, which has historically approximated the center of town.

Keauhou Resort

The 2,000-acre Keauhou Resort area is in the midst of its third phase of development with planned residential and condominium development centered near the existing hotels, resort multi-family project, and the Kona Country Club. To date, 1,330 hotel rooms and 1,252 condominium units have been constructed in the project.

Extensive non-tourist commercial development has been moderately successful at Keauhou within the original phase of the Keauhou Shopping Center. Phase II of the shopping village, completed in late 1994, remained mostly vacant until late 1996 and 1997 at which time leasing of remaining commercial space occurred, indicative of improving economic times.

Bishop Estate's Kamehameha Investments, which owns the resort, took back the Kona Lagoon Hotel from Azabu in early September 1995 for non payment of lease rent. The hotel had been closed since 1989, when Azabu purchased it in conjunction with the neighboring Keauhou Beach Hotel, which it gave back to Bishop Estate effective

May 1, 1998. It was reported at the end of April 1998, that the Keauhou Beach Hotel would be closing due to a transfer of leasehold ownership to a Arizona real estate group which will start immediate renovations. On March 1, 1999 Aston Hotels and Resorts re-opened the 314-room former Keauhou Beach property.

ADDENDA III: MARKET STUDY OF THE WEST HAWAII INDUSTRIAL SECTOR

The proposed Kaloko-Honokohau Business Park project will offer subdivided light industrial, industrial/commercial mixed-use lots, and quarry/heavy industrial which would be competitive with other existing and proposed industrial/ commercial developments for buyers and tenants in the West Hawaii market sector. The sphere of economic influence in this market is the entire leeward (or west) side of the island encompassing the districts of North and South Kona, and North and South Kohala.

The westerly side of the central mountain range has become basically autonomous from the windward/easterly side over the past two decades, with expanded public facilities and emerging independent business community. The on-island demand of the resident, tourist and business groups in the area are focused towards regional suppliers and services. The subject would be competing to provide space for these businesses.

The vast majority of regional demand has been focused into the Queen Kaahumanu Highway corridor between Kailua-Kona and the Kona International Airport. This is anticipated to continue based on the favorable location and access characteristic of the area.

Our analysis of the West Hawaii industrial market sector is divided into three general subsections: **quantification of demand, identification of supply, and correlation of indicators.**

The demand and supply characteristics of the Quarry/Heavy Industrial Sector are discussed in a subsequent subsection.

Demand is discussed from both long- and short-term perspectives; the former using resident and tourism population requirements as a basis for determining additional industrial spatial needs over the next two decades, the latter based on absorption levels currently being achieved in study area subdivisions and prospects for further business expansion over the next several years.

The level of existing and proposed industrial acreage supply is addressed subsequently, with the demand/supply quotients then compared to arrive at a conclusion of need (or lack thereof) for further designation of industrial lands in West Hawaii.

The analysis is not dependent upon public agency land use planning guidelines. Although the existing state and county development plans covering the subject call for urban/industrial uses specifically in the affected area, this does not influence our assessment of demand and supply.

Quantification of Demand

1. Mid- to Long-Term Indicators

Being in the midst of a transformation from an agrarian-based to "modern" community, historic industrial demand levels for West Hawaii are not fully indicative of probable future occurrence or appropriate for projecting long-term regional space needs. Significant new services and products will be required by the coastal resorts, expanding Kailua businesses, and state-sponsored developments at the HOST Park, Keahole Agricultural Park, Keahole Airport and Honokohau Harbor.

Additionally, the growing resident and tourism populations will create economies of scale allowing "industrial" businesses previously located on Oahu or the mainland to relocate to and operate efficiently in West Hawaii.

We believe the best method for determining the level of projected spatial needs for the study region is through the use of per capita spatial demand trends.

Fundamentally, demand for industrial development is a direct function of consumer demand for the finished product or service. As population levels (resident and tourist) increase, the need for additional services is proportionately created.

By ascertaining an appropriate *"per square foot of industrial development per person"* allowance, and applying this ratio against forecast population levels, the regional demand for industrial space over time can be quantified.

Owing to its isolated island status, a precise measurement of direct market (consumer) requirements can be made. This is a reasonably accurate and desirable method unavailable to "linked" mainland urban centers wherein market demand overlaps between sectors and identification of an exact "impact radius" is virtually impossible.

All industrial and commercial real property demand is a product of base consumer needs, and the most efficient projection process is one which can identify the breadth of consumer shares.

There are three steps in completing this forecasting model:

1. Project consumer population levels
2. Estimate per capita spatial demand ratios
3. Test model scenarios

The various model scenarios tested identify the most probable market demand ranges for further West Hawaii industrial development.

Consumer Population Levels -- Demand for West Hawaii industrial space is a function of two ultimate constituent consumer groups, local residents and tourists visiting the area.

Table III-1 displays our projections for these demographic categories during our 20-year study and projection time-frame 2000 to 2020.

Resident population estimates are based on State of Hawaii Department of Business, Economic Development and Tourism (DBEDT) forecasts contained in their "DBEDT 2020 Projections," as tempered by other sources, including:

- Mid-point projections prepared by the county of Hawaii Planning Department in recent General Plan updating;
- Resident housing demand forecasts by the US Department of Housing and Urban Development; and,
- Estimates prepared by various private consultants and developers for use in land use change petitions (typically within EIS).

The tourism population levels were estimated based on analyses undertaken by (or for) the state and county, the Hawaii Visitors Bureau, and based on extensive experience in the statewide and West Hawaii visitor industries. The tourism totals are the average daily visitor census during the projection year.

Together, the resident and tourist totals combine to form the effective "de facto" population of consumers in the study area.

Per Capita Spatial Demand Trends -- The best indicators of appropriate industrial demand requirements for an urban island economy can best be drawn from the experience of Oahu, which though historically under-supplied, provides useful insight into the probable growth trends of the outer islands.

Table III-2 displays the industrial space per capita demand trends for the City and County of Honolulu for the period 1977 through 1999. For comparative purposes, demand is expressed on a de facto (resident and tourist) population basis. The total estimated developed industrial space of 35,200,000 square feet, equates to a de facto per person ratio of 38.58 square feet as of the end of last year.

This compares with nationwide estimates by the **Urban Land Institute** and others which indicate a range of 25 to 35-plus square feet per person is appropriate for an urban economy. The overall national range represents the lower end of the spectrum for Hawaii. In the islands, unlike the mainland, many quasi-service and full commercial users locate in industrial projects instead of retail development, pushing the effective per capita "industrial" figure higher.

Applying the Oahu figures to West Hawaii requires some analysis. In many respects, being the center of the state economy and home to the majority of residents, Oahu would be expected to have an atypically high amount of industrial development in order to support statewide consumers. Conversely, in order to provide a service to West Hawaii, a similar-sized plant as would be found in a larger metropolitan area may be required even though the population is far less; pushing upwards the per capita space ratios.

Maui, which is a market several steps advanced beyond West Hawaii in its transformation from agriculture to urban uses, currently has about 41 square feet of identified mixed use industrial floor space per

TABLE III-1

HISTORIC AND PROJECTED DE FACTO POPULATION LEVELS
IN PRIMARY MARKET AREA 1999 TO 2020
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

Year	Year End 1999	Projected 2000	2005	2010	2015	2020
RESIDENT POPULATION						
North Kohala	6,165	6,227	6,810	7,484	8,210	8,960
% Average Annual Change	%	1.01%	1.87%	1.98%	1.94%	1.83%
South Kohala	17,948	18,140	20,651	23,720	26,508	29,422
% Average Annual Change	%	1.07%	2.77%	2.97%	2.35%	2.20%
North Kona	29,942	30,425	34,268	38,932	44,620	49,981
% Average Annual Change	%	1.61%	2.53%	2.72%	2.92%	2.40%
South Kona	10,110	10,239	11,347	12,640	14,210	15,980
% Average Annual Change	%	1.28%	2.16%	2.28%	2.48%	2.49%
Total Resident Population	64,165	65,031	73,076	82,776	93,548	104,343
% Average Annual Change	%	1.35%	2.47%	2.65%	2.60%	2.31%
TOURIST POPULATION						
Average Regional Daily Visitor Count	21,690	22,740	26,589	30,920	36,224	42,688
% Average Annual Change	%	4.84%	3.39%	3.26%	3.44%	3.56%
TOTAL REGIONAL DE FACTO POPULATION	85,855	87,771	99,665	113,696	129,782	147,031
% Average Annual Change	%	2.23%	2.71%	2.82%	2.83%	2.66%

(1) All figures drawn or extrapolated from "DBEDT 2020 Projections" series Table A

Source: State of Hawaii Department of Business Economic Development & Tourism, and The Hallstrom Group, Inc.

TABLE III-2

SUMMARY OF INDUSTRIAL SPACE DEVELOPMENT ON OAHU 1977 TO 1999

Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment of the Proposed Kaloko-Honokohau Business Park Honokohau, North Kona, Hawaii

Year	Industrial Floor Space Area (Leaseable Sq. Ft.)	De Facto Population of Island	Ratio of Industrial Space Per Person (Sq. Ft.)
1977	22,819,000	793,285	28.77
1978	23,412,000	801,527	29.21
1979	23,976,000	817,511	29.33
1980	24,780,000	823,400	30.09
1981	25,645,000	824,700	31.10
1982	---	837,600	---
1983	---	846,300	---
1984	---	852,300	---
1985	28,929,999	854,800	33.84
1986	28,159,000	871,000	32.33
1987	28,644,000	881,000	32.51
1988	29,714,000	888,200	33.45
1989	30,582,000	905,900	33.76
1990	31,261,000	911,800	34.28
1991	32,444,000	913,400	35.52
1992	33,280,000	907,700	36.66
1993	33,600,000	903,900	37.17
1994	33,820,000	914,500	36.98
1995	34,000,000	915,000	37.16
1996	34,200,000	918,000	37.25
1997	34,460,000	906,100	38.03
1998	34,831,000	908,200	38.35
1999	35,200,000	912,300	38.58
Compounded Annual Growth Rate for 1977 through 1999	1.99%	0.64%	1.34%
Average Annual Addition for 1977 through 1999	538,304	5,175	0.43

Note: Complete data not available for all study years.

Source: State of Hawaii Department of Business and Economic Development, Hawaii Real Estate, CB Commercial, and The Hallstrom Group, Inc.

person in the de facto population. Kauai has 35 square feet; and Hilo, 33 square feet.

At present, West Hawaii has an estimated 1,967,040 square feet of competitive industrial space, as shown on Table III-3. This equates to an average per capita supply of 22.90 square feet per person in the de facto population of 85,855. This is undersupplied relative to other island markets and mainland levels; a conclusion bolstered by the emerging shortfall of product in the region as the economy has grown over the past several years, and by the rapid absorption of newly available industrial lots in late 1999.

The development of space has expanded on a per capita basis in West Hawaii at a compounded annual rate of 1.51 percent annually over the past two decades, and at less than one percent per year during the 1990s.

We have concluded an appropriate full-service objective in per capita finished spatial allowance for West Hawaii would be circa 29 to 42 per square feet per person in the de facto population (tourist and resident). Based on the market data, we anticipate spatial demand to increase from the current level (22.9 square feet) to the stabilized supply level at a rate of 1.19 percent ("slow" growth) to 3.08 percent ("extraordinary" growth) compounded annually during the study period.

Application of the Model -- By multiplying the de facto population forecasts by the per capita spatial trends, we can estimate the probable demand for finished industrial space in West Hawaii. This figure can be translated into underlaying acreage requirements through use of an appropriate Floor Area Ratio (FAR).

We have tested four demand scenarios using the following assumptions:

TABLE III-3

SUMMARY OF ESTIMATED ABSORPTION AND VACANCY RATES FOR INDUSTRIAL SPACE IN WEST HAWAII THROUGH 1999
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

Year	Finished Space Constructed Annual (Sq. Ft.)	Finished Space Constructed Cumulative (Sq. Ft.)	Estimated Vacancy Rate (% of Mkt.)	Effective Space Available (Sq. Ft.)	Gross Land Area Requirement Periodic (Acres)	Gross Land Area Requirement Cumulative (Acres)	Available Acreage (1)	Oversupply or (Undersupply)
Pre-1978	430,000	430,000	—		52.52	52.52	117.6	65.08
1978	89,600	519,600	3.50%	18,186	10.94	63.46	124.6	61.14
1979	94,500	614,100	1.00%	6,141	11.54	75.00	132.6	57.60
1980	39,800	653,900	2.00%	13,078	4.86	79.86	132.6	52.74
1981	16,300	670,200	2.50%	16,755	1.99	81.85	141.6	59.75
1982	28,800	699,000	2.00%	13,980	3.52	85.37	141.6	56.23
1983	43,100	742,100	1.00%	7,421	5.26	90.63	147.7	57.07
1984	57,300	799,400	0.50%	3,997	7.00	97.63	217.9	120.27
1985	68,700	868,100	1.00%	8,681	8.39	106.02	217.9	111.88
1986	85,700	953,800	2.00%	19,076	10.47	116.49	217.9	101.41
1987	108,600	1,062,400	3.00%	31,872	13.26	129.75	217.9	88.15
1988	122,200	1,184,600	3.50%	41,461	14.92	144.68	217.9	73.22
1989	139,500	1,324,100	4.50%	59,585	17.04	161.71	223.7	61.99
1990	171,000	1,495,100	5.00%	74,755	20.88	182.60	223.7	41.10
1991	118,200	1,613,300	6.50%	104,865	14.44	197.03	223.7	26.67
1992	55,000	1,668,300	7.50%	125,123	6.72	203.75	223.7	19.95
1993	36,940	1,705,240	8.50%	144,945	4.51	208.26	223.7	15.44
1994	18,900	1,724,140	9.00%	155,173	2.31	210.57	223.7	13.13
1995	38,600	1,762,740	9.50%	167,460	4.71	215.28	233.6	18.32
1996	64,500	1,827,240	9.25%	169,020	7.88	223.16	233.6	10.44
1997	56,400	1,883,640	8.50%	160,109	6.89	230.05	233.6	3.55
1998	38,400	1,922,040	7.50%	144,153	4.69	234.74	233.6	(1.14)
1999	45,000	1,967,040	5.50%	108,187	5.50	240.24	305.8	65.56
Annual Average 1978-1999	73,192		4.69%		8.94			

Note: Figures include some quasi-commercial space in industrial parks.
(1) Available acreage increases with the opening of new industrial/business subdivisions. Excludes OTEC and HOST Parks.

Source: Various, CB Commercial, and The Hallstrom Group, Inc.

Growth Scenario	Per Capita Space in 2020 (Sq. Ft./Person)	Annual Growth Rate from Present
Slow	29.0	1.19%
Moderate	33.0	1.84%
Aggressive	39.0	2.70%
Extraordinary	42.0	3.08%

Application of these figures to the projected de facto population levels are shown on Tables III-4 through III-7. The results from the analysis are summarized on Table III-8. The indicated mid-point demand conclusion is shown at the bottom of the table.

Based on our study, we estimate the total increase in demand for finished industrial space in West Hawaii between the report date and the year 2020 will be some 3,179,045 square feet.(3) This equates to a two decade demand for industrial lands of approximately 388 gross acres during the study period.

2. Short-Term Demand Indicators

The construction and absorption of industrial space in the study region over the past decade both mirrors general West Hawaii economic trends and is directly insightful into the on-going evolution of a "sleepy seaside village" into a more modern, service-based community.

The industrial sector has increased dramatically in extent and complexity since 1978, with some 1.97 million square feet absorbed through 1999, representing a five-fold expansion of the market in 20 years. And, despite periodic surges in demand/supply ratios, the vacancy level for existing industrial buildings throughout the time-frame has historically been well-below comparable-sized mainland regions.

A summary of estimated industrial space demand in the study area in recent years was shown on Table III-3. The figures are based on inspection of tax office records, discussions with developers and brokers, and review of space listing data. Also shown were estimated

(3) Includes 3,127,352 square feet between 2000 and 2020, and 51,693 square feet of latent demand in 1999-2000.

TABLE III-4

PROJECTED INDUSTRIAL SPACE DEMAND
IN WEST HAWAII 2000 TO 2020
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
SCENARIO ONE: Slow

Year	De Facto West Hawaii Population	Per Capita Industrial Space	Total Required Gross Industrial Floor Space Area
2000	87,771	23.00	2,018,733
2005	99,665	24.50	2,441,793
2010	113,696	26.00	2,956,096
2015	129,782	27.50	3,569,005
2020	147,031	29.00	4,263,899

Source: The Hallstrom Group, Inc.

TABLE III-5

PROJECTED INDUSTRIAL SPACE DEMAND
IN WEST HAWAII 2000 TO 2020
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
SCENARIO TWO: Moderate

Year	De Facto West Hawaii Population	Per Capita Industrial Space	Total Required Gross Industrial Floor Space Area
2000	87,771	23.00	2,018,733
2005	99,665	25.50	2,541,458
2010	113,696	28.00	3,183,488
2015	129,782	30.50	3,958,351
2020	147,031	33.00	4,852,023

Source: The Hallstrom Group, Inc.

TABLE III-6

PROJECTED INDUSTRIAL SPACE DEMAND
IN WEST HAWAII 2000 TO 2020
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
SCENARIO THREE: Aggressive

Year	De Facto West Hawaii Population	Per Capita Industrial Space	Total Required Gross Industrial Floor Space Area
2000	87,771	23.00	2,018,733
2005	99,665	27.00	2,690,955
2010	113,696	31.00	3,524,576
2015	129,782	35.00	4,542,370
2020	147,031	39.00	5,734,209

Source: The Hallstrom Group, Inc.

TABLE III-7

PROJECTED INDUSTRIAL SPACE DEMAND
IN WEST HAWAII 2000 TO 2020
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
SCENARIO FOUR: Extraordinary

Year	De Facto West Hawaii Population	Per Capita Industrial Space	Total Required Gross Industrial Floor Space Area
2000	87,771	23.00	2,018,733
2005	99,665	28.00	2,790,620
2010	113,696	33.00	3,751,968
2015	129,782	38.00	4,931,716
2020	147,031	42.00	6,175,302

Source: The Hallstrom Group, Inc.

TABLE III-8

SUMMARY OF PROJECTED INDUSTRIAL SPACE DEMAND SCENARIOS FOR WEST HAWAII 1999 THROUGH 2020
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
All Figures in Gross Square Feet Except as Noted

TOTAL SPACE DEMAND (Sq. Ft.)

Scenario	1	2	3	4
Year	*Slow Growth*	*Moderate Growth*	*Accelerated Growth*	*Extraordinary Growth*
2000	2,018,733	2,018,733	2,018,733	2,018,733
2005	2,441,793	2,541,458	2,690,955	2,690,955
2010	2,956,096	3,183,488	3,524,576	3,524,576
2015	3,569,005	3,958,351	4,542,370	4,542,370
2020	4,263,899	4,852,023	5,734,209	5,734,209

PERIODIC DEMAND (Sq. Ft.)

Scenario	1	2	3	4
Year	*Stable Growth*	*Moderate Growth*	*Accelerated Growth*	*Extraordinary Stable Growth*
2000	—	—	—	—
2005	423,060	522,725	672,222	672,222
2010	514,303	642,030	833,621	833,621
2015	612,909	774,863	1,017,794	1,017,794
2020	694,894	893,672	1,191,839	1,191,839

CUMULATIVE STUDY PERIOD DEMAND (Sq. Ft.)

Scenario	1	2	3	4
Year	*Stable Growth*	*Moderate Growth*	*Accelerated Growth*	*Extraordinary Stable Growth*
2000	—	—	—	—
2005	423,060	522,725	672,222	672,222
2010	937,363	1,164,755	1,505,843	1,505,843
2015	1,550,272	1,939,618	2,523,637	2,523,637
2020	2,245,166	2,833,290	3,715,476	3,715,476

CONCLUDED STUDY MID-POINT DEMAND

	Finished Space Demand in Square Feet			Total Gross Land Area Demand (1)
	Total	Periodic	Cumulative	
2000	2,018,733	—	—	246.5
2005	2,591,290	572,557	572,557	316.5
2010	3,297,184	705,894	1,278,451	402.7
2015	4,153,024	855,840	2,134,291	507.2
2020	5,146,085	993,061	3,127,352	628.5

(1) Assuming average FAR of .25 and gross to net usability loss of 30% of the site.

Source: The Hallstrom Group, Inc.

market-wide floor space vacancy rates for existing/established buildings.

The key factors in short-term demand analysis are the velocity of absorption for offered product, and vacancy rates in completed developments. If newly subdivided lots and multi-tenant buildings are quickly sold or "leased out," and the tenant turnover rate is low, the market is healthy.

Such a positive condition has been emerging in West Hawaii over the past two years. The recovery of tourism, increasing demand for resort-oriented and upscale residential product, and success of numerous "big box" retailers has vitalized the construction, trade and service sectors. The cumulative effect has been to absorb the inventory oversupply in industrial real estate which existed in the early to mid-1990s, and create a favorable high demand cycle. Finished space absorption has been slowed by lack of new product, not limited demand, a situation which will change as new buildings are constructed at Kaloko Industrial Park II and Kohanaiki Mauka.

West Hawaii has generally been the fastest growing neighbor island region since the mid-1980s. During this period, the scale and diversity of industrial-type businesses has increased, competition has replaced sole-source operators, major companies now favorably view Kona as a long-term location, and local entrepreneurs have expanded in response to new opportunities.

In response to the development at Kohala resorts and a general economic upturn, the industrial sector surged upwards during the mid- to late 1980s, followed by a deep recession that lasted until mid-decade in the 1990s. Construction and absorption similarly peaked and waned over the past 18 years, typically with a 12 to 18-month delayed reaction period. With virtually every major economic indicator pointing to a regional upcycle beginning in 1997-1998, the current high demand is an expected by-product of the general upturn.

Large additions to the regional inventory began coming on-line in 1985-86 and were absorbed rapidly, typically with lease-up periods of less than six to twelve months. Established properties were experiencing vacancy rates of less than two percent.

In some respects, the absorption showed a "migration" of use types from the older leasehold Kona Industrial Subdivision, located on the northern edge of Kailua-Kona, to the new fee simple Kaloko Industrial Park space four miles north along Queen Kaahumanu Highway.

Concerned with increasing land and space rent structures, deteriorating truck traffic/access conditions, and conflicting neighboring uses, many firms chose to relocate from the older subdivision to the then more remote park. The vacated space was quickly absorbed by new and expanding commercial and other "non-industrial" businesses who desired a central Kailua location.

The result has been that most of the "true" business and light industrial users are now at Kaloko (or elsewhere), while the Kona Subdivision is now a commercial/retail/service facility. The trend towards commercialization of light industrial subdivisions is common in Hawaii, with excellent examples at Kahului/Wailuku and Central Oahu.

During the past 21 years, the average rate of absorption of finished space has been at 73,192 square feet per year, equating to approximately 8.94 acres of subdivided lots annually.

After plummeting to a low of 18,900 square feet in 1994, demand for new space increased strongly, averaging nearly three times that level over the following five years.

The actual number of lots absorbed in 1999 far outpaced the finished space land requirement. Two projects, the Kaloko Business Park (35 one-acre lots) and Kohanaiki Mauka development (32 one- to five-acre lots), sold more than 80 percent of their available inventory last year, at prices ranging from $8.50 to $18.00 per square foot. While the successful offerings were the culmination of several years of pre-sale marketing, the exceptional acceptance of the product is of significant note. Our discussions with realtors indicates demand for additional lots continues.

An excellent picture of the finished space market leasing conditions can be taken from *West Hawaii Today*, the only daily newspaper in leeward Big Island and the primary vehicle for advertising available space, as the MLS does not contain such data. We have surveyed

listings in the "Business Property for Rent" section of the classifieds on a biannual basis from October 1987 through October 1999.

While it is difficult to make exact industrial versus commercial space delineations, we estimate there is some 100,000 to 110,000 square feet of finished vacant industrial floor space in the regional market, which equates to a vacancy rate of 5.5 percent. This is the lowest amount of available space since 1991, and the lowest vacancy rate since 1990. During the preparation of this report, absorption of available space quickened significantly, with the vacancy rate dropping by more than 1.5 points in the last quarter of 1999. Recent discussions indicate vacancy levels may now be less than five percent.

The increase in demand is reflected in the tightening rent rolls of multi-tenant buildings. In the Kona Industrial Park, about 30 percent mixed-use buildings have space available, down from 40 percent one year ago. In the Kaloko Industrial Park, about 8 to 10 percent of multi-tenant projects are offering floor space, down from 12 to 15 percent in mid-1999.

The strongest space demand is coming from the industrial users (contractors, suppliers, storage and specialty service providers) not the quasi-commercial users, who now have numerous alternatives in in-town developments. The industrial users favor the access, lesser congestion, joint industrial use mix, and lower rents of the Kaloko-Honokohau area.

Generally, warehouse rents in the subject's effective market area are quoted on a gross basis, with a common area maintenance (CAM) expense being identified. Tenants typically pay a pro rata share of operating expenses including common area maintenance, utilities, management fees, real property tax, security, administrative overhead, insurance, and gross excise taxes. From a market perspective, gross rent is the comparable figure considered by most potential tenants.

The landlords report that up until mid-1999 it was a common practice to offer 30 to 60-plus days free rent during a move-in period. However, there has been a stiffening of incentives in recent months as the market has strengthened. Tenant improvement allowances are not common, but landlords are open to long-term leases that build the cost of improvements into a higher rent structure. Typically, tenants are

responsible for finishing their space with no reimbursement allowance provided by the landlord.

The current trend is to negotiate tenant leases having terms of approximately three years, although one-year leases are also prevalent in the market. For multi-year leases with annual step-up provisions, the prevailing practice is an annual increase of three percent.

The resurgent demand for developable (vacant) industrial lots since mid-1999 is considered a primary indicator of the general economic recovery underway in West Hawaii.

Finished lot sales declined dramatically in the early 1990s due to lack of new inventory and a deep recession. No vacant industrial properties were sold/leased in 1994, the low point in the cycle, before the market stabilized and began showing recovery by late in the decade.

By 1998, strengthening tourism and resort sectors created new employment, service and supply opportunities, which spurred interest in industrial expansion. In 1999, two long-planned projects came on-line in the most favorable area, with 54 of 67 lots selling within nine months; about half being the result of extended pre-sale efforts. Several additional sites were successfully absorbed within new minor subdivisions at Honokohau II and Kealakehe.

The selling prices, though below the peaks achieved in the late 1980s upcycle, are slightly above prices of mid-decade and represent one of the smallest percentage declines from peak values to current values among any island sector.

Based on discussions with brokers and agents, it is apparent the new offerings have gone a long way to meeting the pent-up demand that had been emerging very slowly during the prolonged recession. The last significant addition to the standing lot inventory had been in 1987, and the intervening decade without additional supply had developed some new or expanding interest in alternative sites awaiting favorable economic conditions despite the generally slow conditions from 1991 into 1997.

However, with the signals pointing to a meaningful upcycle emerging in West Hawaii, there continues to be a demand for industrial lots. Agents report resale discussions among the initial buyers at the new

projects, and that investors are now showing interest in lots in the region whereas most of the purchasers were end-user parties.

3. Demand Conclusions

Based on our investigation and analysis of the West Hawaii industrial market sector, we have reached the following conclusions:

- The long-term economic future of the study region is positive, with significant growth anticipated in population and consumer levels, business activity, development and the primary industries over the long term. This will create demand for an estimated 3.18 million square feet of finished industrial space over the next two decades if the goal of a modern, service-based economy is to be achieved. Upwards of 388 bulk acres of holdings will be required to meet the needs.

- Following an extended period of low activity in early to mid-decade, the West Hawaii economy and industrial real estate sector (a foundational indicator) have shown substantial recovery and growth since late 1996, with particular strength over the past nine months. An average of 73,200 square feet has been leased annually, a figure which will likely be broken in 2000-2001 as the market continues a general upcycle which began in 1996-1997. Regional demand is expected to reach up to 125,000 square feet annually by mid-decade, with demand for about 15 new finished lots each year.

- We anticipate the industrial sector expansion will continue over the next several years as increasing tourism, construction activity and business development and enlargement occurs. This will be the second major thrust towards standard urbanization for West Hawaii. Thereafter, demand will stabilize at a lower level and show more gradual growth.

We anticipate the large majority of this development/use (90 to 95-plus percent) will be focused along Queen Kaahumanu Highway between northerly Kailua-Kona and the Kona International Airport.

Identification of Supply

1. Existing Supply

There are currently eight competitive industrial developments in West Hawaii. An overview of the inventory offered and their general status are individually summarized in the following paragraphs and on Table III-9, and identified on the adjoining map.

The Kona Industrial Subdivision -- This was the first modern industrial subdivision in the Kona area. It encompasses approximately 52 acres on the northerly edge of the Kailua-Kona community, at the southern end of the Kailua-Kona to Kawaihae corridor. Despite its prime location and the economic growth of the past two decades, the project has not been expanded since the early 1980s even though there is a long-planned 100-acre site available adjacent to the subdivision. Historically, this development has been the most significant industrial complex on Hawaii's leeward coast, and an important economic factor in Kailua-Kona.

A total of 53 lots, ranging in size from 1.0 to 6.1 acres, were developed during the first five increments from 1960 through 1981. The fee landowners and master lessor are the Trustees of the Liliuokalani Trust (First Hawaiian Bank).

It required 18 years (1970-1988) for all 53 lots to be absorbed by the market, or at a rate of 2.94 lots per year. Peak demand was during the mid to late 1970s, at about three times this rate. From 1983, demand virtually ceased until wide-spread commercial development began dominating the demand for park sites at mid-decade. The lots are leased basically ungraded, with the lessor providing all on-site infrastructure improvements.

The subdivision has been the source of sporadic controversy since its inception due to two factors: tenant-types allowed, and ground lease rent increases. In some respects, the issues are related.

The original zoning designation of the project (ML-1a) is generally considered one of the most broad classifications within the County of Hawaii Zoning Ordinance. While the legislative attempt was to provide warehouse, operational and limited store frontage for wholesaler/distributors and light industrial uses, the actual experience

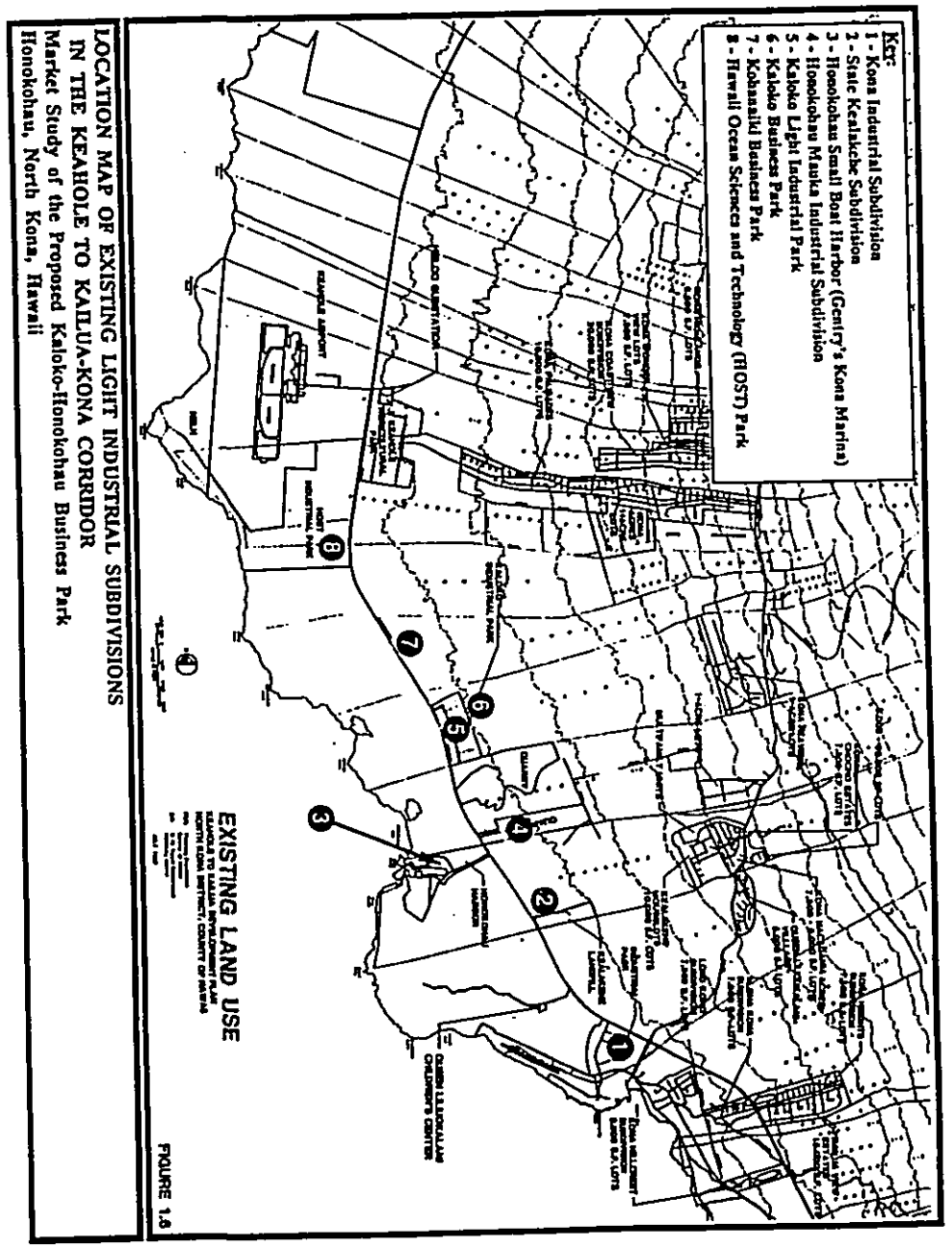


TABLE III-9

SUMMARY OF MAJOR EXISTING INDUSTRIAL PROJECTS
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Chronological Order of Development

Project Name	Location	Approx. Gross Acreage	Number of Subdivided Lots	Original Offering Date	Land Tenure	Original "Sales" Price (per Sq FT)	Absorption Speed (Lots/year)	Lot Size Range (acres)	Comments
Kuai Hana II	Kawaihae, North Kohala	53.6	23	1964	Lease	$0.60	1.15	1.0 to 12.9	HIE park not truly marketed until mid-70's.
Kona Industrial Subdivision	Kaloko-Kona, North Kona	52.3							Main industrial park in West Hawaii, adjacent to Kaloko-Kona. Subject to expansion area for project.
Phase I			18	1969	Lease	$0.70 (1)			
Phase II			11	1973	Lease	$2.30			
Phase III			7	1977	Lease	$3.10			
Phase IV			8	1979	Lease	$3.25			
Phase V			2	1981	Lease	$6.39			
Totals			53				2.94	1.0 to 6.1	
Honokohau Small Boat Harbor	Honokohau, North Kona	6.1	4	1983	Lease	$4.00	4.00	.25 to 4.1	State harbor support lands, must be marine-related use. Rents to reach market levels by 1991.
Kaloko Industrial Park	Kaloko, North Kona	70.2	55	1984	Fee	$6.75	13.47	1.0 to 1.4	First major fee park in region, much space exact, in late 80's.
Hawaiian Ocean Sciences and Technology (HOST) Park (2)	Kaloko, North Kona	547.0	Open	1990	Lease	Open	0.00	Open	Major directed-use development. No tenants as yet.
State Kaloko Subdivision (2)	Kaloko, North Kona	5.8	4	1990	Lease	$12 to $18	4.00	.2 to 1.1	On Hwy, adjacent to prison and waste transfer station.
Honokohau Marina Ind. Subdivision	Honokohau, North Kona	9.9	3	1995	Fee	$6 to $26 (4)	3.00	3.1 to 3.5	Marina of boat harbor, developed as joint venture. Highway-front park in demand.
Kaloko Business Park	Kaloko, North Kona	34.3	32	1999	Fee	$8 to $22	—	1.0 to 1.7	Expansion of industrial park, 16 lots in negotiations/sources after two years prevails offers.
Kaloko-Hill Business Park	Kaloko-Hill, North Kona	37.9	26	1999	Fee	$8.50 to $17.11	—	1.0 to 1.1	New park, 23 lots sold or reserved.

Note: List does not include heavy-industrial, marine-oriented State subdivision at Kawaihae Harbor, non-competitive Waimea lands, NELH uses or other minor projects.
(1) Fee simple indicates taken from basis for lease rent or capitalized value of rents.
(2) Unavailable for open market light industrial and quasi-commercial uses. Not considered as providing competitive product.
(3) Market portion only of state 60-plus acre subdivision, remainder of land in public use.
(4) Average indicated value of $10.43 per square foot as basis. Portions of Highway-front larger parcel subsequently leased for $26 per SF.
Source: County Planning Department, Various and The Hallstrom Group, Inc.

has been the proliferation of non-conforming retail, restaurant and other commercially-oriented lessees. The result of this retail tenant influx (more concerned with lower rents relative to available commercial facilities than in appearances) was that space lease rents escalated to levels that while still-readily acceptable to commercial users, were high for industrial tenants. Attempts to expedite enforcement of the zoning codes have proven unsuccessful. The problem of non-conforming commercial uses becoming major tenants in industrially-zoned developments (potentially damaging legitimate commercial space developers), is common in the outer islands.

The project has moved almost entirely away from its original light industrial use commitment. All of the improvements constructed in the past ten years have been of the multi-tenant retail/commercial type, with minimum "true" industrial space developed. Acknowledging this unstoppable trend, portions of the Park should be re-zoned from industrial (MG-1A) to commercial (CV-10), to legally accommodate the prevailing dominant uses for future phases.

One of the reasons for the delay in offering expansion phases in the project has been in the decision on whether to make the new phases primarily or exclusively commercial/business/service uses. This would capitalize on the excellent in-town location of the holding, build on the existing tenant base, and avoid the unfavorable view industrial land buyers have of leasehold ownership for commercial users for whom this is less of an issue.

The controversies surrounding rent renegotiation are common in all Hawaii real property sectors. The rapid appreciation of land over the last 20 years has resulted in present rents many-fold above earlier fixed-term periods. For industrial tenants in the Kona complex, many of which faced re-opening during the late 1980s upcycle, the rent appreciation effect was worsened by the subsequent general economic recession experienced early in the 1990s which limited consumer demand. Many industrial lessees were concerned the fee owners considered the ability of the non-conforming commercial tenants to pay higher rents during the renegotiation process, which was eventually decided through an appointed arbitration panel.

While the declining desirability of the Park for industrial uses (which was near all-time lows in 1985-87) ebbed, and "prices" paid for lots

have stabilized, the subdivision no longer holds a predominant position in the industrial-oriented market as it did prior to 1984-85.

The owners, the Queen Liliuokalani Trust (QLT), have recognized the concerns brought about by the problematic leasing structure and have moved to modify existing and proposed agreements (to some degree). Also, they have moved to adapt future expansion designs, in order to recapture market share.

A major draw-back to further industrial development at the Park is the extremely poor and increasingly congested access to the project, a concern for truckers, workers and consumers. While somewhat more acceptable for commercial users, the problematic access (with the access onto Queen Kaahumanu Highway considered dangerous by many) is exceptionally undesirable for industrial tenants. The larger numbers of vehicles attracted by commercial development in the Park further exacerbates the problem.

For all practical purposes, the Park remains "industrial" in regards to name and long-passed historic development only, ceasing to be a competitive alternative in the industrial market sector beyond finished space leasing programs in existing warehouse buildings. Brokers active in the Park stated warehouse/industrial space currently achieves prices of $0.55 to $0.90 per square foot monthly (triple net) in accordance with quality and location. Retail space, which dominates the project, is currently leased in the range of $0.95 to $1.25 per square foot per month. Common Area Maintenance (CAM) costs are typically between $0.20 and $0.29 per square foot monthly.

The commercial orientation of the park and consequent surge in multi-tenant buildings has resulted in relatively large vacancy levels during the past decade relative to historic rates. The commercial sector, which has been inundated with competitive inventory over the past 12 years, has been slower to recover than the industrial sector.

The Kaloko Light Industrial Subdivision (also known as the Kaloko Industrial Park) – The first phase of this development, comprising 55 one-acre lots was fully absorbed by the market (by mid-1989), and extensive improvement construction progressed for the subsequent five years. The total marketing period for the initial increment sites was some 48 months, not including pre-sale efforts, equating to an absorption rate of 1.15 lots/acres per month.

However, this average rate over the total sales period of the subdivision is something of a misnomer, as demand escalated significantly beginning in late 1987. At that time, only 24 lots had been sold over the 30 months the sites were originally offered (excluding pre-sale), or at a rate of .80 lots per month. Over the following 18 months, 31 lots were successfully marketed, equaling an absorption rate of 1.72 lots/acres per month.

Several factors contributed to this upsurge in demand beyond the general health of the West Hawaii economy and real estate market, among the most critical:

1. The sites are sold on a fee simple basis, which most purchasers/developers considered far superior to the uncertainties associated with leasehold ownership (as at the Kona Industrial Subdivision).

2. The project is closer to critical economic assets, including the Keahole Airport, Kawaihae Harbor and the coastal resort zones.

3. Access to the subdivision (via Queen Kaahumanu Highway) is vastly superior to that at the increasingly congested Kona Industrial Subdivision, which has an exceptionally poor and dangerous traffic pattern for oversized vehicles.

4. It has become apparent much of the growth in the greater Kailua-Kona region will take place in the corridor stretching north of the village to Keahole Point, and the Kaloko location is in the central area of this expansion zone.

The initial increment sales at Kaloko were primarily, at first, to end-user owners/businesses, with the latter spurt in demand attributable to investors and developers who hoped to either turn the lots for profit at a later date, or construct multi-tenant improvements for lease.

The second phase of the project included 35 lots ranging in size from 43,578 to 75,084 square feet (or 1.0 to 1.7 acres) located mauka of the first increment and worth of the Costco site. The development is called the Kaloko Business Park and has been in planning and construction since the mid-1990s.

Pre-sale began in mid-1999 and achieved strong market acceptance much the result of intensive marketing to potential purchasers over several prior years. Prices ranged from $8.50 to $14.22 per square foot, fee simple. Five prime lots owned by the contractor were marketed separately at prices of $18 to $22 per square foot. By March 31, 2000, 26 of the lots had been sold, under contract or joint-ventured, resulting in an average of 2.89 sales per month during the offering period.

Realtors expect full absorption by fall of this year, or an average overall activity rate of about 2.4 sales per month. The large majority of buyers are end-user concerns who plan on building and then utilizing the space. Investors, who would hold the site or build multi-tenant improvements have begun to show interest in recent months but are still a minor share of prospective purchasers.

A third phase (Increments III and IV) of the project is in planning at this time. It will include 82 subdivided lots on 102.3 acres mauka of the Kaloko Business Park lands. The development is currently in the State Land Use re-classification period (from Conservation to Urban on Land Use Maps), the first step in an entitlement process which typically takes one to three years. This phase will be directed to similar users as currently exists in the Kaloko industrial area.

All but a handful of lots in the first phase of the Kaloko Industrial project have been improved with one- to two-story metal clad masonry buildings. There are a significant number of single-tenant (owner/user) buildings or ones in which the owner is a primary tenant, with fewer small-space multi-tenant improvements.

Discussions with leasing agents indicate that just over half of the multi-tenant buildings have some available spaces, typically small in size and interior bays. Demand for space in the park is increasing with fewer square feet being made available (due to increased tenant stability) and larger spaces more rare. Most agree the market is "firming up" and expect to see fewer landlord concessions and rising rents in 2000-2001. At present, it is estimated the overall vacancy rate in the park is about ten percent, down from 12 to 15 percent in mid-1999.

Current rental rates for warehouse space is at $0.40 to $0.50 per square foot, monthly, triple net. Building in the recently sold phase is expected to be underway by 2001.

Honokohau Small Boat Harbor -- Overlooking the Honokohau Small Boat Harbor, Gentry's Kona Marina is a highly successful commercial/marine industrial development which achieved full occupancy shortly after opening in 1985. Tastefully designed, the complex has improved the appearance and status of the harbor, and tenants have generally expressed pleasure with the sales ratios experienced.

As a result of the absorption velocity, plans were forwarded in 1985-86 to develop Phase II of the project in short order, however, these have never been actualized. Barring expansion of the harbor, there is not sufficient marina-oriented demand for a major increase in such facilities. The state has not pursued plans to significantly enlarge the marina basin, although a tentative project to realign the existing moorings will create more slips.

The approximately 35,000 square feet of gross improvement area (not including the boat stack-storage facility in the project) is located on 4.083 acres leased by developer, Gentry-Pacific, Ltd., from the State of Hawaii Department of Transportation, Harbors Division on April 8, 1983 (Document Number H-82-4).

A second, circa 8,000-square-foot, stucco and tile marine-oriented facility along the southerly side of the basin opened in 1987-88, and was absorbed in a rapid manner. To some degree, the two-story improvement was a coalescing of existing harbor use needs.

Interviewed tenants felt that with the exception of some additional "office" space for charters and administrative uses, the demand for commercial/industrial development at the harbor is limited to repair and chandlery services, and further construction will not be necessary until the basin is enlarged at some future date.

Historically, tenant turnover in the Gentry project has been very low, with available space filled immediately without significant advertising efforts at rates of about $1.00 per square foot monthly.

Hawaiian Ocean Science and Technology (HOST) Park -- The initial infrastructure in this 547-acre state-sponsored development at Keahole Point was completed in late 1990. However, the market response for Park sites has been very poor. This is attributable to the restrictive nature of the uses allowed, which must be oriented towards exploitation of the near shore marine resources of West Hawaii.

The first tenant in the park was announced in early April of this year. A California aqua-culture firm specializing in abalone production has arranged to lease up to 40 acres and expect the first crop by 2001, with most to be exported to Japan. The tenancy basis or terms were not public as of the report date. Although it is an important first-step, the park has been vacant for nearly a decade and it was hoped it would attract more intensive (capital, improvements and employment) development than just aqua-culture.

For the most part, marine-oriented use-types are dependent upon newly developed or applied technology and have difficulty absorbing high land costs in their budget.

State agents still consider it likely the HOST Park will achieve market acceptance over the long-term as the demand for marine-related products and services is further developed and the economics of the industry improved. Studies published prior to construction called for an absorption period of five to ten years.

Because HOST was considered as capital expenditure providing a long-term primary economic catalyst for the Big Island and the entire island chain, the state has pursued co-sponsoring or subsidizing some development in the Park.

Owing to its highly-specific market niche, this project is an anomaly, and does not reflect on the general status of the West Hawaii industrial real estate sector, either by providing competing supply or through dilution of demand. There has been some preliminary discussions regarding allowing a broader market-use of the park so as to increase absorption. The concept has met with resistance and our analysis assumes the park will continue to have restrictive use covenants into the future.

Honokohau Industrial Park -- Southerly adjacent to the subject property, development of the first phase of the 89.5-acre mixed use

industrial and commercial park began in the mid-1990s, with the subdivision of three three-plus-acre lots near the highway frontage. The properties have been improved with warehouse, showroom, self-storage, auto dealership and gas station facilities, with space and building pads absorbed rapidly upon offering.

The holding was initially proposed for urbanization in late 1990, with several buildings constructed and uses in-place before final subdivision in 1994-1995.

Portions of the larger property (approximately 11 acres) are set aside for continued quarry use, five acres are intended for marine-related uses, 8.5 acres for lumber/hardware operations, five acres for nursery operations, and three acres for open storage. Timing for development of later phases has no been announced.

Of the sites sold on the open market, not held-back by the developer/owners or associated with an existing use, prices ranged upwards to the equivalent of nearly $25 per square foot for a prime building pad with highway frontage.

Activity level at the location is high, and it appears all of the available space was occupied as of the publication of this report. Due to the way in which the property was improved and subdivided, with several lots retained by the developers/partners, specific absorption analysis is problematic. At the least it can be asserted that the ten makai acres of phase one required about five years to be fully absorbed, but as there was no intensive effort to construct and lease space until 1998-99, the velocity achieved was faster.

Kohanaiki Business Park -- Infrastructure development on this 70-acre project, located on the mauka frontage of Queen Kaahumanu Highway one mile north of the subject, was completed in early 2000 following nearly a decade of planning and approvals. The 25 lots range in size from 1.01 to a single lot of nearly five acres. The eight lots closest to the highway are being marketed as "commercial" sites, with the 17 more mauka lots called "industrial."

The asking prices range from $8.45 per square foot in the mauka areas to $17.11 per square foot along the highway. Absorption has been strong since initial offerings in summer 1999, although the developers retained numerous lots and several purchasers have been committed

for some time. As of March 2000, 23 of the 25 lots in the subdivision have been sold or are in escrow, and sell-out is expected within several months.

The average rate of absorption has been at 2.44 lots per month during the sales period, and should be about 2.08 sales monthly over the entire one-year program. A gas station/mini-mart along the highway is expected to be the first improvement by early 2001. No other improvements have been announced at this time, however, a variety of uses in the commercial area have been proposed, from standard strip mall retail/restaurant development to theme/destination projects (including an aquarium) attracting passer-by visitors.

Purchasers in the industrial area have primarily been owner/users drawn by the northerly location (closer to the airport and resorts) and less congestion than at Kaloko Industrial Park. Agents report continuing strong interest in the sites and for eventual finished space at the project.

Kealakehe Subdivision -- The State of Hawaii subdivided six lots for industrial-type uses along Queen Kaahumanu Highway within its expansive Kealakehe (Village of Laiopua) holding in the late 1980's. The four smaller lots, ranging in size from .2 to 2.1 acres, are leased to private companies (including HELCo, Honolulu Gas Company and Amfac), with the larger parcels reserved for public uses. A 10.0-acre site is developed with the Kona police station and assorted county agencies, and a 30.175-acre lot is used by the state for recycling, storage and operations associated with the closing of the landfill formerly abutting the property.

The privately-used lots are held via a long-term lease agreement with the state as landowner. The properties are effectively fully developed and in full utilization. Further industrial development by the state on the site has not been announced and has not been forwarded as a major component in the Liopua project, except in association with the civic center uses proposed for the site.

Industrial development in West Hawaii outside the primary study area (Kailua-Kona to Keahole corridor) has been very limited. There is a single major "private" industrial subdivision owned by the Department of Hawaiian Homelands in the late 1960s outside the area near Kawaihae, as discussed below. Other industrial lands are scattered in

freestanding ribbon development along highways in Waimea and South Kona.

These properties provide needed community space for baseyards, some storage, and small scale service/technical work and suppliers. They are not considered highly competitive in the current or projected industrial market sector, and could not attract or support statistically significant levels of development.

Kaei Hana II -- A development planned to eventually encompass a total of 82.182 acres, the Kaei Hana II Industrial Subdivision near Kawaihae Harbor, has leased all 23.885 acres available for short-term development since original subdivision offering in 1968. The project is owned in fee and administered by the state Department of Hawaiian Home Lands, one of many projects on ceded native lands. The site was originally planned for development with a nuclear power plant by the Hawaii Electric and Light Company, a concept abandoned in the late 1960s. The acreage then began to be used for industrial purposes. The property is zoned for light industrial use.

Located at the extreme northerly end of the Kailua-Kona to Kawaihae coastal corridor, the emphasis of the subdivision is on general industrial and warehouse type uses. The primary attribute of the Kawaihae location, a rapidly emerging crossroads community, is the inter-island Port of Kawaihae (operated by the State of Hawaii Department of Transportation Harbors Division) which services the expanding leeward Hawaii region. The completion of Queen Kaahumanu Highway enhanced the market area serviced by port users.

A total of 23 lots, ranging in size from 1.0 to 12.9 acres, have been leased in the project; six of which have been improved. The sales period required to market the absorbed lots was more than 20 years, resulting in an average annual market demand of only 1.15 lots per year. However, the project (due to the extent of the previously planned use) was opened "ten to 15 years ahead of schedule," and effective development did not begin until 1978; resulting in the relatively low absorption rate.

As all of the readily available subdivided lots in the "initial" phase of this Hawaiian Home Lands (HHL) industrial development have been absorbed by the market, emphasis is now on development of

warehouse and showroom space, and secondary (or speculative) investment.

The remainder of the "zoned" average at Kaei Hana II will be absorbed into the HHL-submitted master plan, covering 2,500 acres mauka of the park, which calls for an additional 154 acres of industrial development. However, this expansion and other efforts to meet the apparent market demand are stymied by the lack of water services available for further subdivision and the wait associated with the approval process.

Several space lease rental opportunities are being offered at Kaei Hana II with warehouse space being offered at circa $.50 per square foot monthly triple net.

The increased interest at Kaei Hana II seen beginning in the mid-1980s was a direct result of:

- An expanding population in Kawaihae, specifically at Kohala Ranch; in North Kohala, whose residents must pass by the development to reach employment centers; and, in Waimea, the largest urban center in the region only ten miles distant.

- The continued large-scale development of resort communities along the South Kohala coast, particularly at Waikoloa Beach and Mauna Lani. This has created a wide spectrum of demand for construction, operational and tourist-oriented services.

- In concert with the above factors, the importance of the **Kawaihae Harbor** is growing, creating a demand for warehouse, shipping, final processing and other industrial/manufacturing businesses.

Resulting from the pace of construction and the apparent real property market stimuli, Kawaihae has rapidly evolved from a somewhat deserted port-side village to a regional center of secondary, or support, economic activity.

2. Proposed Supply

There are numerous industrial projects proposed for West Hawaii over the coming decade(s). These planned developments are summarized on Table III-10 and identified on the adjoining map.

Cumulatively, the "probable market" subdivisions in the primary study area will contain some *752 gross* acres of industrial lands, which would equate to circa *500 to 560 net* acres (or less) of finished sites.(4) Apart from the subject, the total proposed addition to the industrial supply would be 518 gross acres or some 345 to 414 net acres of finished lots.

Several additional projects have been proposed. However, for the most part they are either outside the primary market area, have specialized uses proposed or have uncertain status at this time. We have considered it unlikely these secondary projects can/will provide meaningful competitive inventory during the projection period.

Based on our analysis, apart from the subject, the total probable development for competitive industrial acreage in the primary study area during the study period is only some 188 gross acres, and 125 to 150 net acres.

There are various reasons why several of the proposed "industrial" developments in the area are unlikely to provide competitive inventory in the coming decades.

The 100-acre addition to **Kona Industrial Park** has been long-delayed, will be focused towards commercial uses (perhaps exclusively), as part of the larger QLT Keauhuolu project, and has an underlying land tenure (leasehold) which the industrial sector has now all but fully rejected. The expansion of industrial lands at **Kealakehe** as part of the state master planned community are only a minor concept within a slow moving major development and may never be actualized. The **Hawaiian Homelands** project would also be leasehold, is well outside the primary market section, has been on hold for more than a decade, and is not considered potentially competitive.

(4) Excludes 102.49 acres of Quarry and "Heavy" Industrial lands at the proposed Kaloko Honokohau Business Park.

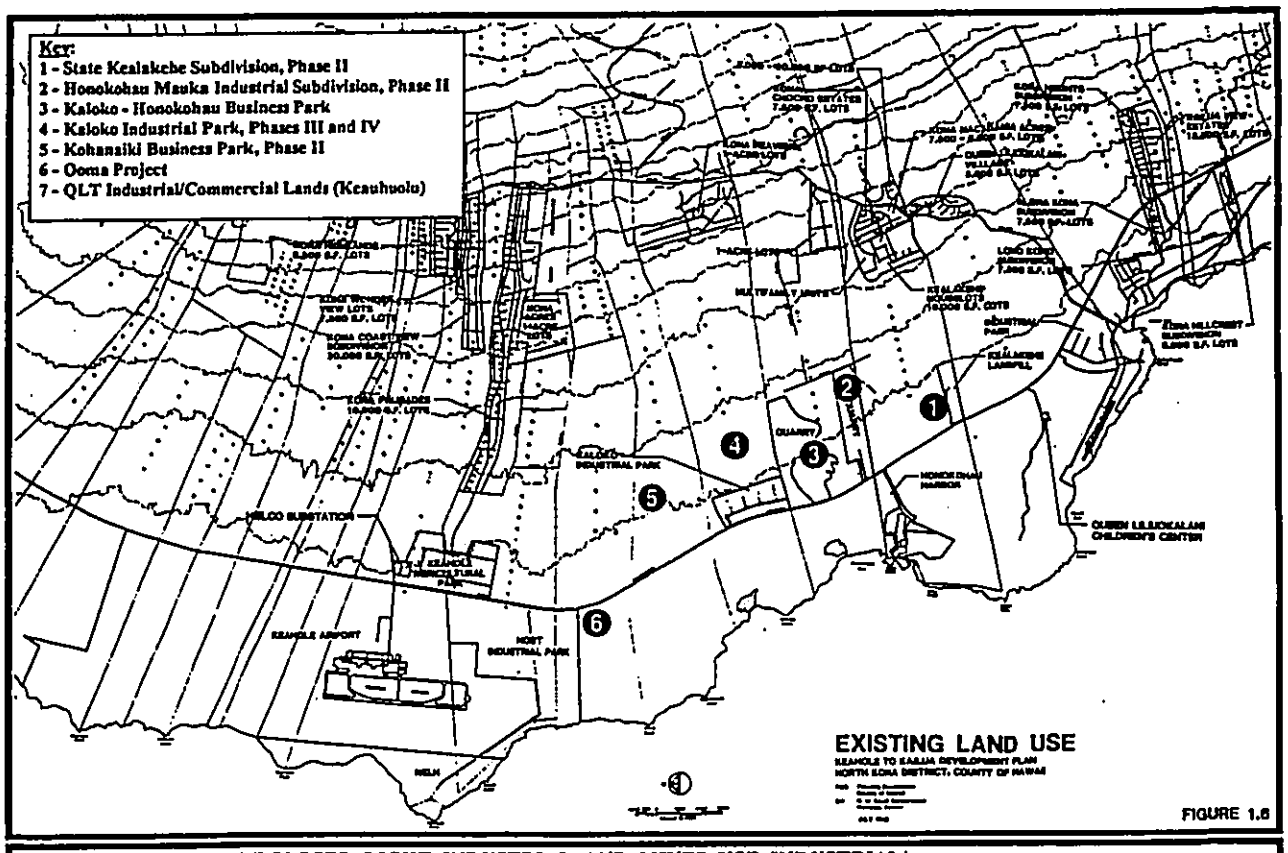
TABLE III-10

SUMMARY OF MAJOR PROPOSED INDUSTRIAL PROJECTS
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

Project Name	Location	Planned Inventory: Approx. Gross Acreage	Planned Inventory: Estimated Floor Space (1) (in Sq Ft)	Estimated Opening Date	Comments
PROBABLE "MARKET" PROJECTS					
Kaloko Industrial Park Phases III & IV	North Kona	103	740,302	2003	N. Adjacent to subject property.
Honokohau Business Park, Phase I	North Kona	150 (3)	718,740	2003	Subject, has 50+ ocn. heavy ind.
Honokohau Business Park, Phase II	North Kona	140 (3)	646,866	2011	Subject, has 50+ ocn. heavy ind.
Honokohau Business Park, Phase II	North Kona	35	251,559	2020	Subject, no heavy industrial.
Honokohau Mauka Ind. Subdivision, Phase II	North Kona	54	388,120	Mid-Decade	Upslope expansion of existing park.
Kohanaiki Business Park, Phase II	North Kona	31	222,809	Mid-Decade	Upslope expansion of existing park.
Keauhuolu (QLT) Project	North Kona	100	718,740	Unknown	Expansion of Kona Ind. Sub. and other nearby lands. (4)
State Kealakehe Subdivision, Phase II	North Kona	50	359,370	Unknown	Considered as component of various master plans for large state holding.
Hawaiian Home Lands Project	North Kohala	154	1,106,860	Unknown	Expansion of Kawi Hana II Park.
Parker Ranch 2020 Site	North Kohala	23	179,685	On-Hold	Part of regional master plan. Near Kamuela Airport. Timing uncertain.
SPECIALIZED OR UNCERTAIN PROJECTS					
Mauna Lani Resort	South Kohala	103	N/A	On-hold	In- resort use. Master plan allocation.
Waikoloa Resort	South Kohala	250	2,041,875	On-hold	Part of SLU approved plan, may be withdrawn upon revision.
Kawaihae Harbor Project	South Kohala	N/A	N/A	On-hold	Potential State-sponsored park.
Ooma Project	North Kona	50	408,375	On-hold	Support for HOST Park.

(1) Assuming FAR of .23 of net acreage (70% of gross), unless other indicators available.
(2) Includes 50 acres of heavy industrial/quarry lands. Floor area estimate for 100 acres of light industrial/commercial only.
(3) Includes 50 acres of heavy industrial/quarry lands. Floor area estimate for 90 acres of light industrial/commercial only.
(4) Includes master-planned areas calling for mixed-use industrial/business park development and quasi-commercial uses. Developer focusing on mauka commercial/residential lands. Some acreage has been utilized for temporary and specialized uses.

Source: County Planning Department, Various EIS, and The Hallstrom Group, Inc.



LOCATION MAP OF PROPOSED LIGHT INDUSTRIAL AND MIXED-USE INDUSTRIAL/ COMMERCIAL SUBDIVISIONS IN THE KEAHOLE TO KAILUA-KONA CORRIDOR
Market Study of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii

Of the secondary projects, all are uncertain at this time, except for the **Parker Ranch lands at Kamuela Airport** which may be developed during this decade. Tenure concerns, master plan changes, entitlement issues and competitiveness make any significant competitive addition to regional industrial supply unlikely.

While there has been meaningful additional industrial land supply added in the past year, it has been readily sold and will serve to meet pent-up demand which has steadily grown over the past decade and as is produced in the initial phases of the emerging economic upcycle. Thereafter, over the mid- to long-term there will be relatively limited amounts of additional lot inventory based on the proposed developments to date apart from the subject.

Correlation of Demand and Supply Indicators

The demand for additional industrial lands in West Hawaii over the coming two decades is estimated at 388 gross acres. There are some 65.8 acres of available existing competitive general industrial supply, or about four to five years worth of developable inventory.

Probable general-market development during the projection period, apart from the subject will total some 188 gross acres, with the majority being within the Kohanaiki to Honokohau neighborhood.

Without the subject there will be insufficient supply to meet demand levels during the projection period, and there will be a shortfall in supply of up to 200 gross acres, or the equivalent of 140 to 160 net acres and 1.5 million-plus square feet of finished floor space. This insufficiency would undoubtedly result in an unnecessary disruption to the on-going evolution of the West Hawaii economy due to a lack of available lands to service market needs.

Table III-11 provides a general overview of the projected supply/demand situation in the competitive West Hawaii industrial market over the next two decades. The analysis assumes all competitive non-subject projects are developed in a timely manner. If the Kaloko-Honokohau Business Park is not developed, the net shortfall in this scenario where all other competitive inventory is built by the year 2020 will be 134 acres.

TABLE III-11

SUMMARY OF PROJECTED ABSORPTION OF INDUSTRIAL SPACE IN WEST HAWAII 2000 TO 2020, EXCLUDING SUBJECT PROPERTY
Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment of the Proposed Kaloko-Honokohau Business Park
Kaloko, North Kona, Hawaii

Year	Finished Space Demand Annual (Sq. Ft.)	Finished Space Demand Cumulative (Sq. Ft.)	Estimated Vacancy Rate (% of Mkt.)	Effective Space Required (Sq. Ft.)	Gross Land Area Requirement Periodic (Acres)	Gross Land Area Requirement Cumulative (Acres)	Available Acreage	Oversupply or (Undersupply)
2000	124,850	2,036,500	5.50%	112,008	14.33	254.57	305.8	51.23
2001	124,850	2,161,350	5.25%	113,471	14.33	268.90	305.8	36.90
2002	124,850	2,286,200	5.00%	114,310	14.33	283.23	305.8	22.57
2003	124,850	2,411,050	5.00%	120,553	14.33	297.56	408.8	111.24
2004	124,850	2,535,900	5.00%	126,795	14.33	311.89	408.8	96.91
2005	141,179	2,677,079	5.00%	133,854	16.21	328.10	462.8	134.70
2006	141,179	2,818,258	5.00%	140,913	16.21	344.30	493.8	149.50
2007	141,179	2,959,437	5.00%	147,972	16.21	360.51	493.8	133.29
2008	141,179	3,100,616	5.00%	155,031	16.21	376.71	493.8	117.09
2009	141,179	3,241,795	5.00%	162,090	16.21	392.92	493.8	100.88
2010	171,168	3,412,963	5.00%	170,648	19.65	412.57	493.8	81.23
2011	171,168	3,584,131	5.00%	179,207	19.65	432.21	493.8	61.59
2012	171,168	3,755,299	5.00%	187,765	19.65	451.86	493.8	41.94
2013	171,168	3,926,467	5.00%	196,323	19.65	471.51	493.8	22.29
2014	171,168	4,097,635	5.00%	204,882	19.65	491.16	493.8	2.64
2015	198,612	4,296,247	5.00%	214,812	22.80	513.95	493.8	(20.15)
2016	198,612	4,494,859	5.00%	224,743	22.80	536.75	493.8	(42.95)
2017	198,612	4,693,471	5.00%	234,674	22.80	559.55	493.8	(65.75)
2018	198,612	4,892,083	5.00%	244,604	22.80	582.35	493.8	(88.55)
2019	198,612	5,090,695	5.00%	254,535	22.80	605.14	493.8	(111.34)
2020	198,612	5,289,307	5.00%	264,465	22.80	627.94	493.8	(134.14)
Annual Average 2000-2020	160,841		5.04%		18.46			

Note: Figures include some quasi-commercial space in industrial parks.
(1) Available acreage increases with the opening of new industrial/business subdivisions. Excludes OTEC and HOST Parks.

Source: Various, CB Commercial, and The Hallstrom Group, Inc.

However, it is unlikely that all of the market subdivisions would come on-line in such a consistent manner, and it is highly probable the actual shortfall will be sooner and greater. If any of the second phases (at Kohanaiki or Honokohau Mauka) are not pursued, the state does not seek additional industrial use at Kealakehe, or the Kaloko Industrial Park Phases III and IV is not approved, a major shortfall would result. Even in this "best supply" case, there is a need for the subject.

ADDENDA IV: APPROPRIATENESS OF THE SUBJECT FOR THE PLANNED USE AND ABSORPTION ESTIMATES

Appropriateness of the Subject Site

The subject site is a superior and highly appropriate location for a mixed-use industrial and service/commercial development, and quarry/heavy industrial uses, as proposed due to a variety of reasons, most notably:

- *It has extensive frontage and direct access onto Queen Kaahumanu Highway, the primary regional thoroughfare.* The highway allows the most direct access to the transhipment infrastructure (notably Kawaihae Harbor and Kona International Airport) and the major business areas of the region (the coastal resorts and central Kailua-Kona). The exposure provided by the highway frontage will enhance the business located in the makai areas of the development, allowing full exploitation of the mixed-use zoning envisioned for this part of the project. Also, it is likely the interior streets will someday be extended into the holdings to the north and south of the site as a mauka reliever to the highway, placing the subject property at the junction of several critical secondary roads.

- *It is adjacent to existing development containing similar uses.* Industrial businesses typically rely on proximity to supporting services, suppliers and storage facilities, and often find their primary customers to be other industrial-oriented concerns. Proximity also lessens travel times, allows easy and frequent face-to-face contact among businesses, and provides outside customers with relatively "one stop" convenience for a variety of services and goods. Commercial businesses thrive in close proximity to one another, by providing a wide range of competitive options for customers, speedier deliveries due to the concentration effect, and the benefits of cumulative attractions (or "critical mass") in the marketplace.

- *It is within an area well-established in the marketplace as an industrial and mixed-use location.* Businesses and investors commonly hold the perception there are advantages to being within a recognized trade community, from an operating perspective (greater customer awareness and traffic) and in regards to potential property re-sale characteristics (higher values in higher demand areas). This allows for both collective promotion and ease in individual marketing. The marketplace viewpoint is that the Kohanaiki-Kaloko-Honokohau area has now become "the" location for major industrial development in West Hawaii (supplanting the Kona Industrial area), a concept unlikely to change during the foreseeable future, which will inherently increase the level of general demand for such development in the area.

- *The proposed subject use conforms with all relevant public and private land use master plans for the area.* The market has a strong tendency to be guided by long-range plans developed by governmental agencies and leading landowners, and make purchase and trade adjustments accordingly. In its West Hawaii Regional Plan (1989), the state Office of Planning identifies the subject as being within the Keahole to Kailua-Kona sub-regional planning area, is described as "in-filling the undeveloped area south of the airport... logical given its proximity to the existing urbanized area and that availability of infrastructure," with industrial uses cited as a specific favorable use type. The County of Hawaii Keahole to Kailua Development Plan (1989) similarly identifies the corridor as a prime urban expansion area and specifically calls for industrial type uses in the Kaloko-Honokohau neighborhood mauka of Queen Kaahumanu Highway. Several major landowners in the region have also produced master plans calling for additional industrial and service/commercial development along the highway. Business, investors and developers will look to these plans for guidelines, and this will be reflected in market activity.

- *Apart from the proposed use, there is no significant alternative economic use for the property in the foreseeable future.* The land has poor/limited agricultural potentials, being off-water it has no resort characteristics, it is in an elevational/climate band that is not considered desirable by permanent residents, and has

no meaningful scenic beauty or archaeological sites which would create demand for a park or other public use of the holding. given these attributes (or lack thereof) the only reasonable use for the site from a market perspective is for some form of industrial and/or commercial uses.

- *The proposal brings the existing quarry into conformance with land use designation guidelines and will be an excellent site for needed "Heavy" (General) Industrial uses in West Hawaii.* Significant quarry materials will be needed in the study region over the coming decades as the area continues to be developed and move towards a typical modern, urban community. This trend will also create meaningful demand for heavy or general industrial uses in the area. Currently, the demand for such use types is limited due to the size and make-up of the area's economy, with most being met by Hilo or Kawaihae lands. However, as West Hawaii becomes more diverse and urbanized, a significant need for storage, processing, manufacturing, large baseyards and other currently atypical industrial uses will be created (as is seen on Oahu at the Campbell Industrial Park and at Kahului, Maui). The subject will provide a large, closed-in land area already with heavy industrial quarry and related batch-plant uses. Alternatives will otherwise be limited, outlying, or otherwise out of character with surrounding uses.

Based on these attributes of the subject property, the industrial sector demand/supply indicators, and the historic experience of other projects in the regional marketplace, we have estimated the probable absorption velocity for the subdivided subject lots using three methodologies:

Quantification of Subject Demand

We have quantified the probable market demand for the subject lots by correlating the statistical industrial and mixed-use sector "needs" and our subjective investigation insights using three analytical methods.

Basic Demand/Supply Comparison – This straight-forward technique assumes that if there is insufficient existing and planned supply to meet projected market gross demand levels during the projection period, the proposed subject lots will be

absorbed in a reasonable manner, regardless of competitive qualities, as there are no other alternatives available.

As previously noted, even if all the competitive light industrial development proposed in the effective subject market area was approved and constructed in a timely manner, there would be a shortfall in supply during the later stages of the projection period by more than 130 acres. Thus, on a base comparison analysis, the "worst case" scenario would have the subject lots being absorbed between the years 2010 and 2020. On a "best case" scenario, wherein several of the proposed projects, or their later phases, were not constructed, the demand for the subject would occur during this decade (2005 to 2010).

This technique is a very pessimistic method as it assumes the subject is only minimally competitive and all other inventory must be completely absorbed prior to the subject coming on-line. The reasonable application of this gross technique indicates there will be sufficient excess demand to absorb the first phase of the project within the projection period, or within six to 12 years from initial offerings. The second phase would require a similar period; and the third phase, an additional four to eight years.

The Residual Method -- In this technique, all of the competitive major proposed industrial and mixed-use industrial/commercial projects are placed on a time-line depicting the sales absorption either anticipated by the developers (as stated in EIS, reported in the media or through interviews) or assuming a reasonable market share. To the extent these projects and the remaining existing market land/space supply fall short of the forecast demand for space in the study region or exceed the total on a periodic basis, a respective undersupply or oversupply situation is present.

Having accounted for all of the proposed space in the market, and acknowledging the unlikelihood of otherwise buildable sites in the region, it can be asserted the subject development will capture a significant portion of any residual demand. This approach is generally conservative, as it assumes the subject will capture only what is left over after all other projects garner their share. It is somewhat more optimistic than the base

supply/demand comparison technique as it incorporates a reasonable timing factor and is not as gross an analysis. Given the nature of the subject holding we believe it could be a regional market leader, not a follower.

Application of this method to the proposed subject development is shown on Table IV-1. Only in six years (at a maximum) would anticipated absorption by proposed projects exceed quantified demand (2004 to 2009). In every other year of the study period, there would be a shortfall of supply. It is assumed the subject would capture virtually all (90 to 100 percent) of this additional demand. If any of the identified projects were constructed, the supply shortfall would be even more severe.

As can be seen, without the subject lands, the market will experience a significant lack of sites to meet qualified demand, with no alternative supply available the last seven years of the projection period.

Based on this method, the first phase of the Kaloko-Honokohau Business Park could be absorbed in as little as eight to as much as 14 years, with the most likely range being at 10 to 11 years beginning in mid-decade. The second phase would require only four to six years under this method, as it would capture virtually all of the market. The third phase, portions of which may extend past the 2020 time-frame, would take two to four years to be absorbed according to this technique.

The Market Shares Method. This approach accounts for the probable competitiveness of the subject inventory regardless of the total level of product being otherwise offered on the market. In essence, it is an estimate of how much of the total forecast demand in the West Hawaii industrial and mixed-use markets the subject could expect to achieve on an annual basis in light of its locational, pricing and amenity characteristics.

Generally moderate in application, this technique tests "pure" competitiveness and is considered the classic methodology, but does require subjective selection of factors.

As indicated by the foregoing residual tables, annual market shares of 32 to 60-plus percent are envisioned for the competitive offerings. Due to the quality exposure on Queen Kaahumanu Highway, we believe the makai lots in Phase I will be rapidly absorbed, creating an above-average market share potential during the first two years of offering. Thereafter, as these most desirable lots are absorbed, the capture rate would slacken for a year or two until the interior of the subdivision achieved full market recognition.

Application of moderate "conservative" and "optimistic" shares against the proposed subject development are shown on Table IV-2. These models test capture rates of 47 to 61 percent of the market, and indicate absorption of Phase I in 10 to 13 years. Phase II lots, which could expect to achieve higher capture rates as there would be fewer competing lots at the end of the projection period, would need from six to nine years to be fully absorbed. Phase III absorption, which extends out beyond the 2020 forecast time-frame[5] would require about three to five years to reach sell-out.

Correlation

In correlating these indicators, we have given greatest weight to the residual and market shares methods. We conclude the absorption of the subject project (following completion of infrastructure, and assuming an aggressive pre-sale program) will require some 10 years for Phase I, nine to ten years for Phase II, and four to six years for Phase III, under a light industrial and mixed-use industrial/commercial development concept.

The demand for the quarry materials and concurrent and subsequent "heavy" (general) industrial uses is more difficult to quantify using these methods. Market analysis quantifies demand for heavy industrial bulk acreage sites in West Hawaii by 2020 to be from 100 to 140 acres.

There is existing and projected demand for the resource materials and in-place production using at present about 30 acres of the site (with a leased total of about 60 acres). The success of the on-going businesses is evident based on their efforts to secure the long-term access to and

(5) We have assumed a stabilized demand level for years extending beyond the 2020 projection period, with demand at the levels for the period 2015 to 2020.

TABLE IV-1

QUANTIFICATION OF SUBJECT UNIT DEMAND USING THE RESIDUAL METHOD BASED ON TOTAL DEMAND FOR COMPETITIVE INDUSTRIAL DEVELOPMENT IN WEST HAWAII
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
Residual Subject Property, QLT Commercial-Quasi Lands and Specialty, GIORT and Runoff Projects

Project	Total Available Gross Acres 1	Acres Absorbed @ 100% 2	2001 3	2002 4	2003 5	2004 6	2005 7	2006 8	2007 9	2008 10	2009 11	2010 12	2011 13	2012 14	2013 15	2014 16	2015 17	2016 18	2017 19	2018 20	2019 21	2020 22	Totals 23
Kohanaiki Business Park, Phase I		204																					
Market Share %		8																					
Kaloko Business Park		204																					
Market Share %																							
Kaloko Industrial Park Phases III & IV	103																						
Market Share %																							
Honokohau Marina Subdv., Phase II	54																						
Market Share %																							
Kohanaiki Business Park, Phase II	31																						
Market Share %																							
TOTALS	196																						
		16	0	0	10	10	10	10	10	10	10	10	3	0	0	0	0	0	0	0	0	0	196
			100%	50%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	
Probable Annual Regional Demand		14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33	14.33
Shortage or (Excess) Supply		4.33	14.33	14.33	4.33	(5.67)	(9.67)	(9.67)	(9.67)	(9.67)	(9.67)	(9.67)	(1.67)	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	144.19
Residual Subject Demand (of Shortage Only)																							
at 100% Residual Capture Rate		4	14	14	4	(6)	(10)	(10)	(10)	(10)	(10)	(10)	4	5	5	5	5	5	5	5	5	5	156
at 95% Residual Capture Rate		4	14	14	4	(6)	(10)	(10)	(10)	(10)	(10)	(10)	4	5	5	5	5	5	5	5	5	5	156
at 90% Residual Capture Rate		4	13	13	4	(6)	(10)	(10)	(10)	(10)	(10)	(10)	4	5	5	5	5	5	5	5	5	5	152
														5	9	9	9	9	9	9	9	9	157
														5	9	9	9	9	9	9	9	9	157
														5	9	9	9	9	9	9	9	9	157

Source: The Hallstrom Group, Inc.

TABLE IV-3

QUANTIFICATION OF SUBJECT DEMAND
USING THE MARKET SHARES METHOD
Market Study, Economic Impact Analysis and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
DEMAND EXPRESSED AS GROSS ACREAGES, STABILIZING AFTER YEAR 2018
Subject Project has 101.8 Gross Acres of Development Area in Phase I,
87.8 gross acres in Phase II, and 44.8 gross acres in Phase III. Excludes Quarry
and is Assumed to Begin Sales of Finished Lots in Year 1983

Moderate/Conservative				
Year		Total Regional Demand	Estimated Subject Share	Total Subject Demand
2003		14.33	50.00%	7.17
2004		14.33	50.00%	7.17
2005		16.21	40.00%	6.48
2006		16.21	45.00%	7.29
2007		16.21	45.00%	7.29
2008		16.21	45.00%	7.29
2009		16.21	45.00%	7.29
2010		19.65	45.00%	8.84
2011		19.65	45.00%	8.84
2012		19.65	45.00%	8.84
2013		19.65	45.00%	8.84
2014		19.65	45.00%	8.84
2015	(1)	22.80	45.00%	10.26
2016		22.80	45.00%	10.26
2017		22.80	45.00%	10.26
2018		22.80	45.00%	10.26
2019		22.80	45.00%	10.26
2020		22.80	50.00%	11.40
2021		22.80	50.00%	11.40
2022		22.80	50.00%	11.40
2023	(2)	22.80	50.00%	11.40
2024		22.80	50.00%	11.40
2025		22.80	50.00%	11.40
2026		22.80	50.00%	11.40
2027		22.80	40.00%	9.12
Totals		584.36	44.48%	234.43

Moderate/Optimistic				
Year		Total Regional Demand	Estimated Subject Share	Total Subject Demand
2003		14.33	70.00%	10.03
2004		14.33	70.00%	10.03
2005		16.21	50.00%	8.11
2006		16.21	60.00%	9.73
2007		16.21	60.00%	9.73
2008		16.21	62.00%	10.05
2009		16.21	62.00%	10.05
2010		19.65	62.00%	12.18
2011		19.65	62.00%	12.18
2012	(1)	19.65	62.00%	12.18
2013		19.65	62.00%	12.18
2014		19.65	62.00%	12.18
2015		22.80	62.00%	14.14
2016		22.80	62.00%	14.14
2017		22.80	65.00%	14.82
2018	(2)	22.80	65.00%	14.82
2019		22.80	65.00%	14.82
2020		22.80	65.00%	14.82
2021		22.80	65.00%	14.82
2022		22.80	15.00%	3.42
		398.36	60.85%	234.43

(1) Phase I acreage fully absorbed.
(2) Phase II acreage fully absorbed.

Source: The Hallstrom Group, Inc.

use of the site. If there were other more suitable alternatives, they would be in use at this time. Similarly, there are no near to mid-term competitive alternatives available for heavy industrial uses.

In regards to the three methods, the indicators for the subject are highly favorable as the limited amount of competing supply means the base comparison, residual and market shares indicators would all be extremely high. We conclude the subject quarry/heavy industrial area would be mined and developed (absorbed) over about 20 years based on comparison with other island locales. Or, some ten years each for the 50-acre portions included in the first and second phases.

ADDENDA V: ECONOMIC IMPACT ANALYSIS

The development of the Kaloko-Honokohau Business Park subdivision will result in significant expenditures that will favorably impact the West Hawaii economy on both a direct and indirect basis, increasing the level of capital investment and capital flow in the region, which will in turn create employment and widen the tax base.

From a direct perspective, the proposed 150 to 200 light industrial and mixed-use industrial/commercial lots, 15 to 30 quarry/heavy industrial lots,(6) and finished buildings thereon will create numerous construction, equipment operator and specialty trade jobs on- and off-site during the planning and emplacement of the infrastructure, future operations of the existing quarry, and building of the improvements. After completion of the buildings and support facilities over an estimated 34-year total development period, there will be significant additional employment positions created by the tenant businesses and the buildings themselves (landscape, service, maintenance, and renovation needs in the course of their use).

Numerous local businesses will enjoy significant profit opportunities arising for contracting companies constructing the improvements, and for local businesses which would supply a substantial portion of the materials needed in the building efforts.

The general island economy also will benefit from the subject development and its employees and businesses, which will spend large amounts of wage income in off-site shops, restaurants, and service establishments throughout the Big Island, and in purchasing goods and services.

Indirectly, as these wages, profits, and expenditures move through the regional economy, they will have a ripple, or "multiplier," effect--increasing the amount of capital flowing to the entire community as a result of the subject.

(6) For analysis purposes, we have assumed there will be 185 total light industrial and mixed-use lots averaging one acre each, and 20 quarry/heavy industrial lots averaging four acres each.

Construction, operational and other workers earning wages from the Kaloko-Honokohau Business Park and associated off-site efforts will spend the majority of their income on living and entertainment expenses while supporting and patronizing other island businesses. Much of this spending would be re-directed by these businesses to other island industries, and significant portions of these secondary profits would in turn be put back through the region's economic and tax structure.

These substantial direct and indirect economic impacts associated with the proposed subject project, as quantified in the following sections, are all the result of the capital investment and entrepreneurship necessary to convert undeveloped "conservation" lands into a working mixed-use community. The Hawaii County economy will be meaningfully stimulated by the capital investments and business requirements of park tenants and consumers who patronize the project.

Capital Investment and Construction Costs

The subject development will bring an estimated $329.62 million in direct development capital into West Hawaii over the 34-year build-out period for the project. A breakdown of the basic expense items, their respective costs and expenditure over time is summarized on Table V-1.

Also shown are anticipated contractor and supplier profits flowing to local businesses as a result of the project, and profits associated with the anticipated clubhouse/commercial operations.

Infrastructure cost estimates were at $9 million total, by Okahara & Associates, Inc. We have allocated these costs at $5 million for Phase I, $3 million for Phase II, and $1 million for Phase III.

Building construction costs were estimated at a total of $320.62 million. This is based on the assumption that each of the 185 light industrial and mixed-use lots, on average, would be developed with 12,000 square feet of finished space at a cost of $125 per square foot. The typical improvement would be a metal clad or masonry warehouse-type structure with a total improvement cost of $1,625,000, which includes a $125,000 allowance for site work, rock walks, landscaping and paving (roughly $4 per square foot of non-building site area).

Most of the industrial buildings will have minimal interior finishes, but some of the mixed-use commercial-oriented structures may have as much as $60 per square foot of tenant improvements. Assuming 40 such buildings in the subdivision, up to an additional $28 million in construction assets may take place beyond those shown on the table.

Each four-acre quarry heavy industrial lot was assumed to be improved by a single metal-clad building of 10,000 square feet, having a total construction and site improvement cost of $1,000,000. We believe this to be generally conservative, but recognize the nature of the heavy/industrial sue type is focused on minimal building costs.

The light industrial and mixed-use improvements are assumed to be built at a stabilized rate of six per year (reached in development year 5), and the "heavy" industrial improvements, which are somewhat dependent upon the quarrying operations to open the sites, at the rate of one annually in development years 5 through 24.

We have included any existing improvements in the quarry area, their expansion on the related employment, as these operations are in place and not dependent upon the proposed business park development.

The Kaloko-Honokohau Business Park will infuse an anticipated $9.69 million annually into the Big Island building industry on average over the build-out period. This is the equivalent of a 3.5 to 6.5 percent boost over recent yearly construction levels during the mid to late 1990s.

West Hawaii was hard hit by the recession of last decade, and though employment in the depleted construction trades is beginning to rise for the first time in a decade, there is a continuing instability in the Hawaii economy. This has been exacerbated in its recovery efforts by the 1997-98 Asian monetary crises; the reduced asset values and earnings of major in-state companies; and the limited flow of investment capital and developer interest in undertaking major new projects. There are limited favorable near to mid-term opportunities for a resurgence in the commercial construction employment, although residential construction is picking up meaningfully. Many skilled tradesman have left the island or moved into other occupations, failing to pass their knowledge and experience onto the next generation of workers, damaging the long-term health of the foundational construction industry.

TABLE V-1

CONSTRUCTION COSTS AND CONTRACTOR AND SUPPLIER PROFIT ESTIMATES

Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	11	12
Construction Costs:												
Infrastructure (1)	$2,750,000	$2,250,000										$1,750,000
LI/Mixed-Use Construction (2)			$6,500,000	$8,125,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000
Q/HI Construction (3)					$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
TOTAL CONSTRUCTION COSTS	$2,750,000	$2,250,000	$6,500,000	$8,125,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$12,500,000
CONTRACTOR'S PROFIT	$275,000	$325,000	$650,000	$812,500	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,250,000
SUPPLIER'S PROFIT	$82,500	$67,500	$260,000	$325,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$482,500

Development Year	13	14	15	16	17	18	19	20	21	22	23	24
Construction Costs:												
Infrastructure (1)	$1,250,000									$1,000,000		
LI/Mixed-Use Construction (2)	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000
Q/HI Construction (3)	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000
TOTAL CONSTRUCTION COSTS	$12,000,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$10,750,000	$11,750,000	$10,750,000	$10,750,000
CONTRACTOR'S PROFIT	$1,200,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,075,000	$1,175,000	$1,075,000	$1,075,000
SUPPLIER'S PROFIT	$467,500	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$460,000	$430,000	$430,000

Development Year	25	26	27	28	29	30	31	32	33	34	Totals
Construction Costs:											
Infrastructure (1)											$9,000,000
LI/Mixed-Use Construction (2)	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$3,250,000	$300,625,000
Q/HI Construction (3)											$20,000,000
TOTAL CONSTRUCTION COSTS	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$9,750,000	$3,250,000	$329,625,000
CONTRACTOR'S PROFIT	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$975,000	$325,000	$32,962,500
SUPPLIER'S PROFIT	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$390,000	$130,000	$13,095,000

(1) Total direct costs only for infrastructure estimated at $9,000,000. Phase I costs of $5,000,000 incurred in Years 1 & 2. Phase II costs of $3,000,000 incurred in Years 12 & 13, and Phase III costs of $1,000,000 in Year 22.

(2) Light Industrial and Mixed-Use Industrial/Commercial construction estimated average construction cost of $1,625,000 per structure, 12,000 square feet at $125 per square foot, plus $125,0000 for site work, rock walls, paving & landscaping.

(3) Quarry and "Heavy" Industrial construction estimated at one structure per four acres with average total cost of $1,000,000 per building. Timed to occur after one is quarried.

Source: Various, and The Hallstrom Group, Inc.

Based on building permit data, a total of $178 million of construction was put in-place on the Big Island in 1999, more than $50 million below the level of a decade earlier. All indicators point to a regional construction industry continuing under stress, with limited favorable aspects from an employment perspective. The subject development would be a substantive component of any major recovery.

Employment Opportunities Created

Based on indicators provided by the construction of comparable sized projects and Hawaii industry averages, we have estimated the demand for on- and off-site, full-time equivalent employment positions associated with laying of initial infrastructure systems, quarry operations, and building of the finished industrial and mixed-use industrial/commercial structures, the on-going businesses in the park, and in providing continuing services to the occupied buildings.(7)

The employment opportunities created by the subject development will not be "new" jobs requiring new West Hawaii residents but will be new opportunities for resident construction trade workers and local businesses.

It is assumed the off-site/indirect work created will be steered towards existing Big Island supply, equipment providers, and other service companies, which despite the up-tick in the county economy over the past two years remain in a "lean" period following the massive development activity of the late 1980s.

According to the State of Hawaii Department of Labor and Industry Relations, the current number of jobs in the Big Island construction industry is about 1,960 positions, a minor increase from the previous year, but well below the annual average of 3,000 jobs that existed during the late 1980s and the first two years of this decade. Overall, unemployment on the island of Hawaii is presently at some nine percent, down more than one point from mid-decade but still several points above the figure of ten years ago. The rate of joblessness in the building trades is estimated to range from 15 to 25-plus percent.

(7) Only additional jobs, wages, costs and revenues being created as a result of on site activity are shown. Existing quarry, batching and pre-fab casting jobs for the in-place businesses were not counted in our analysis.

The subject development will provide needed employment opportunities in the construction, supply and building support industries during an estimated 34-plus year planning, site development and building construction period. The planning process, currently underway, is anticipated to require one year, on-site backbone and subdivision infrastructure some 24 months, and industrial and mixed-use construction about 32 years.

Our employment estimates on are based on full-time "worker/years," although one worker/year (or circa 2,000 working hours) may be comprised of many employees involved in specialized tasks of a much shorter duration.

Estimates based on a 34-year period of project construction and the associated number of employment opportunities created are displayed on the top of Table V-2. Included are the full-time equivalent off-site and support employment opportunities which will be provided to West Hawaii businesses as a result of the project. Also shown are the employees of the operating tenant businesses occupying the finished floor space, and maintenance/trade workers for the structures, which will be required to service the community over time.

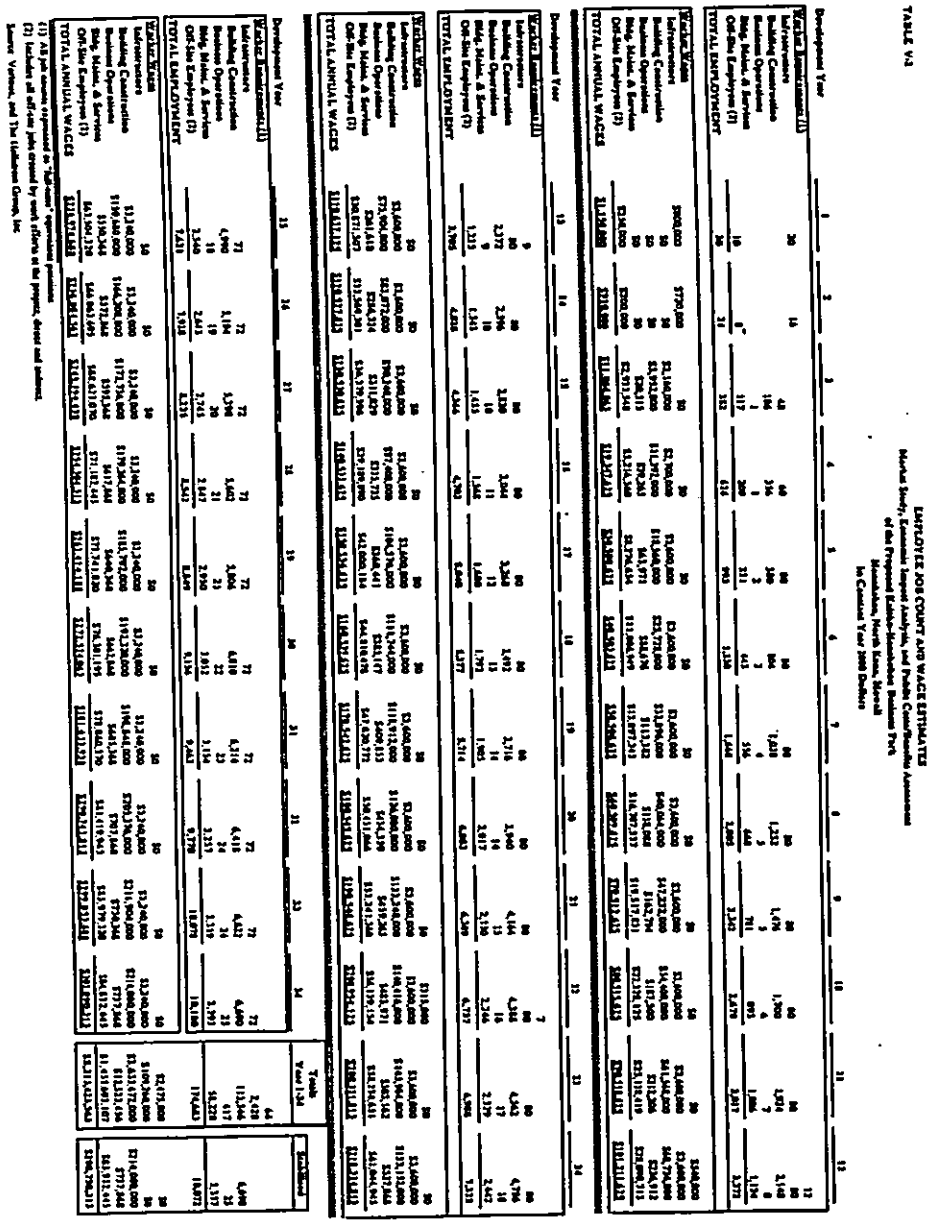
The projections are founded on examples provided by various light industrial developments undertaken on Maui and Hawaii over the past decade, and via formulae expressing relationships between total worker wages/benefits and construction task costs.

Infrastructure employment forecasts are taken from discussions with developers, review of project records and ratios of direct costs to job creation (assuming an average wage of $45,000/year plus benefits equal to 25 percent of wages).

Building construction is anticipated to require 12 total worker/years per 12,000-square-foot light industrial and mixed-use structure, including site work. The 10,000-square-foot average heavy/general industrial buildings are estimated to require eight total worker/years per structure. The average wage for these construction workers is also $45,000 per year plus benefits.

Business operations in the light industrial and mixed-use sections of the park are estimated at one worker per 350 square feet of finished floor space, or 34 positions per building. It will be slightly higher for

The Hallstrom Group, Inc. Proposed Kaloko-Honokohau Business Park



the commercial-oriented uses, and slightly less (on average) for industrial uses. In the heavy/general industrial section, it was conservatively estimated the employee requirement would be 20 positions per site (or five per acre). The average wage of these workers is estimated at $32,000 per year.

The finished improvements and sites will require maintenance, service and repair workers which will, in total, equal some 25 worker/years annually, or one worker/year for every eight buildings. These workers are estimated to be paid on average $30,000 per year.

Off-site employees were estimated at 50 percent of on-site workers, and are comprised of three groups:

- Numerous off-site building industry positions will also be enhanced by the Kaloko-Honokohau Business Park development, including such jobs as administration, office help, material providers, equipment maintenance and specialty tasks. Analysis of Hawaii County labor trends from 1980 through 1999 demonstrate a linkage equal to about 30 percent between the creation of on-site construction positions and direct off-site employment.

- Off-site support businesses, including contractor/retail/counter sales, fuel providers, shipping, storage and professional services will also benefit. A conservative job creation relationship of five to ten percent relative to on-site positions was used (or, one off-site support worker/year for each ten to 20 on-site worker/years).

- Extrapolation of state Department of Business Economic Development and Tourism (DBEDT) data, along with indicators provided by other state agencies and First Hawaiian Bank studies, demonstrate that each Hawaii worker creates demand for services (and related employment) during and directly attributable to the work day at up to a ten-plus percent ratio. These positions include food businesses, providers of tools and trade goods, payroll/financial and insurance businesses, medical requirements and other secondary indirect/off-site employment.

During the 34-year building period of the project, the number of worker/years created on- and off-site by the development varies from 30 to 10,180 positions annually, totaling 174,683 worker/years over the entire timeframe. Of this total, 2,492 worker/years (an annual average of 73.3 positions) are direct construction-oriented, 113,546 total (or 3,340 per year) are on-going business operating positions; and 58,228 are off-site worker requirements.

On a stabilized basis, after the completion of construction (year 34 of the model), the project will generate some 10,072 permanent full-time equivalent employment opportunities--6,715 directly related to on-site activities, and 3,357 indirect positions throughout the island.

The employment created during the subject development period represents about a 16 percent increase from the total jobs presently available in Hawaii County (10,072 additional jobs per year to a current job count of 63,000), and could potentially lower unemployment in the construction industry by more than 15 percent.

At build-out in 2034-2035, the subject project will contain, on-site, some five percent of the total jobs on the island (6,715 jobs out of an estimated 135,000 islandwide). The off-site positions created/supported by the subdivision will be another 2.5 percent of the then in-place workforce.

Additional employment will be created by the operating business within the development. These monies, much to be spent into the Big Island economy, are forecast to reach $839 million per year on a stabilized basis (quantified in a subsequent section). Based on DBEDT data stating each $65,000 to $80,000 spent creates one position, an additional 10,488 to 12,907 secondary jobs will be supported on the island as a result of the subject property businesses.

Wage Income Generated

In accordance with data compiled by the state Department of Labor and Industry Relations, as tempered through our analysis, we have estimated the personal income (in the form of wages) which will flow to West Hawaii workers as a result of the Kaloko-Honokohau Business Park project.

The 2000 average wage of a full-time infrastructure construction worker is estimated at $45,000 per year. For industrial (light and heavy) and commercial construction workers, the average annual pay will also be about $45,000. Tenant business operating personnel are assumed to be paid $32,000 per year on average ($16 per hour), building maintenance and grounds/landscape workers are projected to receive average pay equivalent to $30,000 per year. Off-site building and support industry jobs were estimated to receive an average pay of $25,000 annually.

Overall project average wages are equal to $29,845 per worker/year created.

Application of these wage estimates to the employment forecasts generates personal income (wage) projections directly resulting from subject development as shown at the bottom of Table V-2. The wage figures are all presented in constant 2000 dollars, and will undoubtedly escalate over time in accordance with inflationary pressures.

In the first year of development, the "Total Annual Wages Generated" by the subject development effort would be $1,150,000, increasing to a high of $302.89 million, as the number of construction, business operations and maintenance/service workers peak in year 34. After completion of all construction, the on-going operational, maintenance, off-site and indirect employment would result in average annual wages of $298.75 million thereafter in uninflated 2000 dollars.

Over the first 34 years of the development, on- and off-site, direct and indirect worker wages would total $5.213 billion.

Development Costs as Profit Income

While the significant majority of the materials needed to build the subject industrial and commercial structures must be imported to the Big Island, a portion of the construction costs spent in the development will flow to local businesses in the form of contractor profits and supplier profits.

Typically, within the industry net contractor profit margins are expected to be at 8 to 20 percent of total construction costs. We have used a conservative ten percent figure. Supplier profits were extrapolated at four percent of total costs (supplies/materials equate to

50 to 60 percent of total cost, with a profit margin for the supplier of six to eight percent).

Application of these estimates to the forecast development parameters of the subject project was shown on Table V-1.

The total Contractor's Profit ranges from $275,000 to $1,175,000 per year, with a cumulative profit of $32.96 million over the construction period. The total annual Supplier's Profit ranges from a low of $82,500 to a high of $460,000, and equates to $13.09 million over the 34-year development time-frame.

Population and Business Operations

As an industrial and mixed-use industrial/commercial development, the proposed Kaloko-Honokohau Business Park project will not have any resident population and the attendant needs for housing, schools, parks and most government services.

The business operations will annually generate some $839.01 million in gross sales/business activity based on an estimate of $350 of "sales" per square foot of finished floor area. The figure is likely to be higher for the commercial uses ($400-plus per square foot in 2000 dollars) and less for the industrial uses ($250 per square foot). Quarrying operations (which continue through year 23) are estimated to generate $3.0 million per year.

Summary of Direct, Local Economic Impacts

The various direct, local economic impacts which will flow to the subject region as a result of the subject development are summarized on Table V-3.

The annual Total Base Economic Impact increases from $1,507,500 in year 1 of the development effort to a high of $303,345,313 by year 34 (in 2000 dollars). Over the three-plus decade development and stabilization period, the total is $5.26 billion. Fueled by business operations, the estimated stabilized annual base impact thereafter is $298.75 million. This does not include the more than $800 million annually in business operations activity by in-park tenants.

TABLE V-3

$1MMARY OF ECONOMIC IMPACTS ASSOCIATED WITH DEVELOPMENT
Market Study, Economic Impact Analysis, and Public Cost/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	11	12
ANNUAL WAGES	$1,350,000	$720,000	$11,044,043	$19,247,457	$30,500,823	$40,503,823	$50,364,435	$60,509,823	$70,515,823	$80,511,823	$90,518,823	$100,211,823
CONTRACTOR'S PROFIT	$275,000	$225,000	$450,000	$412,500	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,150,000
SUPPLIER'S PROFIT	$82,500	$67,500	$360,000	$225,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$460,000
TOTAL BASE IMPACT	$1,507,500	$1,012,500	$11,854,043	$19,884,957	$32,001,823	$41,004,823	$51,865,435	$61,010,823	$72,016,823	$81,012,823	$92,019,823	$101,821,823
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$3,015,000	$2,025,000	$23,708,085	$39,769,913	$64,003,646	$82,009,646	$103,730,870	$122,021,646	$144,033,646	$162,025,646	$184,039,646	$203,643,646
Development Year	13	14	15	16	17	18	19	20	21	22	23	24
ANNUAL WAGES	$110,637,123	$120,577,423	$130,390,823	$140,333,423	$150,394,423	$160,379,423	$170,342,823	$180,345,823	$190,341,823	$200,294,423	$210,373,823	$220,373,823
CONTRACTOR'S PROFIT	$1,200,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,137,000	$1,071,000	$1,071,000
SUPPLIER'S PROFIT	$407,500	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$440,000	$430,000	$430,000
TOTAL BASE IMPACT	$111,244,623	$122,078,423	$131,891,823	$141,834,423	$151,895,423	$161,880,423	$171,843,823	$181,846,823	$191,842,823	$201,871,423	$211,874,823	$221,874,823
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$222,489,246	$244,156,846	$263,783,646	$283,668,846	$303,790,846	$323,760,846	$343,687,646	$363,693,646	$383,685,646	$403,742,846	$423,749,646	$443,749,646
Development Year	25	26	27	28	29	30	31	32	33	34	Totals Years 1-34	Stabilized
ANNUAL WAGES	$230,394,423	$240,394,423	$250,394,423	$260,394,423	$270,394,423	$280,394,423	$290,394,423	$300,394,423	$310,394,423	$320,394,423	$5,313,433,343	$298,750,313
CONTRACTOR'S PROFIT	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$1,071,000	$31,963,500	$1,071,000
SUPPLIER'S PROFIT	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$430,000	$11,895,000	$430,000
TOTAL BASE IMPACT	$231,895,423	$241,895,423	$251,895,423	$261,895,423	$271,895,423	$281,895,423	$291,895,423	$301,895,423	$311,895,423	$321,895,423	$5,357,291,843	$300,251,313
Multiplier Effect Ratio	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
TOTAL OVERALL IMPACT	$463,790,846	$483,790,846	$503,790,846	$523,790,846	$543,790,846	$563,790,846	$583,790,846	$603,790,846	$623,790,846	$643,790,846	$10,714,583,685	$600,502,625

Source: Various, and The Hallstrom Group, Inc.

These dollars will be spent, than re-spent, on goods and services on the island, diminishing in impact on the local economy with each turnover as a portion flows off the Big Island for goods, services and financing commitments. First Hawaiian Bank studies have concluded the appropriate economic multiplier rates in Hawaii are from 1.2 to 3.5 times (or 20 to 250 percent) of the base impact amount. Mainland studies (by the Urban Institute and others) tend toward the upper end of this range, and reach multipliers as high as 4.0.

Due to the need to import more than 80-plus percent of supplies/goods used on Big Island, the multiplier impact for the island is not as great as for mainland locales, particularly for construction-based expenditures. We have therefore tested multiplier rates at the mid-point of the market spectrum, ranging from 1.5 to 3.5 times.

On a conservative basis, using a relatively low-end multiplier effect ratio of 2.0, the total overall direct impact on the Hawaii County economy resulting from the Kaloko-Honokohau Business Park project would be $10.52 billion over the 34-year projection period (in constant 2000 dollars). On a stabilized annual basis thereafter, the overall impact would be at $597.5 million.

This is equivalent to about ten large size hotel operations.

ADDENDA VI: PUBLIC COST/BENEFIT ASSESSMENT

The purpose of this analysis is to delineate the direct areas in which the proposed subject industrial and mixed-use industrial/commercial development will potentially impact the sphere of public agency resources, and quantify (where possible) the costs of providing expanded services to the project, versus the economic benefits that accrue to the community through an increase in local and state tax payments.

For most developments, potential direct costs to governmental services and programs include:

- Police Protection
- Fire Protection
- Public Oversight Agencies
- Infrastructure Services
- Recreational Demands
- Educational Needs
- Infrastructure Costs
- Various Other Services and Financial Commitments

However, as a privately built industrial project many of these costs will not be increased on the state or county levels as a result of the proposed Kaloko-Honokohau Business Park. There will be no increased educational or recreational needs directly attributable to the subject development; the major public infrastructure items (highway and primary water/sewer mains) are already in place; and the development will require no specific public subsidies, welfare services, bonding or capital improvements.

Direct tax benefits to the state and county coffers will primarily flow from the project and its operation over time from three major sources:

- Real Property Taxes
- Gross Excise Tax Receipts
- State Income Taxes

Some cost/benefit issues are considered as off-setting, or "a wash," as the cost of the services to the government is theoretically directly reimbursed in the form of user fees. Building permits and utility hook-up fees are two prime examples. Other such items include workers compensation premiums and benefits, utility operations and associated use billing rates, and business oversight/registration verses licensing fees. These items are excluded from this study.

A concern of this analysis is the integration of the subject project into the overall state and Hawaii governmental services plan on both an actual and pro rata perspective.

From an actual public service cost perspective to the Big Island and state agencies, the Kaloko-Honokohau Business Park will represent only a fraction of the county and state industrial/commercial plant and overall urban lands in use. Given the vast number of housing units, resorts, businesses, and agricultural lands on the island, it is difficult to assert that of themselves the subject improvements and users will create the need for expansion of existing public services.

No new schools, parks, highways, recreational facilities, service agencies, hospitals, or other public enterprises will be required specifically because of this project. The impact on the total regional land base will be minimal. New public safety facilities at Kealakehe are proximate and have the personnel and equipment to service the businesses and buildings in the park. And, regional public infrastructure systems were generally designed with the capacity to service development in the Keahole to Kailua-Kona corridor.

However, the need for additional services is a cumulative effect, each project, each resident, tourist and, to a lesser degree, business adds a little bit to the community base until increased "need thresholds" are reached.

In regards to some services, the effective actual impact may not be apparent from a cost perspective, merely creating nominally greater demands which can be readily met through existing agencies and facilities without the need for additional workers or funds.

Our analysis of Hawaii County and state budgets indicate the actual effect of governmental services relating to Kaloko-Honokohau

Business Park would not create the need to expand county and state services.

As an alternative to actual cost estimates, which are often disparate as inherently cannot provide for unexpected and/or atypical items, it is most common to project public costs on a per capita allocation.

While this is wholly appropriate only for residential developments, as public costs and services generally accrue to where a person lives (or in the case of a tourist, where they are lodging), it is not considered to be necessarily accurate for an industrial or commercial project. By their very nature, industrial/commercial businesses are private enterprises responsible for their own costs and benefits.

Conversely, government services are holistic in nature, providing a foundation throughout a community, regardless of actual, specific impact on any given land holding. A business may not have a need for parks or schools, but they are essential to the patrons and workers and create the climate in which the business operates. Similarly, government administration, capital projects and public welfare items may have no direct relation to a particular project, but provide the economic underpinnings that enhances overall commercial success.

We have therefore looked at the public costs issue from both perspectives, on an actual cost basis, which we believe to be most appropriate for the subject project and is the focus of our conclusions, and on a per capita allocation basis.

Public Costs

Actual Costs

The county of Hawaii will directly incur several areas of cost increases as a result of the Kaloko-Honokohau Business Park, primarily in regards to emergency services. Based on analysis of response frequencies, time/cost data, and discussions with affected agencies we have made general allowances for these items as summarized below.

Police/Enforcement -- Using a base cost of $125 per hour for a responding officer (wages, benefits, overhead and amortized equipment), we estimate the annual additional police/enforcement cost to the county of Hawaii on a stabilized basis after project build-out will be $188,750.

This is comprised of:

- One miscellaneous call per day at an average of two total officer hours each. (2 hrs. x $125/hr. x 365)
- One "minor" traffic accident each week requiring on average five hours of officer time. (5 hrs. x $125 x 52)
- One "major" traffic accident each month requiring on average of 20 hours of officer time. (20 hrs. x $125 x 12)

Response times are minimized by the proximity of the subject to the Kealakehe substation. This demand is the equivalent of 1 to 1.5 new officer positions.

Fire Protection – This based on a crew cost of $750/hour (four to five firemen, wages, benefits, overhead and amortized equipment). We estimate that at build-out, the yearly additional costs to Hawaii County resulting from the project is $189,000 per year.

This is comprised of:

- One "minor" fire/rescue per week requiring one crew for a total of three hours (response and clean-up). (3 hrs. x $750/hr. x 52)
- One "major" fire/rescue every other month requiring two crews for a total of eight hours each. (2 crews x 8 hrs. x $750/hr. x 6)

Emergency Medical Response – This is based on average cost per response of $500, with an average of three calls per week. The total cost to the county would be $78,000 per year on a stabilized basis after build-out. ($500/response x 3 per week x 52)

Road Maintenance – An allowance of $50,000 per year was made for this item.

The total annual cost to the county on a stabilized basis at build out of the subject development would be $505,750. This cost was reached on an escalating basis over time, beginning at 10 percent in year 3 and increasing in accordance with the number of operating businesses in the business park.

State of Hawaii costs would include highway frontage work, health inspections of food service establishments and other minor oversight duties. An allowance of $200,000 per year was made for these items, increasing to the stabilized level as the park is built out.

Per Capita Costs

An alternative method for determining public costs is through per capita expenditures incurred by the State of Hawaii and Hawaii County in accordance with the de facto population area of the jurisdiction. This is founded on the principal that each individual on the island equitably benefits from all governmental costs, regardless of type or focus throughout the day, with each new member of the community (whether resident or visitor) creating a proportionate new cost burden in their daily home and working life.

As previously noted, this is an atypical application as most costs are viewed as accruing to residential aspects of a persons lifestyle and land use. We have included it as a means of demonstrating the overall public fiscal impact potential of the proposed subject project even when viewed from this maximum potential cost perspective. We judge this method to be secondary at best and as setting the absolute upper limit on all public costs (actual, indirect and inferred).

According to the state Financial Services database, the state expects to spend a total of $6.7 billion on services, salaries, infrastructure, and financing in 2000. The total de facto population in the state on an average daily basis at year-end 1999 was about 1,380,000 persons, including residents, tourists, and military personnel.

The per capita expenditure by the state will thus be about $4,855 for 2000, an increase of over four percent from 1999. From 1979 through 1999, costs increased at a rate of just over five percent annually compounded.

The average daily worker population at the subject at build-out will be 6,715 persons, a figure reached in year 34 of the development process. Assuming that each worker spends about one-quarter of their life on the job (or at their place of employment), the allocated state cost per worker would be $1,214 per year. The total "costs" to the public purse at stabilization by the project using the per capita allowance method would be $8.152 million in constant year 2000 dollars.

At build-out, the first phase of development would have some 2,830 permanent workers (non-construction) equating to a total cost to the state of $3.44 million. The second phase an additional 2,383 workers and an associated cost of $2.89 million, and the third phase, an additional 1,502 workers and cost of $1.82 million.

Analyzed on a similar basis, the county of Hawaii's budget for the island government in year 2000 is $186,264,404, which represents an escalation over time at 4.83 percent compounded annually since 1995.

The current de facto population on the Big Island is some 161,000 persons (comprised of 145,000 residents and 16,000 visitors). The resulting de facto per capita county expenditure for this year is therefore anticipated to be $1,157.

Using a 25 percent of total county cost share as being attributable to each worker while on the job, the average annual amount spent by Hawaii County to support the workers at the proposed Kaloko-Honokohau Business Park is $289 per worker.

Application of this figure to the total on-site worker population at subject build out would be $1,940,635 annually in costs to the county government on a stabilized basis (6,715 workers x $289). This would be comprised of Phase I costs of $817,870, Phase II costs of $688,687 and Phase III allocated expenses of $434,078.

Total Public Costs -- On an actual cost basis, which we believe to be the preferred analytical method for a business park, the state and county expenses associated with the subject development would range from $75,575 in year 3 of the project (the first year of business occupancy) to a stabilized maximum of $555,750 at build-out in year 34 in year 2000 dollars.

Phase I costs at completion would be $419,313. It is assumed costs would reach the stabilized projection level by the build-out of Phase II.

On a per capita allowance basis, which we acknowledge is an atypical perspective and an absolute maximum accounting of all direct, indirect and inferred costs, the total governmental costs to the state and county would be $10.092 million annually.

Public Fiscal Benefits

Real Property Taxes -- Property taxes paid by landowners in the subject project were calculated using the 1999-2000 tax rates for both land and buildings, improved and unimproved.

Assessed values for the lots are based on an average sales prices of $4 per square foot for quarry/heavy industrial lots, and a range of $8 to $17 per square foot for the industrial and mixed-use industrial/commercial lots in the three phases, with the most valuable being those having highway frontage or located near the main entrance. The improvement assessments are based on the projected development/construction costs of the finished buildings (at $1,625,000 for the industrial and mixed-use structures and $1,000,000 for the heavy industrial buildings). This may result in a slight understatement of assessments on the improvements, as market value often exceeds reproduction expense.

It was assumed the land would be classified as industrial or mixed use commercial and be taxed at the rate of $10.00 annually per $1,000 of assessed value. The improvements would be classified as industrial or commercial with a tax rate of $8.50 per $1,000 of assessment.

Land taxes are based on an unserviced value of $50,000 per acre for 337 useable acres of the subject site in years 1 and 2, increasing to $57,212,000 per acre in year 3 as the Phase I subdivision infrastructure is finished, and is being absorbed at market lot prices. The unserviced phases remain assessed at $50,000 per acre until developed. The assessed values of the finished improvements are added as of the year of their construction.

All real property value of the subject holding is assumed to be vested in the completed "salable" components, with no assessment placed against open spaces, roads, or other community systems.

The total real property tax to be paid to Hawaii County in 2000 dollars ranges from $168,500 in year 1 of development, to a stabilized level of $6,990,019 at build-out in year 34 and beyond. Phase I will generate $3.41 million annually in property taxes, Phase II an additional $2.26 million, and Phase III another $1.32 million. The aggregate taxes paid over the 34-year study time-frame will be $128.59 million.

State Income Tax -- The state will receive income taxes from two sources:

- the wages of the workers associated with the construction, maintenance, and operation of the Kaloko-Honokohau Business Park components; and

- the corporate profits from contractors and suppliers serving the construction and maintenance phases of the development, and as generated by on-going industrial, commercial, and quarrying operations.

According to DBEDT data, individual State of Hawaii income tax liability as a ratio to gross income has ranged from 5.62 to 5.80 percent during the past decade, with the more current figures tending toward the mid to upper-end of the range. We have employed an effective tax rate of 5.80 percent of gross income for individual workers and full-time residents.

The effective tax rate for the corporate income is estimated at 2.00 percent of gross operating profits, based on available DBEDT statistics.

The total income tax revenues to be received by the state are projected at $76,850 in the first year of construction increasing to a maximum level at year 34 of $18.42 million annually in constant 2000 dollars.

On a stabilized basis, after build-out, the permanent worker incomes, building maintenance and off-site workers, and operating businesses, would pay an annual state income tax of $18.42 million.

On a phase-by-phase breakdown, the initial increment annual income taxes paid would stabilize at build-out at $7.96 million, the Phase II taxes would be $6.42 million, and the Phase III income taxes are estimated at $4.04 million.

Over the 34-year study period, the cumulative income taxes paid are estimated at $317.53 million.

We have not included any corporate income or other taxes which will be paid by the Lanihau venture as a result of its profits from undertaking the Kaloko-Honokohau Business Park development, or from the secondary jobs created by the discretionary spending of workers and businesses. Such items have the potential to be substantial contributions to the state coffers.

State Gross Excise Tax -- This 4.166 percent of expenditures tax was applied against:

- the total estimated construction contract costs;

- the total gross sales of the industrial, mixed-use commercial and quarrying businesses; and

- the discretionary expenditures of the worker population of the subject (estimated at 40 percent of total wages).

The anticipated state excise tax receipts arising from the subject development grow from an estimated $201,426 in the first year of development to a peak of $40,068,223. Over the 34-year study period, the receipts total $688.9 million and stabilize at circa $40.0 million per year.

The Phase I stabilized excise tax revenues will be an estimated $16.92 million (excluding construction items); Phase II at $14.28 million; and Phase II at $8.79 million.

We have not included any excise tax revenues associated with the direct, local "multiplier effect" expenditures on the Big Island, or those created in the secondary market by the suppliers to the operating businesses or secondary worker expenditures.

Total Public Benefits (Revenues) -- In constant 2000 dollars, the aggregate annual tax revenues flowing from the subject development at full project build-out range from:

- $168,500 to $6,990,019 per year for the county of Hawaii, stabilizing over time at the higher figure, totaling $128.59 million over the 34-year development projection time-frame;

- $278,276 to $58,483,971 annually for the State of Hawaii, stabilizing at $58,416,274 million per year, and cumulatively at $1.006 billion over the 34-year projection period; and

- $446,776 to $65,473,900 per year for total tax receipts (county and state), totaling $1.135 billion for the first three-plus decades of the Kaloko-Honokohau Business Park community.

TABLE VI-1

PUBLIC COST/BENEFIT SUMMARY TABLE
Market Study, Economic Impact Analysis, and Public Cost/Benefits Assessment
of the Proposed Kalaeloa-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	1	2	3	4	5	6	7	8	9	10	11	12
PUBLIC BENEFITS (Revenues)												
1. REAL PROPERTY TAXES												
Cumulative Assessed Values												
Improvements			$6,500,000	$14,625,000	$23,375,000	$34,125,000	$46,875,000	$57,625,000	$68,375,000	$79,125,000	$89,875,000	$102,375,000
Land	$16,250,000	$16,250,000	$17,312,500	$17,312,500	$17,312,500	$17,312,500	$17,312,500	$17,312,500	$17,312,500	$17,312,500	$17,312,500	$17,312,500
Total Assessed Value	$16,250,000	$16,250,000	$41,712,500	$71,037,500	$92,547,500	$97,337,500	$104,087,500	$114,837,500	$125,587,500	$136,337,500	$147,087,500	$101,991,500
TOTAL REAL PROPERTY TAXES	$146,500	$146,500	$492,372	$842,465	$1,041,560	$1,240,436	$1,439,310	$1,638,185	$1,837,060	$2,035,935	$2,234,810	$2,795,136
2. STATE INCOME TAXES												
Taxable Personal Income	$1,130,000	$920,000	$11,066,063	$19,347,625	$30,509,625	$40,303,625	$50,509,625	$60,309,625	$70,512,625	$80,315,625	$90,518,625	$101,211,625
Taxable Corporate Profits	$307,500	$462,500	$1,099,979	$2,177,453	$4,954,150	$6,333,347	$7,713,543	$9,101,740	$10,490,936	$11,880,133	$13,269,329	$13,112,174
Personal Taxes Paid	$66,708	$53,360	$641,832	$1,122,162	$1,769,036	$2,349,210	$2,929,384	$3,509,558	$4,089,732	$4,669,906	$5,250,080	$5,870,274
Corporate Taxes Paid	$18,150	$8,150	$20,000	$43,549	$90,663	$126,467	$154,251	$183,035	$209,819	$237,603	$265,387	$262,343
TOTAL STATE INCOME TAXES	$84,858	$61,510	$659,831	$1,165,711	$1,867,719	$2,475,677	$3,083,635	$3,691,593	$4,299,551	$4,907,509	$5,515,467	$6,132,618
3. STATE GROSS EXCISE TAX												
Taxable Transactions												
Construction Materials	$1,375,000	$1,125,000	$2,250,000	$4,062,500	$5,375,000	$5,375,000	$5,375,000	$6,500,000	$5,375,000	$5,375,000	$5,375,000	$6,250,000
Business Operations	$3,000,000	$2,000,000	$10,799,366	$40,799,070	$66,363,881	$94,366,913	$124,130,864	$151,934,795	$179,738,727	$207,502,658	$235,206,590	$267,593,487
Discretionary Expenditures	$460,000	$368,000	$4,426,425	$7,739,056	$12,200,250	$16,301,450	$20,302,650	$24,203,850	$28,205,050	$32,206,250	$36,207,450	$40,464,650
Total Taxable Transactions	$4,835,000	$3,493,000	$17,476,011	$53,600,626	$86,138,231	$117,043,383	$149,728,514	$240,638,645	$213,298,777	$245,083,908	$276,860,040	$314,328,137
TOTAL STATE EXCISE TAX	$201,438	$157,170	$1,144,631	$2,191,342	$3,589,353	$4,918,521	$6,237,690	$10,025,896	$8,304,037	$10,210,196	$11,534,364	$13,094,510
TOTAL GROSS PUBLIC REVENUES												
To Hawaii County (Item #1)	$146,500	$146,500	$492,372	$842,465	$1,041,560	$1,240,436	$1,439,310	$1,638,185	$1,837,060	$2,035,935	$2,234,810	$2,795,136
To State (Items #2 & 3)	$270,296	$209,680	$1,824,462	$3,377,053	$5,457,072	$7,309,198	$9,321,325	$13,716,599	$13,013,576	$15,117,705	$17,049,831	$19,267,428
AGGREGATE TAX REVENUES	$416,796	$417,680	$2,316,834	$4,219,518	$6,498,631	$8,549,633	$10,760,635	$15,354,784	$14,850,636	$17,153,639	$19,284,641	$22,062,563
PUBLIC COSTS (Expenses)												
State			$30,000	$70,000	$80,000	$90,000	$90,000	$90,000	$100,000	$100,000	$110,000	$110,000
County			$90,575	$75,863	$101,150	$116,438	$151,725	$177,013	$202,300	$252,875	$279,163	$301,450
TOTAL PUBLIC COSTS			$120,575	$145,863	$181,150	$206,438	$241,725	$267,013	$302,300	$352,875	$389,163	$411,450
TOTAL NET PUBLIC BENEFITS												
To State	$270,296	$209,680	$1,794,462	$3,307,053	$5,377,072	$7,309,198	$9,231,325	$13,626,599	$13,013,576	$15,017,705	$16,939,831	$19,157,428
To Hawaii County	$146,500	$146,500	$641,797	$766,822	$940,410	$1,123,997	$1,307,585	$1,461,172	$1,634,760	$1,783,060	$1,956,647	$2,484,686
AGGREGATE NET BENEFITS	$416,796	$417,180	$2,436,259	$4,073,875	$6,317,482	$8,433,195	$10,538,910	$15,087,771	$14,720,336	$16,800,764	$18,896,478	$21,642,113

Sources: The Hallstrom Group, Inc.

Correlation

Table VI-1 summarizes our costs/benefits findings on both an actual cost and per capita allowance basis for the entire project and each constituent phase.

Our public cost/benefit assessment is comprehensively displayed on Table VI-2, which also contains the correlation of public service costs (actual basis) with the anticipated tax revenue benefits.

As can be seen, regardless of the cost methodology adopted, in no single year does public coffers suffer a net loss.

TABLE VI-1
Continued

PUBLIC COST/BENEFIT SUMMARY TABLE
Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	25	26	27	28	29	30	31	32	33	34	Totals Year 1-34	Stabilized
PUBLIC BENEFITS (Revenues)												
1. REAL PROPERTY TAXES												
Cumulative Assessed Values												
Improvements	$243,375,000	$253,125,000	$262,875,000	$272,625,000	$282,375,000	$292,125,000	$301,875,000	$311,625,000	$321,375,000	$334,625,000	$5,477,875,000	$334,625,000
Land	$98,445,600	$98,445,600	$98,445,600	$98,445,600	$98,445,600	$98,445,600	$98,445,600	$98,445,600	$98,445,600	$98,445,600	$2,724,590,600	$98,445,600
Total Assessed Value	$341,820,600	$351,570,600	$361,320,600	$371,070,600	$380,820,600	$390,570,600	$400,320,600	$410,070,600	$419,820,600	$433,070,600	$8,202,465,600	$433,070,600
TOTAL REAL PROPERTY TA	$5,464,894	$5,647,360	$5,847,444	$6,024,019	$6,208,394	$6,388,760	$6,560,144	$6,749,519	$6,929,894	$6,998,019	$128,306,904	$6,998,019
2. STATE INCOME TAXES												
Taxable Personal Income	$228,974,600	$236,084,561	$241,194,438	$254,304,313	$263,414,186	$272,524,063	$281,633,938	$290,743,813	$299,853,688	$302,998,313	$5,313,423,563	$302,998,313
Taxable Corporate Profits	$32,815,764	$34,075,733	$35,315,702	$36,595,671	$37,855,640	$39,111,609	$40,373,578	$41,633,547	$42,893,516	$42,405,306	$737,468,873	$42,405,306
Personal Taxes Paid	$13,164,532	$13,692,905	$14,221,277	$14,749,650	$15,278,023	$15,806,396	$16,334,768	$16,863,141	$17,391,514	$17,567,638	$302,378,367	$17,567,638
Corporate Taxes Paid	$656,315	$681,515	$706,714	$731,913	$757,111	$782,312	$807,512	$832,711	$857,910	$848,110	$15,148,001	$848,110
TOTAL STATE INCOME TAX	$13,820,847	$14,374,419	$14,927,991	$15,481,564	$16,035,136	$16,588,708	$17,142,280	$17,695,852	$18,249,424	$18,415,748	$317,526,368	$18,415,748
3. STATE GROSS EXCISE TAX												
Taxable Transactions												
Construction Materials	$4,875,000	$4,875,000	$4,875,000	$4,875,000	$4,875,000	$4,875,000	$4,875,000	$4,875,000	$4,875,000	$1,625,000	$223,917,500	
Business Operations	$629,015,266	$654,214,665	$679,414,045	$704,613,425	$729,812,805	$755,012,184	$780,211,564	$805,410,944	$830,610,323	$839,810,117	$14,226,851,499	$839,810,117
Discretionary Expenditures	$90,790,875	$94,433,825	$98,077,775	$101,721,725	$105,365,675	$109,009,625	$112,653,575	$116,297,525	$119,941,475	$121,156,125	$2,081,360,425	$121,156,125
Total Taxable Transactions	$724,680,141	$753,523,490	$782,366,820	$811,210,150	$840,053,480	$868,896,809	$897,740,139	$926,583,469	$955,426,798	$961,791,242	$16,534,138,424	$960,166,242
TOTAL STATE EXCISE TAX	$30,190,175	$31,391,789	$32,593,402	$33,795,015	$34,996,628	$36,198,241	$37,399,854	$38,601,467	$39,803,080	$40,066,333	$688,896,360	$40,000,526
TOTAL GROSS PUBLIC REVENUES												
To Hawaii County (Item #1)	$5,464,894	$5,647,360	$5,847,444	$6,024,019	$6,208,394	$6,388,760	$6,560,144	$6,749,519	$6,929,894	$6,998,019	$128,306,904	$6,998,019
To State (Items #2 & 3)	$44,011,022	$45,766,208	$47,521,393	$49,276,579	$51,031,764	$52,786,949	$54,542,134	$56,297,319	$58,052,505	$58,481,971	$1,006,422,928	$58,416,274
AGGREGATE TAX REVENUES	$49,497,916	$51,413,476	$53,368,837	$55,300,597	$57,240,157	$59,175,717	$61,111,275	$63,046,838	$64,982,398	$65,473,990	$1,135,800,322	$65,406,292
PUBLIC COSTS (Expenses)												
State	$170,000	$170,000	$180,000	$180,000	$190,000	$190,000	$200,000	$200,000	$200,000	$200,000	$4,450,000	$200,000
County	$505,750	$505,750	$505,750	$505,750	$505,750	$505,750	$505,750	$505,750	$505,750	$505,750	$12,062,138	$505,750
TOTAL PUBLIC COSTS	$675,750	$675,750	$685,750	$685,750	$695,750	$695,750	$705,750	$705,750	$705,750	$705,750	$16,512,138	$705,750
TOTAL NET PUBLIC BENEFITS												
To State	$43,841,022	$45,596,208	$47,341,393	$49,096,579	$50,841,764	$52,596,949	$54,342,134	$56,097,319	$57,852,505	$58,283,971	$1,001,972,928	$58,216,274
To Hawaii County	$4,981,164	$5,161,519	$5,341,894	$5,522,269	$5,702,644	$5,883,019	$6,063,394	$6,243,769	$6,424,144	$6,484,269	$116,524,456	$6,464,269
AGGREGATE NET BENEFITS	$48,822,186	$50,757,726	$52,683,287	$54,618,847	$56,544,407	$58,479,967	$60,405,527	$62,341,088	$64,276,648	$64,768,240	$1,118,497,384	$64,700,542

TABLE VI-1
Continued

PUBLIC COST/BENEFIT SUMMARY TABLE
Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment
of the Proposed Kaloko-Honokohau Business Park
Honokohau, North Kona, Hawaii
In Constant Year 2000 Dollars

Development Year	13	14	15	16	17	18	19	20	21	22	23	24
PUBLIC BENEFITS (Revenues)												
1. REAL PROPERTY TAXES												
Cumulative Assessed Values												
Improvements	$114,375,000	$125,125,000	$135,875,000	$146,625,000	$157,375,000	$168,125,000	$178,875,000	$189,625,000	$200,375,000	$212,125,000	$222,875,000	$233,625,000
Land	$89,616,000	$89,616,000	$89,616,000	$89,616,000	$89,616,000	$89,616,000	$89,616,000	$89,616,000	$89,616,000	$98,445,600	$98,445,600	$98,445,600
Total Assessed Value	$203,991,000	$214,741,000	$225,491,000	$236,241,000	$246,991,000	$257,741,000	$268,491,000	$279,241,000	$289,991,000	$310,570,600	$321,320,600	$332,070,600
TOTAL REAL PROPERTY TA	$3,012,136	$3,211,001	$3,409,876	$3,608,751	$3,807,626	$4,006,501	$4,205,376	$4,404,251	$4,603,126	$4,908,760	$5,107,644	$5,306,519
2. STATE INCOME TAXES												
Taxable Personal Income	$110,637,125	$120,527,625	$130,530,625	$140,533,625	$150,536,625	$160,539,625	$170,542,625	$180,545,625	$190,548,625	$200,954,125	$206,331,813	$210,334,813
Taxable Corporate Profits	$16,397,905	$17,834,003	$19,213,799	$20,602,995	$21,992,192	$23,381,388	$24,770,585	$26,159,781	$27,548,978	$29,197,403	$30,456,999	$31,695,791
Personal Taxes Paid	$6,616,953	$6,998,603	$7,570,776	$8,150,950	$8,731,124	$9,311,298	$9,891,472	$10,471,646	$11,051,820	$11,611,339	$12,082,665	$12,662,839
Corporate Taxes Paid	$311,958	$336,492	$364,276	$412,868	$439,644	$467,623	$495,412	$523,196	$550,980	$581,948	$609,132	$633,916
TOTAL STATE INCOME TAX	$6,740,911	$7,347,094	$7,936,052	$8,563,818	$9,170,968	$9,778,924	$10,386,884	$10,994,842	$11,602,800	$12,230,287	$12,691,797	$13,296,755
3. STATE GROSS EXCISE TAX												
Taxable Transactions												
Construction Materials	$4,000,000	$5,375,000	$5,375,000	$5,375,000	$5,375,000	$5,375,000	$5,375,000	$5,375,000	$5,375,000	$5,375,000	$5,375,000	$5,375,000
Business Operations	$290,688,100	$326,392,840	$354,175,971	$381,959,103	$409,742,234	$437,527,365	$465,311,497	$491,095,628	$520,879,760	$551,248,043	$579,031,973	$603,815,906
Discretionary Expenditures	$44,254,850	$48,211,050	$52,212,250	$56,213,450	$60,214,650	$64,215,850	$68,217,050	$72,218,250	$76,219,450	$80,181,650	$83,328,725	$87,329,925
Total Taxable Transactions	$340,942,950	$379,978,890	$411,763,221	$443,548,353	$475,333,484	$507,118,615	$538,903,747	$570,688,878	$602,474,010	$637,304,693	$667,735,700	$696,520,831
TOTAL STATE EXCISE TAX	$14,533,431	$15,829,887	$17,154,864	$18,478,234	$19,802,393	$21,134,563	$22,450,738	$23,774,899	$25,099,061	$26,536,466	$27,817,869	$29,017,058
TOTAL GROSS PUBLIC REVENUES												
To Hawaii County (Item #1)	$3,012,136	$3,211,001	$3,409,876	$3,608,751	$3,807,626	$4,006,501	$4,205,376	$4,404,251	$4,603,126	$4,908,760	$5,107,644	$5,306,519
To State (Items #2 & 3)	$21,282,342	$23,176,982	$25,109,106	$27,041,235	$28,973,361	$30,905,488	$32,837,616	$34,769,741	$36,701,867	$38,797,751	$40,509,666	$42,313,813
AGGREGATE TAX REVENUES	$24,294,468	$26,387,983	$28,518,984	$30,649,985	$32,780,987	$34,911,988	$37,042,990	$39,173,991	$41,304,993	$43,706,504	$45,617,310	$47,620,332
PUBLIC COSTS (Expenses)												
State	$130,000	$130,000	$130,000	$130,000	$130,000	$140,000	$140,000	$150,000	$150,000	$150,000	$160,000	$160,000
County	$320,738	$354,025	$379,313	$404,600	$429,888	$429,888	$455,175	$480,463	$505,750	$505,750	$505,750	$505,750
TOTAL PUBLIC COSTS	$446,738	$474,025	$499,313	$534,600	$559,888	$569,888	$595,175	$630,463	$655,750	$655,750	$665,750	$665,750
TOTAL NET PUBLIC BENEFITS												
To State	$21,162,342	$21,056,982	$24,989,106	$26,911,235	$28,843,361	$30,765,488	$32,697,616	$34,619,741	$36,551,867	$38,647,751	$40,349,666	$42,153,813
To Hawaii County	$2,665,388	$2,856,976	$3,030,563	$3,204,151	$3,377,738	$3,576,613	$3,750,201	$3,923,788	$4,097,376	$4,403,010	$4,601,894	$4,800,769
AGGREGATE NET BENEFITS	$23,845,730	$25,913,957	$28,019,671	$30,115,385	$32,221,099	$34,342,101	$36,447,815	$38,543,529	$40,649,243	$43,050,761	$44,951,560	$46,954,581

LIMITING CONDITIONS AND ASSUMPTIONS

The research, analysis, conclusions, and certification performed by The Hallstrom Group, Inc. are subject to and influenced by the following:

- The report expresses the opinion of the signers as of the date stated in the letter of transmittal, and in no way has been contingent upon the reporting of specified values or findings.
- Any sketches, maps, plot plans, and photographs included in the report are intended only to show spatial relationships and/or assist the reader in visualizing the property. They are not measured surveys or maps and we are not responsible for their accuracy or interpretive quality.
- It is assumed that the subject property is free and clear of any and all encumbrances other than those referred to herein, and no responsibility is assumed for matters of a legal nature. The report is not to be construed as rendering any opinion of title, which is assumed to be good and marketable. No title information or data regarding easements which might adversely affect the use, access, or development of the property, other than that referenced in the report, was found or provided. The property is analyzed as though under responsible ownership and competent management.
- Preparation for, attendance, or testimony at any court or administrative hearing in connection with this report shall not be required unless prior arrangements have been made therefor.
- If the report contains a valuation relating to a geographical portion or tract of real estate, the value reported for such geographical portion relates to such portion only and should not be construed as applying with equal validity to other portions of the larger parcel or tract; and the value reported for such geographical portion plus the value of all other

TABLE VI-2

SUMMARY OF PRIMARY GOVERNMENTAL TAX RECEIPTS AND PUBLIC SERVICE COSTS
Market Study, Economic Impact Analysis and Public Cost/Benefits Assessment
of the Proposed Kalaka-Honokohau Business Park
Honokohau, North Kona, Hawaii

On Stabilized Basis At Build-Out	Actual Cost Comparison			Per Capita Allocation Comparison		
	Receipts	Costs	Net Benefits or (Costs)	Receipts	Costs	Net Benefits or (Costs)
Phase I	$23,109,108	($120,000)	$24,999,108	$3,409,876	($379,313)	$3,030,563
Phase II	$20,657,100	($30,000)	$20,687,100	$2,257,393	($126,437)	$2,130,956
Phase III	$12,650,066	($30,000)	$12,620,066	$1,322,750	$0	$1,322,750
Total Project	$58,416,274	($200,000)	$58,216,274	$6,990,019	($505,750)	$6,484,269

Source: The Hallstrom Group, Inc.

geographical portions may or may not equal the value of the entire parcel or tract considered as an entity.

- It is assumed that there are no hidden or inapparent conditions of the property, subsoil, or structures which would render it more or less valuable; we assume no responsibility for such conditions or for engineering which might be required to discover such factors.

- Information, estimates, and opinions provided by third parties and contained in this report were obtained from sources considered reliable and believed to be true and correct. However, no responsibility is assumed for possible misinformation.

- Possession of the report, or a copy thereof, does not carry with it the right of publication, and the report may not be used by any person or organization except the client without the previous written consent of the appraiser, and then only in its entirety. If the client releases or disseminates the reports to others without the consent of the appraiser, the client hereby agrees to hold the appraiser harmless, and to indemnify the analysts from any liability, damages, or losses which the analysts might suffer, for any reason whatsoever, by reason of dissemination of the report by the client. Further, if legal action is brought against the analyst by a party other than the client concerning the report or the opinions stated therein, the client agrees, in addition to indemnifying the analysts for any damages or losses, to defend said analysts in said action at client's expense. However, nothing herein shall prohibit the client or analysts from disclosing said report or opinions contained therein as may be required by applicable law.

- Disclosure of the contents of this report is governed by the By-Laws and Regulations of the Appraisal Institute. Neither all nor any part of the contents of this report (especially any conclusions as to value, the identity of the appraisers or the firm which they are connected, or any reference to the Appraisal Institute or to the MAI designation) shall be disseminated to the public through advertising media, public relations media, news media, sales media, or any public means

of communication without the prior consent and approval of the appraisers.

- Unless otherwise stated in this report, the existence of hazardous material, which may or may not be present on the property, was not observed by the appraiser. The appraiser has no knowledge of the existence of such materials on or in the property. The appraiser, however, is not qualified to detect such substances. The presence of substances such as asbestos, urea-formaldehyde foam insulation, or other potentially hazardous materials may affect the value of the property. The value estimate is predicated on the assumption that there is no such material on or in the property that would cause a loss in value. No responsibility is assumed for any such conditions, or for any expertise or engineering knowledge required to discover them. The client is urged to retain an expert in this field, if desired.

- The Americans with Disabilities Act (ADA) became effective January 26, 1992. We have not made a specific compliance survey and analysis of this property to determine whether or not it is in conformity with the various detailed requirements of the ADA. It is possible that a compliance survey together with a detailed analysis of the requirements of the ADA could reveal that the property is not in compliance with one or more of the requirements of the act. If so, this fact could have a negative effect upon the value of the property. We did not consider possible noncompliance with the requirements of ADA in estimating the value of the property.

CERTIFICATION

The undersigned do hereby certify that, to the best of our knowledge and belief, the statements of fact contained in this report are true and correct. It is further certified that the reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are our personal, impartial, and unbiased professional analyses, opinions, and conclusions. We further certify that we have no present or prospective interest in the property that is the subject of this report, and have no personal interest with respect to the parties involved. We have no bias with respect to the property or the parties involved with this assignment. Our engagement was not contingent upon developing or reporting predetermined results. Our compensation is not contingent on an action or event resulting from the analyses, opinions, or conclusions in, or the use of, this report. The analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute, and the Uniform Standards of Professional Appraisal Practice. The use of this report is subject to the requirements of the Appraisal Institute relating to review by duly authorized representatives. The undersigned certify that they have made personal inspections of the property that is the subject of this report. No other persons provided significant professional assistance other than the undersigned.

The Appraisal Institute conducts programs of continuing education for their designated members. As of the date of this report, James E. Hallstrom, Jr. has completed the requirements of the continuing education program of the Appraisal Institute.

THE HALLSTROM GROUP, INC.

James E. Hallstrom, Jr., MAI, CRE
Hawaii State Certified
General Appraiser, CGA-178
Exp. Date December 31, 2001

Tom W. Holliday

/as 4056_R01

THE HALLSTROM GROUP INC.
REAL ESTATE CONSULTANTS & APPRAISERS

PROFESSIONAL BACKGROUND AND SERVICES

The Hallstrom Group, Inc. is a Honolulu based independent professional organization that provides a wide scope of real estate consulting services throughout the State of Hawaii with particular emphasis on valuation studies. The purpose of the firm is to assist clients in formulating realistic real estate decisions. It provides solutions to complex issues by delivering thoroughly researched, objective analyses in a timely manner. Focusing on specific client problems and needs, and employing a broad range of tools including after-tax cash flow simulations and feasibility analyses, the firm minimizes the financial risks inherent in the real estate decision making process.

The principals and associates of the firm have been professionally trained, are experienced in Hawaiian real estate, and are actively associated with the Appraisal Institute and the Counselors of Real Estate, nationally recognized real estate appraisal and counseling organizations.

The real estate appraisals prepared by The Hallstrom Group accomplish a variety of needs and function to provide professional value opinions for such purposes as mortgage loans, investment decisions, lease negotiations and arbitrations, condemnations, assessment appeals, and the formation of policy decisions. Valuation assignments cover a spectrum of property types including existing and proposed resort and residential developments, industrial properties, high-rise office buildings and condominiums, shopping centers, subdivisions, apartments, residential leased fee conversions, special purpose properties, and vacant acreage, as well as property assemblages and portfolio reviews.

Market studies are research-intensive, analytical tools oriented to provide insight into investment opportunities and development challenges, and range in focus from highest and best use determinations for a specific site or improved property, to an evaluation of multiple (present and future) demand and supply characteristics for long-term, mixed-use projects. Market studies are commissioned for a variety of purposes where timely market information, insightful trends analyses, and perceptive conceptual conclusions or recommendations are critical. Uses include the formation of development strategies, bases for capital commitment decisions, evidence of appropriateness for state and county land use classification petitions, fiscal and social impact evaluations, and the identification of alternative economic use/conversion opportunities.

PROFESSIONAL QUALIFICATIONS OF JAMES E. HALLSTROM, JR., MAI, CRE

Business Background

Chairman	The Hallstrom Group, Inc. Honolulu, Hawaii
Former Senior Vice President and Treasurer	Hastings, Martin, Hallstrom and Chew, Ltd., Honolulu, Hawaii (1972-1980)
Former Real Property Appraiser and Analyst	Administration, Inc., a subsidiary of C. Brewer and Company, Limited Honolulu, Hawaii (1971-1972)
Former Senior Real Property Appraiser and Analyst	Opitz Realty, Madison, Wisconsin (1969-1971)

National Designations and Memberships

- CRE Designation (1998) - The Counselors of Real Estate
- MAI Designation (1976) - American Institute of Real Estate Appraisers
- SRPA Designation (1975) - Society of Real Estate Appraisers

The American Institute of Real Estate Appraisers (AIREA) and the Society of Real Estate Appraisers (SREA) consolidated in 1991, forming the Appraisal Institute (AI).

Education

- M.S. (Real Estate Appraisal and Investment Analysis) 1971, University of Wisconsin at Madison
- B.A. (Economics) 1969, Brigham Young University at Provo
- Additional numerous specialized real estate studies in connection with qualifying for national professional designations, and continuing uninterrupted Continuing Education.
- Completed Continuing Education requirements with the Appraisal Institute through December 31, 2002.

Professional Involvement

- Former President and Officer for Hawaii AIREA and SREA Chapters
- Instructor for Society of Real Estate Appraisers Course 101, "Introduction to Appraising Real Property" and Course 201, "Principles of Income Property Appraising"
- Contributing author to the "Hawaii Real Estate Investor"
- Lecturer at many professional seminars and clinics.
- Appointed numerous times as an Arbitrator and Mediator.

Qualified Expert Witness

Federal and State Courts
State Land Use and County Hearings
Arbitration Proceedings

State of Hawaii Certification

Certified General Appraiser, License Number CGA-178, Exp. Date December 31, 2001

Community Service

Active registered member of the Boy Scouts of America; Officer and Director of Le Jardin Academy; former Advisory Board Member of the School of Business, Brigham Young University, Hawaii Campus.

PROFESSIONAL QUALIFICATIONS OF THOMAS W. HOLLIDAY

Business Background

Senior Analyst	The Hallstrom Group, Inc. Honolulu, Hawaii
Former Staff Appraiser	Davis-Baker Appraisal Co. Avalon, Santa Catalina Island, California

Education

- B.A. (Communications/Journalism) 1978 California State University at Fullerton
- SREA Course 201- Principles of Income Property Appraising
- Numerous professional seminars and clinics
- Contributing author to **Hawaii Real Estate Investor**, Honolulu Star Bulletin

On January 1, 1991, the American Institute of Real Estate Appraisers (AIREA) and the Society of Real Estate Appraisers (SREA) consolidated, forming the Appraisal Institute (AI).

Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 10

Cultural Impact Assessment

CULTURAL IMPACT ASSESSMENT

Kaloko-Honokōhau Business Park
North Kona, Hawaii

Prepared by
Geometrician Associates

January 2001

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1. INTRODUCTION

This assessment summarizes the potential impacts of the proposed Kaloko-Honokōhau Business Park (the project) upon the cultural, historic and natural resources, as well as upon native Hawaiian rights and cultural practices and beliefs, of the area of Honokōhau. As part of land use entitlements for the project, the landowner has prepared a petition for a land use boundary amendment before the State of Hawai'i Land Use Commission (LUC). This assessment addresses cultural impact, and is meant to assist in providing information to address the constitutional duty of agencies of the State of Hawai'i to protect the reasonable exercise of customarily and traditionally exercised rights of native Hawaiians, to the extent feasible, in connection with such petitions. To this end, the Hawai'i Supreme Court has recently pronounced an analytical framework within which State agencies may fulfill this constitutional duty. In the recent case of Ka Pa'akai O Ka 'Aina vs. Land Use Commission, the court directed the LUC, in consideration of petitions for district boundary amendments, to make specific findings before reaching a decision on the petition concerning:

1. The identity and scope of "valued cultural, historical and natural resources" in the petition area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area.
2. The extent to which those resources – as well as traditional and customary native Hawaiian rights – will be affected or impaired by the proposed action, and
3. The feasible action, if any, to be taken by the LUC to reasonably protect native Hawaiian rights, if they are found to exist.

2. PETITION AREA

The Petition Area encompasses approximately 337 acres and is located in the lower mid-plain lands including portions of two *ahupua'a*, Honokōhau nui and Honokōhau iki, North Kona, Hawai'i. The site is approximately one mile *mauka* of the coastline, three miles south of the Kona International Airport, and slightly more than three miles north of the town of Kailua-Kona. The southern half of the Kaloko-Honokōhau National Historical Park is located *makai* of the site, directly across Queen Ka'ahumanu Highway. The terrain slopes gently from east to west and is composed primarily of 3-5,000 year old pahoehoe and 'a'a lava flows (Wolfe and Morris 1996).

3. METHODS

This cultural impact assessment was prepared in accordance with the methodology and content protocol provided in the November 19, 1997 *Guidelines for Assessing Cultural Impacts* from the Office of Environmental Quality Control. The information in this report was drawn from a separate, detailed report by Kepā Maly (2000). Maly examined cultural practices and beliefs within the *ahupua'a* of Honokōhau Nui and Honokōhau Iki and surrounding areas, conducting research on archival-historical literature, and identifying and consulting with individuals and/or organizations with knowledge of the area's practices, and beliefs, as well as the cultural, natural and historical resources.

Archival and historical references included, but were not limited to, land use records, including Land Commission Award records from the Māhele of 1848, Boundary Commission testimonies, and survey records of the Kingdom and Territory of Hawai'i, and various historical texts. The archival-historical resources were located in the collections of the Hawai'i State Archives; the Hawai'i State Department of Land and Natural Resources, Survey Division; the Hawai'i State Bureau of Conveyances; the Bishop Museum Archives; the Hawaiian Historical Society; the University of Hawai'i-Hilo Mo'okini Library; Kaloko-Honokōhau National Historical Park; and private family collections. In addition, oral history interviews were conducted with descendants of the native Hawaiian families and others who are known to be familiar with the natural and cultural landscape and history of land use in Honokōhau and the neighboring lands of the larger Kekaha region.

The primary oral historical-consultation component of this study was conducted between September 28, 1999, to February 28, 2000, and includes interviews and consultation records with 19 individuals who had knowledge of the area's cultural, historical and natural resources and its practices and beliefs (including four historic interviews conducted in 1962). Potential interviewees were identified through previous work in the region by Maly, and through conversations with various individuals and agency representatives. All of the interview participants have lived upon or worked the lands of Honokōhau nui and iki, and provided documentation gained from personal experiences dating back to the 1890s. Several of the interview participants are descended from families who lived at Honokōhau since at least the 1840s.

The recorded interviews were transcribed and returned to each of the interviewees, and follow-up discussions were conducted to review each of the typed draft transcripts. The latter process resulted in the recording of additional narratives with several interviewees. Following completion of the interview process, all of the participants in the tape-recorded oral history interviews gave their written permission for inclusion of portions of their transcripts in Maly's study.

4. ANCIENT HAWAIIAN LAND DIVISIONS IN REFERENCE TO THE PROJECT SITE

By the time 'Umi-a-Līloa rose to rule the island of Hawai'i ca. 1525, the island (*moku-puni*) was divided into six districts or *moku-o-loko* (Fornander 1973–Vol. II:100-102). On Hawai'i, the district of Kona is one of six major *moku-o-loko* within the island. The district of Kona extends from the shore across the entire volcanic mountain of Hualālai, and continues to the summit of Mauna Loa, where Kona is joined by the districts of Ka'ū, Hilo, and Hāmākua.

Kona, like other large districts on Hawai'i, was further divided into *'okana* or *kalana* (regions of land smaller than the *moku-o-loko*, yet comprising a number of smaller units of land). In the region now known as Kona 'akau (North Kona), there were several smaller ancient land divisions (*kalana*) as well. The southern portion of North Kona was known as "*Kona kai 'ōpua*" (interpretively translated as "Kona of the distant horizon clouds above the ocean"), and included the area extending from Lanihau (the present-day vicinity of Kailua Town) to Pu'uohau. The

northernmost portion of North Kona was called "Kekaha" (descriptive of an arid coastal place). Native residents of the region affectionately referred to their home as "Kekaha-wai-'ole o nā Kona" (Waterless Kekaha of the Kona district), or simply as the "*'āina kaha*." It is within this region of Kekaha that the two *ahupua'a* of Honokōhau are found.

The large districts (*moku-o-loko*) and sub-regions (*'okana* and *kalana*) were further divided into manageable units of land, and were tended to by the *maka'āinana* (people of the land) (Malo 1951:63-67). Of all the land divisions, perhaps the most significant management unit was the *ahupua'a*. *Ahupua'a* are subdivisions of land that were usually marked by an altar with an image or representation of a pig placed upon it (thus the name *ahu-pua'a* or pig altar). *Ahupua'a* may be compared to pie-shaped wedges of land that extend from the ocean fisheries fronting the land unit to the mountains or some other feature of geological significance (e.g., a valley or crater). The boundaries of the *ahupua'a* were generally defined by the topography and cycles and patterns of natural resources occurring within the lands (Lyons 1875).

The *ahupua'a* were also divided into smaller manageable parcels of land (such as the *'ili, kō'ele, māla*, and *kīhāpai*, etc.) in which cultivated resources could be grown and natural resources harvested. These access rights were almost uniformly tied to residency

Entire *ahupua'a*, or portions of them, were generally under the jurisdiction of appointed *konohiki* or lesser chief-landlords, who answered to an *ali'i-'ai-ahupua'a* (chief who controlled the *ahupua'a* resources). The *ali'i-'ai-ahupua'a* in turn answered to an *ali'i 'ai moku* (chief who claimed the abundance of the entire district). Thus, *ahupua'a* resources supported not only the *maka'āinana* who lived on the land, but also contributed to the support of the *ali'i* of regional and/or island kingdoms. As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the *maka'āinana*, who lived in a given *ahupua'a* had access to most of the resources from mountain slopes to the ocean. This right to gather resources was generally tied to residency within an *ahupua'a*, and was also tied to the obligation to pay tribute to the *ali'i* (Malo 1951:63-67; Kamakau 1961:372-377; and Boundary Commission testimonies cited in Maly 2000).

This form of district subdivision was integral to Hawaiian life and was the product of careful adherence to resource management planning. In this system, the land provided fruits and vegetables and some meat in the diet, and the ocean provided a wealth of protein resources. Also, in communities with long-term royal residents, divisions of labor (with specialists in various occupations on land and in procurement of marine resources) came to be strictly observed. It is in this setting that we find Honokōhau and the present study area.

Nā Hono i nā Hau 'Elua: The Ahupua'a of Honokōhau nui & iki [1]

The Honokōhau *ahupua'a* are two of twenty-three ancient *ahupua'a* within the *'okana* of Kekaha-wai-'ole. The place name Hono-kō-hau may be literally translated as "Bay-of-wind-born-dew." Maly (2000) cites traditional accounts written by J.W.H.I. Kihe, a native of the Honokōhau-Kaloko *ahupua'a*, which imply that the name is descriptive of the *hau* (dew) that seasonally seems to flow down the mountain. The dew carried with it moisture that enabled native residents to successfully grow dry land crops, and was considered life-giving. Kihe affectionately referred to the land of his ancestors as "*Nā hono i nā hau 'elua*" (Bays of the two wind-born dews) (Kihe in *Ka Hōkū o Hawai'i*, September 13, 1917).

Traditional and historic literature as well as oral historical accounts describe Honokōhau as among the favored lands of Kekaha. The fresh watered shores of Honokōhau; the fishponds of 'Aimakapā, 'Ai'ōpio and ponds like Kahinihini'ula; salt making locations and the rich ocean and near-shore fisheries; the inland agricultural field systems; and diverse forest and mountain resources attracted native residents to the area, and sustained them on the land.

Land Use Patterns within the Ahupua'a

The *ahupua'a* of Honokōhau crosses several environmental zones that are generally called "*wao*" in the Hawaiian language. These environmental zones include the following:

Kahakai	Near shore fisheries and shoreline strand
Kula Kai	Shoreward plains
Kula Uka	Inland plains
Wao Kanaka	Region of man
Wao Nahele	Region of forest
Wao Ma'ukele	Rainforest
Wao Akua	Region or zone of deities (lit. translated)

The following is a more detailed description of each of these environments as they pertain to Honokōhau:

Kahakai

The *Kahakai* includes the nearshore waters and the beach strand areas. In Honokōhau, these areas were rich in marine resources.

Kula Kai and Kula Uka

The *kula* region of Honokōhau and the greater Kekaha is now likened to a volcanic desert, though native and historic accounts describe groves of native hard

[1] Use of the terms "*nui*" (big) and "*iki*" (little) in association with the *ahupua'a* name (i.e., Honokōhau nui and Honokōhau iki), describe the two historic land divisions of the Honokōhau lands. The former, larger ahupua'a extended further upland into the forest region.

wood shrubs and trees such as *'ūlei* (*Osteomeles anthyllidifolia*), *ēlama* (*Diospyros ferrea*), *uhiuhi* (*Caesalpina kavaiensis*), and *ohe* (*Reynoldsia sandwicensis*) extending across the land and growing some distance shoreward.

The lower *kula* lands receive only about 20 inches of rainfall annually, and it is because of their dryness that the larger region, of which Honokōhau is a part, is known as "Kekaha." While no water appears on the surface, abundant groundwater flows beneath the lava and feeds the springs, fishponds and anchialine ponds on the *Kula Kai* (coastal flats).

These were transitional lands between the intensively utilized *Kahakai* and the *Wao Kanaka*. Because of the limited rainfall and barren soils, uses within these areas were primarily transitional or intermittent in nature.

Wao Kanaka and *Wao Nahele*

Continuing along the *Kula Uka* (inland slopes), the environment changes as elevation increases. In the *Wao Kanaka* and *Wao Nahele* rainfall increases to 30 or 40 inches annually, and taller forest growth occurs.

This region provided native residents with shelter for residential and agricultural uses, and a wide range of natural resources which were of importance for religious, domestic, and economic purposes. In Honokōhau, this region is generally between 1,200 and 2,400 feet in elevation, and is crossed by the present-day Māmalahoa Highway (which is situated not far below the ancient *ala loa*, or foot trail that was part of a regional trail system).

Continuing further inland, Honokōhau nui ends at about the 6,000 foot elevation near Pu'u Hinakapo'ula, where it meets the region of Kaloko on the north, Kealakehe and Honua'ula on the south, and Kaupūlehū on the east.

Wao Ma'ukele and *Wao Akua*

In the upper reaches of Honokōhau nui and extending into Kaloko and Keauhou (which includes the summit of Hualālai) we find the *Wao Ma'ukele* (a rain forest-like environment) and the *Wao Akua*, literally translated as the "region or zone of deities."

The *Wao Akua* is so named because of the pattern of cloud cover and precipitation which settles upon the mountain slope—this covering was interpreted as concealing from view the activities of the deity and gods who were believed to walk the land under the cover of the mist and clouds (David Malo 1959:16-18; and M.K. Pukui, pers. comm. to Kepā Maly 1975).

5. HISTORICAL ACCOUNTS OF HONOKŌHAU AND KEKAHA

Pre-Nineteenth Century Accounts of Honokōhau and Kekaha

There are only a few early (pre-nineteenth century) historical accounts that specifically name Honokōhau, as most of the accounts describe the area in the context of the larger Kekaha region. The native account of Punia is perhaps among the earliest accounts of the Kekaha area, and in it is found a native explanation for the late settlement of Kekaha. The following narrative is paraphrased from Fornander's "Hawaiian Antiquities and Folklore" (Fornander 1959):

> "Punia went into the ocean, and one-by-one and two-by-two, he called the ghosts into the water with him, instructing them to dive below the surface. As each ghost dove into the water, Punia twisted the net entangling the ghosts. This was done until all but one of the ghosts had been killed. That ghost fled and Kekaha became safe for human habitation." (Fornander 1959)

One of the earliest datable accounts that describes the importance of the Kekaha region comes from the mid sixteenth century, following 'Umi-a-Līloa's unification of the island of Hawai'i under his rule. Writing in the 1860s, native historian, Samuel Mānaiakalani Kamakau (1961) told readers about the reign of 'Umi, and his visits to Kekaha:

> "Umi-a-Liloa did two things with his own hands, farming and fishing...and farming was done on all the lands. Much of this was done in Kona. He was noted for his skill in fishing and was called *Pu'ipu'i a ka lawai'a* (a stalwart fisherman). *Aku* fishing was his favorite occupation, and it often took him to the beaches (Ke-kaha) from Kalahuipua'a to Makaula." (Kamakau 1961)

In his accounts of events at the end of 'Umi's life, Kamakau (1961) references Kekaha once again. He records that Ko'i, one of the faithful supporters and a foster son of 'Umi, sailed to Kekaha, where he killed a man who resembled 'Umi. Ko'i then took the body and sailed to Maka'eo in the *ahupua'a* of Keahuolu. Landing at Maka'eo in the night, Ko'i took the body to the cave where 'Umi's body lay. Replacing 'Umi's body with that of the other man, Ko'i then crossed the lava beds, returning to his canoe at Maka'eo. From there, 'Umi's body was taken to its final resting place (Kamakau 1961).

The presence of working fishponds in the Honokōhau-Kaloko vicinity dates back to at least the early seventeenth century. In Kamakau's (1961) description of events that occurred in the life time of Lono-i-ka-Makahiki, 'Umi's grandson, the ponds are mentioned as well:

> "I went on to the long stretch of sand, to the small bay with a point on that side and one on this side. There are large inland ponds....The sandy stretch is 'Ohiki, and the walled-in ponds are Kaloko and Honokōhau..."

Historic Narratives of Kekaha (with Kaloko and Honokōhau) ca. 1812 to 1819

As a child ca. 1812, Hawaiian historian John Papa I'i passed along the shores of Kekaha in a sailing ship, as a part of the procession by which Kamehameha I returned to Kailua-Kona from his residency on O'ahu. In his narratives, I'i described the shiny lava flows and fishing canoe fleets of the "Kaha" (Kekaha) lands:

> "The ship arrived outside of Kaelehuluhulu, where the fleet for aku fishing had been since the early morning hours. The sustenance of those lands was fish.
>
> When the sun was rather high, the boy [I'i] exclaimed, "How beautiful that flowing water is!" Those who recognized it, however, said, "That is not water, but *pahoehoe*. When the sun strikes it, it glistens, and you mistake it for water...
>
> Soon the fishing canoes from Kawaihae, the Kaha lands, and Ooma drew close to the ship to trade for the *pa'i'ai* (hard poi) carried on board, and shortly a great quantity of aku lay silvery-hued on the deck. The fishes were cut into pieces and mashed; and all those aboard fell to and ate, the women by themselves" (I'i 1959).

I'i also mentions (though not giving its name) that the surf of Honokōhau was one of the famous surfs of the region. He also stated that in the days of his youth board surfing, bodysurfing, and surfing with canoes were still popular pastimes (I'i 1959).

In 1819, as the life of Kamehameha I drew to an end, the king gave orders that his remains should be carefully hidden. In his account of the events that took place following Kamehameha's death, Kamakau (1961) mentions the lands of Kekaha:

> "At midnight, therefore, when black darkness had fallen and no one was likely to be out on the road and the rough lava plains of Pu'uokaloa [in the land of Keahuolu] lay hushed, Hoapili sent his man Ho'olulu, to bring the container of wicker work in which the bones of Kamehameha were kept to Kaloko in Kekaha.
>
> The next morning Hoa-pili and Ke-opu-o-lani took canoe to Kaloko where Hoa-pili met the man who had charge of the secret cave and together they placed the bones there" (Kamakau 1961).

Following the period of mourning and purification, Liholiho (Kamehameha II), who retreated to Kawaihae upon the death of his father, began his return to the Kailua area. Kamakau (1961) reports that on the way, Liholiho stopped at Honokōhau and dedicated a *heiau* to his god and prepared for his return to Kailua. The events that unfolded at Honokōhau also set in motion, the "*'ai noa*" (free eating), or breaking of the *kapu* (restrictions) of the gods that heralded the end of the ancient religious system.

Honokōhau And Kekaha Described In Journals And Articles (1823-1924)

Narratives cited in this section provide descriptions of the cultural and natural landscapes of Kekaha in the nineteenth and early twentieth centuries. While the land of Honokōhau is specifically mentioned in several citations, the larger body of narratives are of a regional nature. This is because references to Honokōhau are limited—most likely a result of the great changes in the regional population that occurred in the early 1900s. As such, the regional narratives for Kekaha, of which Honokōhau was an important part in ancient times, help us gain a fuller picture of many facets of life, including residency, travel, and collection of resources, in the Honokōhau vicinity.

<u>The Journal of William Ellis (1823)</u>

The journal of William Ellis (Ellis 1963), an English missionary who visited Hawai'i in 1823, contains some important and detailed descriptions of the communities around the island of Hawai'i. Unfortunately, Ellis' discussions on travel between Kailua and the Kohala District do not include accounts of visits to the Honokōhau vicinity, as he passed the area by canoe, making no reference to the land. Ellis' discussion of activities and travel around Kailua, including descriptions of the communities and agricultural field systems through which he passed are insightful:

> "The environs were cultivated to a considerable extent; small gardens were seen among the barren rocks on which the houses are built, wherever soil could be found sufficient to nourish the sweet potato, the watermelon, or even a few plants of tobacco, and in many places these seemed to be growing literally in the fragments of lava, collected in small heaps around their roots" (Ellis 1963).

<u>The Wilkes Expedition (1840-1841)</u>

In 1840-41, Charles Wilkes of the United States Exploring Expedition wrote of his travels through the North Kona and the South Kona districts:

> "A considerable trade is kept up between the south and north end of this district. The inhabitants of the barren portion of the latter are principally occupied in fishing and the manufacture of salt, which articles are bartered with those who live in the more fertile regions of the south, for food and clothing" (Wilkes 1845).

<u>H.W. Kinney's "Visitor's Guide" (1913)</u>

In 1913, H.W. Kinney published a visitor's guide to the island of Hawai'i. In it, he included contemporary descriptions of the land, historical accounts of events, and descriptions of sites and practices that might be observed by the visitor:

"From the trail running north towards Makalawena a side trail runs *makai* to the Honokōhau village which consists of about a dozen houses by the beach. Here is a large cement pan, formerly used for the manufacture of salt from sea water, north of which are some rock drawings. *Makai* thereof, by a couple of cocoanut stumps, are the scant remains of a *heiau*, "Hale o Kane." Directly in front of the houses are some excellent specimens of the *papa konane*, or checker boards used by the ancient Hawaiians. This was quite a complicated game, played with black and white pebbles on a board carved on flat *pahoehoe* rocks.

From the point where the Honokahau trail leaves Kailua a poor trail leads *makai* over the lava to the lighthouse. Hence it continues along the beach for a couple of miles. After passing several old stone mausoleums, the trail passes an abandoned grass house where is a stone wall, the remnants of the *heiau* Keohuulu [Keahuolu]. Still further north is a cocoanut grove, where there were several *heiau*, notably that of Palihiole [Palihiolo]." (Kinney 1913).

J.W.H.I. Kihe (1924)

In 1924, the Hawaiian language newspaper *Ka Hōkū o Hawai'i* published a variety of traditional accounts of Kekaha, penned by J.W.H.I. Kihe. Kihe also submitted articles reflecting on the changes he had seen during his lifetime:

"The lands of Honokōhau were filled with people in those days, there were many women and children with whom I traveled with joy in the days of my youth. Those families are all gone, and the land is quiet. There are no people, only the rocks remain, and a few scattered trees growing, and only occasionally does one meet with a man today (1924). One man and his children are all that remain" (Kihe 1924 in Maly 2000).

6. CULTURAL-HISTORICAL CONTEXT

The ancient Hawaiians saw (as do many Hawaiians today) all things within their environment as being interrelated. That which was in the uplands shared a relationship with that which was in the lowlands, coastal region and even the sea. This relationship and identity with place worked in reverse as well. The *ahupua'a* as a land unit was the thread which bound all things together in Hawaiian life.

The lands of Honokōhau nui & iki were among the favored lands of the North Kona District. This is particularly so in the portion of the district known as Kekaha-wai-'ole o nā, where water, one of the most important natural resources needed for sustaining life, was often difficult to come by. The highly valued and carefully managed resources of Honokōhau extended from the sea to the forested mountain slopes on Hualālai. The diverse resources available to the native residents included rich deep sea and near shore fisheries (*ko'a*), highly developed *loko i'a* (fishponds and fish traps), sheltered shores and canoe landings (*awa pae wa'a*), and fresh water springs (*punawai*) that provided potable water to sustain the native residents, as well as supporting the

unique balance required for long-term propagation and collection of fish from the *loko i'a*. A wide range of environmental zones (*wao*), extending from near shore to upland forests, provided the natural resources and materials necessary for the development of a sophisticated agricultural system. These resources allowed the native residents of the lands to meet their immediate community needs as well as contribute to the overall support of the larger social, economic, religious and political system of Kona.

7. INTERVIEWS AND CONSULTATION

Oral history interviews are an important part of the historical recording process. Interviews help to demonstrate how certain knowledge is handed down through time, from generation to generation. Oral historical narratives provide both present and future generations with an opportunity to understand the relationships shared between people and their natural and cultural environments.

Interview Guidelines

The oral historical research conducted by Maly (2000) was performed in a manner consistent with Federal and State laws and guidelines for such studies, including the National Historic Preservation Act (NHPA) of 1966, as amended in 1992; the Advisory Council on Historic Preservation's "*Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review*" (ACHP 1985); National Register Bulletin 38, "*Guidelines for Evaluating and Documenting Traditional Cultural Properties*" (Parker and King 1990); the Hawai'i State Historic Preservation Statute (Chapter 6E), which affords protection to historic sites, including traditional cultural properties of ongoing cultural significance; the criteria, standards, and guidelines currently utilized by the Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) for the evaluation and documentation of cultural sites (Title 13, Sub-Title 13:274-4,5,6; 275:6 – Dec. 12, 1996); and "*Guidelines For Cultural Impact Assessment Studies*," adopted by the Hawai'i State Office of Environmental Quality Control (November 1997).

Interview Protocol

When the interviewees were contacted, they were told of the proposed Lanihau Partners project, and asked if they could participate in the interview program. Prior to beginning the oral history interviews, a simple-form questionnaire guideline was developed for reference during the interviews. The questionnaire followed a standard oral history interview format, and also included specific questions relative to knowledge of sites and practices associated with the study area (incorporating selected information from archival-historical resources), as well as questions aimed at eliciting recommendations of site treatment. During the interviews and other communications, several historic maps were referenced, and when appropriate, the general locations of sites referenced were marked on the maps (see Maly 2000).

Participants in the Honokōhau Oral History/Consultation Program

All of the interview participants had either lived upon or worked the lands of Honokōhau nui and iki (dating to 1913), or frequented the coastal village while visiting family members or fishing (dating to ca. 1927). Additionally, the historic interviews include documentation based upon personal experiences dating back to the 1890s. Several of the interview participants are descended from native Hawaiian families who lived at Honokōhau since at least the 1840s. Some of the consultation program participants are also descended from native residents of the Honokōhau vicinity, or have worked (and continue to work) on historic preservation and resource management issues in Honokōhau and the larger Kona region. Each participant's name, ethnicity, year of birth, and place of residence, along with other information, are listed in Maly 2000.

Interview Responses

Responses regarding traditional cultural sites in the project area parcel were of a general nature. With the exception of the *Alanui Aupuni* (Old Government Road), and a cave site at the edge of the Petition Area (known to the interviewee as a result of archaeological investigations of the 1970s), no one shared knowledge of specific sites in the project area.

All interviewees recorded that in the early twentieth century, residency and life in Honokōhau focused on activities that took place on the shore or in the uplands, with little activity (except for limited ranching) on the lower *kula* (flatlands or plains). Some area residents worked the fishponds and off-shore fisheries while living on the shore at the small village in Honokōhau iki; others lived in the uplands, where *kalo* (taro), *'ulu* (breadfruit), *'uala* (sweet potatoes), coffee and other crops were grown; and others lived and worked on ranches, generally in the area extending *mauka* from the Māmalahoa Highway.

The Greenwell brothers and others who resided in the Honokōhau area, all recorded that except for occasional excursions into the lowland *kula* areas (generally undertaken as a part of the ranch operations), little or no travel occurred via trails in Honokōhau nui for as long as the interviewees can remember (dating to ca. 1915). Travel via *mauka-makai* trails in Honokōhau iki-Kealakehe; lateral shore line travel between Honokōhau and Kailua; and *mauka-makai* travel between Honokōhau to upland Kohanaiki (the trail crossed through Kaloko) did take place.

Two sisters (V. Leimomi Nihi-Quiddaoen and A. Puakalehua Nihi-Harp), descendants of the Kalua-Kuakahela-Kimona (Kanakamaika'i) line, stated that in their youth (ca. 1930), they went with their *mākua-kūpuna* (parent-grandparent) generation to some areas, which they believe to be above the present-day Ka'ahumanu Highway (in line with Kanalani Street in the Kaloko Industrial Park), to cultivate *'uala* (sweet potatoes) and other crops which could be grown in pockets of soil and mulched planting areas on the lava flats of the lower *kula* (flatlands). Because the families from whom these sisters are descended resided in Honokōhau iki, and the families maintained residences in the uplands of Honokōhau iki (on Grant 3022) and on the shore, it is believed that the *kula* planting fields were in Honokōhau iki.

While interviewees were not able to share site specific documentation for resources within the 337 acre study area parcel, many of them expressed concern for the archaeological sites that may have been found prior to or during project fieldwork. The interviewees concurred with the preservation of sites with *iliina* (human remains), sections of the old *mauka-makai* trail, and other sites, as the archaeological inventory survey recommended. It was also suggested that some of the sites within the study area may receive some level of interpretation (tying in with the interpretation of Kaloko-Honokōhau), and there was agreement that it might be appropriate to curate any artifacts which may be discovered on the parcel in the Kaloko-Honokōhau National Historical Park collection (thus remaining on the land of origin).

The effects of the project on downslope water quality were also of concern to some interviewees:

> "Ask them to take care of the *mauka* lands and ensure that the water quality of the fishponds and important fisheries fronting the Honokōhau vicinity be protected" (Valentine K. Ako, 2000).

Similarly, two primary concerns regarding the proposed development were raised by National Park Service staff and David Kahelemauna Roy, as well as members of the Kaloko-Honokōhau Advisory Commission and Na Kokua Kaloko Honokōhau. First, they advised, steps should be taken to ensure that the development does not adversely impact water quality of the Kaloko-Honokōhau Fishponds and anchialine pond resources. Second, the development should not appear to be looming over the park.

8. IDENTIFICATION AND FINDINGS CONCERNING VALUED CULTURAL NATURAL, AND HISTORICAL RESOURCES, AND PRACTICES/BELIEFS

The Honokōhau lands were highly utilized by native Hawaiians before Western contact, especially in the *Kahakai* and *Wao Kanaka* zones. However, the Petition Area, which is in the *Kula Kai* and *Kula Uka* zones, had much less intensive, intermittent or transitional utilization, including trails, temporary habitation, and intermittent agricultural uses. Although it is acknowledged that certain activities within the Petition Area have the potential to cause impacts off-site or otherwise interact in a way as to cause harm to valued resources, it is important to maintain the distinction between the relatively limited resources in the Petition Area and the significant resources in the greater Honokōhau lands, most of which have already been protected in the National Park.

Valued Cultural, Natural and Historical Resources in the Honokōhau Ahupua'a

As discussed above, traditional and historic literature as well as oral historical accounts describe Honokōhau as among the favored lands of Kekaha for its shoreline, rich ocean and near-shore fisheries and marine resources, fishponds at 'Aimakapā and 'Ai'ōpio, salt making locations, *mauka* agricultural field systems, and diverse forest and mountain resources. A number of storied places associated with history and legend are present, and there are also *heiau* and other features that have vital functions in symbolizing and enabling the relationship among the Hawaiian people, resources, and spiritual activities. Many reminders of these resources still

exist, especially in the Kaloko-Honokōhau National Historical Park, where there are excellent examples of natural and human-altered ponds and water features, along with the extensive archaeological resources and numerous human burials, all of which are important to protect and honor.

Valued Cultural, Natural and Historical Resources in the Petition Area

The Petition Area contains cultural resources in the form of archaeological features, including intensive dryland agricultural complexes; temporary, recurrent and permanent habitation sites; trails and *ahu*; petroglyphs; a refuge cave, and *ahupua'a* and various other walls. Archaeologists have determined that some are important and valuable enough to be significant for preservation in place. These features demonstrate that at one time the area supported a variety of activities. This appears to have been based mostly on the position of this somewhat barren intermediate area between the resource-rich and well-settled areas *mauka* and *makai*. There are remnants of a *maukalmakai* trail extending through the center of the Petition Area. This trail provided access between the *Kahakai* and the *Wao Kanaka* zones. According to the interviews, these trails have not been utilized since the mid-1800s. Since at least these periods, access between the *mauka* areas of Honokōhau and the shoreline area was via the Kaloko Trail to the south or along Palani Road to Kailua Village then north along the coastal trails.

While there were *heiau* in the *Kahakai* and *Wao Kanaka* Zones of Honokōhau, there are no such features identified within the Petition Area. Furthermore, according to native testimony, the *Kula Kai* and *Kula Uka* lands here did not contain any land features (such as *pu'u*) that were used for locating *ko'a 'ōpelu* (*'ōpelu* fishing grounds).

Seven human burials are present, all associated with lava tubes. They represent a sensitive and important cultural resource, one which those consulted urged to be properly respected and preserved in place.

The Petition Area appears to have contained very few valued natural resources such as traditional quarries or water features, although plants important for cultural purposes (e.g., *ko'oko'olau*) were probably present. Today, alien vegetation has replaced native species almost entirely, leaving only the most common natives. Still present are two native plants with ethnobotanical value, the 'uhaloa (*Waltheria indica*) and maiapilo (*Capparis sandwichiana*). The former species is very common in many parts of the Big Island; the latter is less common but relatively well-distributed throughout the *Kula Kai*.

Furthermore, extensive archival research and interviews have not revealed the occurrence of any traditional or ongoing practices or beliefs specifically associated with the Petition Area, or the exercise of any specific traditional and customary native Hawaiian rights.

Relationship Between Petition Area and Entire Ahupua'a

As stated above, there were and are connections between the Petition Area and the lands *mauka* and *makai*. The significance of the *ahupua'a* as a *mauka-makai* planning unit or management

entity has diminished over time, as ownership patterns have become fragmented and modern development patterns and infrastructure have evolved. Nevertheless, certain land use principles fundamental to the *ahupua'a* concept continue in the Kekaha region, and more specifically, Honokōhau. The *Kahakai*, which represents the resource-rich and highly productive coastline, as well as portions of the *Kula Kai*, are protected within the Kaloko-Honokōhau National Historical Park, which will preserve and interpret the history and uniqueness of this most vital component of the *ahupua'a*.

Moving *mauka*, the transitional lands of the *Kula Kai* and *Kula Uka* (which include the project area) today fill a useful and necessary role in the Kona community by providing for commercial and industrial services. The area is well-suited for this use largely due to its favorable terrain, central location, and ready access to the major transportation routes and facilities in West Hawai'i. It also does not conflict with the traditional *ahupua'a* uses either *makai* or *mauka*.

Next *mauka* is the *Wao Kanaka* region, which has continued as the desired living and farming belt in North Kona for many of the same reasons that it was favored in history – adequate rainfall and soil, pleasant temperatures, and relative proximity to the shoreline activities.

More *mauka* still and extending into and above the *mauka*-most portions of Honokōhau, is the Wao Ma'ukele rainforest belt. Here, residential use is less common and is more rural in character, often interspersed with farming, ranching or forested areas. Extending even further *mauka* into the fog-shrouded upper elevations of Hualālai is the *Wao Akua*, within the Keauhou *ahupua'a*.

The *ahupua'a* concept has been transformed, but the values of prudent land use and resource management which were honored in the past merit enduring respect. In particular, the issues related to the water cycle, scenic vistas, and being good neighbors remain as important as ever. Furthermore, these relationships extend beyond the ahupua'a to adjacent areas.

It is thus important to establish not only the valued cultural, natural and historical resources and native Hawaiian rights related to these in the Petition Area, but also those in surrounding areas that could be affected. The resources that have been specifically and repeatedly cited by those interviewed for the project (and others in discussions and meetings) are water quality and the visual character of the *ahupua'a*, particularly as seen from the coastal area, where the traditional visual connection between the summit, slopes and coastal waters is best preserved. Unmitigated impacts to water quality, in particular, could theoretically jeopardize valuable resources in ponds and nearshore waters, which have cultural value and implications for native Hawaiian rights concerning fishing and gathering.

Findings

Based on historical research and oral interviews, as well as review of natural and historical resources, it can be concluded that there are few valued cultural, natural or historical resources within the Petition Area itself. Those present include various archaeological sites and human burials important for preservation in place. With mitigation through preservation where recommended, and selected access and interpretation for certain archaeological sites, there will be minimal adverse effect. The treatment of the seven known burials, all associated with lava tubes, will be in accordance with procedures approved by the Hawaii Island Burial Council and the State Historic Preservation Division.

The proposed project site has not been used for traditional cultural purposes in the recent memory of any of the extensive list of interviewees consulted as part of the oral history research. It is reasonable to conclude that based upon the limited range of resources and the proposed mitigation to all affected resources, the exercise of native Hawaiian rights related to gathering, access or other customary activities will not be affected, and there will be no adverse effect upon cultural practices or beliefs.

Indirect impacts to the valued cultural, natural or historical resources elsewhere in the two *ahupua'a* of Honokōhau and adjacent areas are intrinsically more difficult to evaluate. The resources that have been specifically cited by native Hawaiians consulted for the project have been water quality and the traditional visual character of the *ahupua'a*. The project has the potential through alteration of water quality and topography to impact upon these resources. It is particularly important to recognize that native Hawaiian cultural beliefs and practices are continually affected by the loss of land to development that intrudes into the natural setting, changes the landscape, and disturbs traditional sites and trail networks. These processes have become recently intensified in North Kona, where the rate of development is rapidly increasing. When taken in pieces, each development does not necessarily impose a significant cultural impact, especially when concentrated *mauka* of Queen Ka'ahumanu Highway. Eventually, however, the transformation of the lava fields may result in the loss of this traditional Kona landscape. Similarly, incremental alteration of groundwater may cumulatively detract from the water quality upon which cultural practices partly rely.

The Environmental Impact Statement to which this report is an appendix includes a detailed evaluation of offsite impacts, both from project-only and cumulative perspectives. Water quality studies quantified the degree of impact, and formulated mitigation measures that are designed to avoid or minimize to minor levels any adverse impact on water quality. Changes in groundwater flow levels, salinity and nutrient concentrations would occur as a result of the project, but not to a degree that would harm individual species or the biological community structure of the nearshore marine environment or ponds. When the full range of projects planned in the Kaloko and Honokōhau *ahupua'a* between Mamalahoa Highway and Queen Kaahumanu Highway is implemented, mitigation of the cumulative impacts would require connection to a municipal sewage system, which is expected to occur. Toxic substances can readily be limited to concentrations below the threshold of harm to human health or ecosystems by adherence to applicable laws and regulations which require implementation of appropriate

Best Management Practices (BMPs) for containment, transfer, use and monitoring of these substances.

The EIS also considers visual impacts, especially from the standpoint of viewers within the National Park, where cultural practices are important and ongoing. The scenic view of the summit and upper slopes of Hualalai from the coastal areas of Honokōhau will not be obstructed by the proposed development of the Petition Area. At the South Access Road intersection with Queen Kaahumanu Highway, which would access the Petition Area and also serve as the major gateway to the National Park, project design would provide a harmonious connection between the two properties, with native plants playing a prominent role in landscaping.

In summary, it can be concluded that with implementation of mitigation as recommended in the EIS, the proposed Kaloko-Honokōhau Business Park would have a minimal adverse impact upon valued cultural, natural or historical resources, as well native Hawaiian rights, beliefs, and practices in the project area.

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Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 11

Traffic Impact Assessment

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED

KALOKO-HONOKOHAU BUSINESS PARK

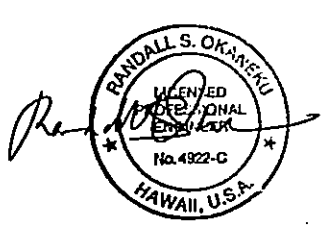
PREPARED FOR
LANIHAU PARTNERS, L.P.

PREPARED BY
THE TRAFFIC MANAGEMENT CONSULTANT

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED

KALOKO-HONOKOHAU BUSINESS PARK

PREPARED FOR
LANIHAU PARTNERS, L.P.
JANUARY 9, 2001



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TRAFFIC IMPACT ANALYSIS REPORT FOR THE PROPOSED

KALOKO-HONOKOHAU BUSINESS PARK

I. Introduction

A. Purpose of Study

The purpose of this study is to identify the traffic impacts resulting from the reclassification of 336.984 acres to State Land Use Urban District, and the development of what is herein referred to as the Kaloko-Honokohau Business Park, in North Kona, Hawaii. The petition area is identified as Tax Map Key (3)7-4-08: Portion of 13 and 30.

B. Scope of Study

1. Description of the proposed project.
2. Description of the study area and existing land uses.
3. Evaluation of existing roadway and traffic conditions.
4. Description of the project environs, relative to other proposed projects and related future and ongoing roadway improvements.
5. Evaluation of future roadway and traffic conditions without the proposed project, and the recommendation of improvements to meet future highway needs.
6. Development of trip generation characteristics of the subject project, using generally accepted techniques developed by the Institute of Transportation Engineers.
7. Analysis of future traffic and roadway conditions with the development of the proposed project.

8. The identification and analysis of traffic impacts resulting from the development of the proposed project.

9. Recommendation of improvements that would mitigate the traffic impacts resulting from the development of the proposed project.

C. Project Description

1. Location

The proposed Kaloko-Honokohau Business Park project site is located in North Kona, Hawaii on the east (mauka) side of Queen Kaahumanu Highway, about midway between the Keahole-Kona International Airport and Kailua-Kona. The site is located immediately across the Kaloko-Honokohau National Historic Park. Adjacent developments include the Kaloko Industrial Park to the north and the McClean Honokohau Project to the south. The project site includes an existing quarry operation covering about 100 acres, located on the northeast corner of the site. The quarry operations are expected to be relocated to the southeast corner of the site. Figure 1 depicts the vicinity of the proposed project.

2. Access

Site access is proposed via two intersections on Queen Kaahumanu Highway and the extension of existing north-south roadways, which are proposed to be extended through the property. The main access road on Queen Kaahumanu Highway is proposed opposite the access to the Kaloko-Honokohau National Historic Park, hereinafter referred to as the South Access Road. The second access on Queen Kaahumanu Highway would be located at the existing access to the quarry site, hereinafter referred to as the North Access Road.

The extensions of Kamanu Street and Kanalani Street through the site are expected to provide access to existing roadways, which connect to Queen Kaahumanu Highway and Mamalahoa Highway. Kamanu Street and Kanalani Street intersect Hina Lani Street to the north to provide access to Mamalahoa Highway. Kamanu Street would be extended through the project site to Kealekehe Parkway, via what is known as Road G, which will be constructed by the McClean Honokohau Project. Figure 2 depicts the proposed site plan.

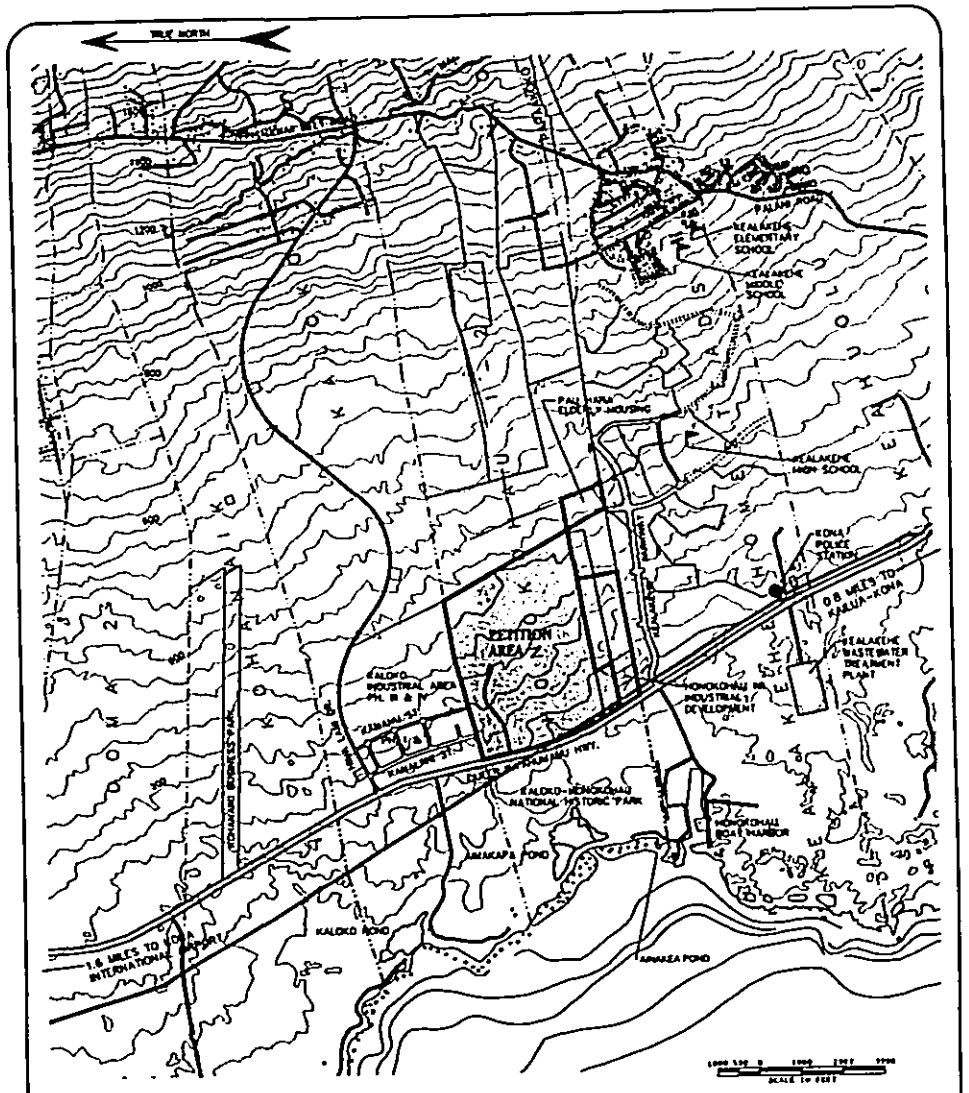

Figure 1
STUDY AREA
PREPARED FOR: LANIHAU PARTNERS, L.P.
PREPARED BY: AKINAKA & ASSOCIATES, LTD.
SOURCE:

KALOKO-HONOKOHAU BUSINESS PARK
HONOKOHAU 1ST & 2ND
NORTH KONA, HAWAII

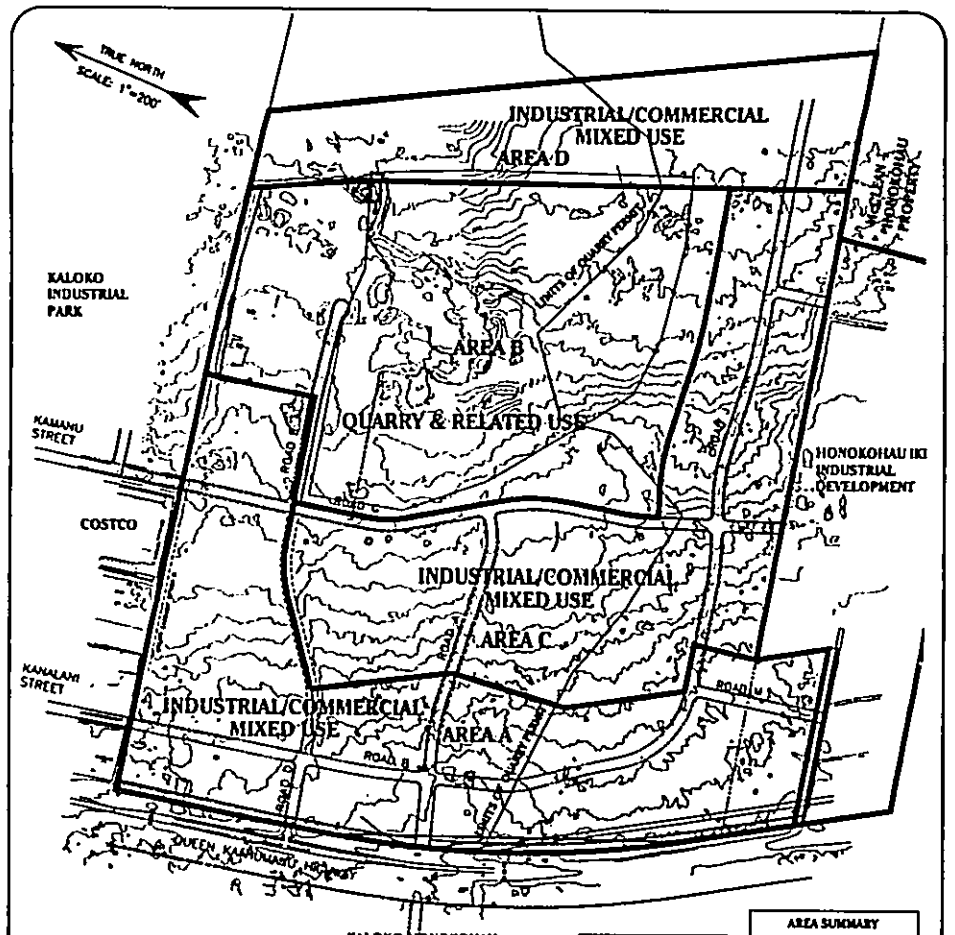

Figure 2

LAND USE & PHASING PLAN

PREPARED FOR: LANIHAU PARTNERS, L.P.
PREPARED BY: AKINAKA & ASSOCIATES, LTD.
SOURCE:

KALOKO-HONOKOHAU BUSINESS PARK
HONOKOHAU 1ST & 2ND
NORTH KONA, HAWAII

3. Phasing

The proposed project is expected to be developed in three Phases. For the purpose of this traffic impact analysis, the proposed project will be analyzed for Phase I and full build-out (Phases I, II, and III) of the proposed project. Phase I is expected to begin development in the Year 2003 and be completed by the Year 2010. Full build-out of the proposed project is expected by the Year 2020. Each Phase consists of mixed uses, including commercial and industrial land use activities.

The commercial-industrial mixed uses and floor-to-area ratios (FAR), i.e., building floor area divided by the land area, were based upon the preliminary market assessment for the proposed project. Of the total 280 net acres planned for the site, 28 acres would contain a variety of commercial-retail activities (0.25 FAR), including a "big-box" tenant and 3 acres of general office uses (0.28 FAR). Ninety-two (92) acres would be developed into light industrial activities (0.15-0.22 FAR); eighty-seven (87) acres would be developed into business park uses (0.22 FAR). One hundred (100) acres would be used for quarry operations. Table I summarizes the proposed development plan.

Table 1. Development Plan			
Phase	**Land Use**	**Land Area Acres**	**Land Use Intensity Gross Square Feet**
I	Retail	18.0	196,020
	Business Park	25.0	239,580
	Light Industrial	30.0	320,166
	General Office	2.0	23,394
	Quarry	100.0	N/A
II	Retail	5.5	59,985
	Business Park	24.0	229,997
	Light Industrial	42.0	390,298
	General Office	0.5	6,098
III	Retail	1.5	16,335
	Business Park	8.0	76,666
	Light Industrial	15.0	163,350
	General Office	0.5	6,098
Totals		280.0	1,728,896

II. Existing Conditions

A. Area Roadway System

Queen Kaahumanu Highway is a two way, two lane, high quality arterial highway between Kailua-Kona and Kawaihae. Queen Kaahumanu Highway is the primary arterial highway along the South Kohala and North Kona coasts. Exclusive left turn lanes, median storage lanes, right turn acceleration lanes, and right turn deceleration lanes are provided on Queen Kaahumanu Highway at key intersections, including Hina Lani Street and the existing quarry access road. The intersection of Hina Lani Street and Queen Kaahumanu Highway is unsignalized at this writing.

Mamalahoa Highway is a two lane, two way arterial highway that is a continuation of a "belt" road that circles the island of Hawaii. Mamalahoa Highway is located approximately 3.3 miles mauka of Queen Kaahumanu Highway. Mamalahoa Highway provides the primary route between Waimea and Kailua-Kona.

Hina Lani Street is a two-way, two-lane collector roadway, located about 3.2 miles south of the Keahole-Kona International Airport Access Road. Hina Lani Street provides mauka-makai (east-west) access between Queen Kaahumanu Highway and Mamalahoa Highway. Hina Lani Street intersects Queen Kaahumanu Highway at a stop-controlled, Tee-intersection. Hina Lani Street also intersects Mamalahoa Highway at a stop-controlled, Tee-intersection.

Kanalani Street is a two-lane, two-way local roadway providing access to the Kaloko Industrial Park. Kanalani Street intersects Hina Lani Street at a stop-controlled, Tee-intersection about 400 feet mauka of Queen Kaahumanu Highway.

Kamanu Street is a two-lane, two-way local roadway providing access to the Costco Store. Kamanu Street intersects Hina Lani Street at a stop-controlled, Tee-intersection.

B. Existing Traffic Volumes and Operating Conditions

1. General

The field investigation was conducted in October, 1999, during the morning peak period of traffic between the hours of 6:30 AM and 9:00 AM, and during the afternoon peak period of traffic between the hours of 2:00 PM and 5:30 PM. The following intersections were surveyed:

- Queen Kaahumanu Highway and Hina Lani Street
- Queen Kaahumanu Highway and Quarry Access Road
- Hina Lani Street and Kanalani Street
- Hina Lani Street and Kamanu Street
- Mamalahoa Highway and Hina Lani Street

2. Capacity Analysis Methodology

The highway capacity analysis performed for this study is based upon procedures presented in the "Highway Capacity Manual" (HCM), Special Report 209, Transportation Research Board, and the "Highway Capacity Software", Federal Highways Administration.

Level of Service (LOS) is defined as "a qualitative measure describing operational conditions within a traffic stream". Several factors are included in determining LOS such as: speed, travel time, freedom to maneuver, traffic interruptions, driver comfort, and convenience. Six Levels of Service are defined for each type of facility with designations from "A" to "F". LOS "A", "B", and "C" are considered satisfactory levels of service. LOS "D" is generally considered a "desirable minimum" operating level of service. LOS "E" is an undesirable condition and LOS "F" is an unacceptable condition.

"Volume-to-capacity" (v/c) ratio is another measure indicating the relative traffic demand to the road's traffic carrying ability, i.e., the maximum hourly rate at which vehicles can be expected to traverse a point on a roadway facility. A v/c ratio of 0.50 indicates that the traffic demand is utilizing 50 percent of the roadway's capacity.

3. Twenty-Four Hour Traffic Count Data

Additional traffic count data were obtained from the State Department of Transportation (DOT). The existing daily traffic count data were taken from DOT Traffic Count Station No. T-8-M on Queen Kaahumanu Highway, about 1.5 miles north of the project site; and Station No. 8-T on Mamalahoa Highway at Kaiminani Drive. The traffic data were collected in May, 2000. Queen Kaahumanu Highway carried about 17,400 vehicles per day, total for both directions. Mamalahoa Highway carried about 11,900 vehicles per day, total for both directions.

4. Existing AM Peak Hour Traffic

The AM peak hour of traffic occurred between 7:15 AM and 8:15 AM. The left turn movement from westbound Hina Lani Street to southbound Queen Kaahumanu Highway operated at LOS "D", during the AM peak hour of traffic. The other intersections within the study area operated at satisfactory Levels of Service, i.e., LOS "C" or better.

Queen Kaahumanu Highway and Mamalahoa Highway each carried about 1,260 vehicles per hour (vph), total for both directions, and operated at LOS "D" and LOS "E", respectively. The AM peak direction of traffic in the highway corridor was southbound with Mamalahoa Highway, which carried about 60 percent of the southbound traffic. Figure 3 depicts the existing AM peak hour of traffic and the results of the capacity analysis.

5. Existing PM Peak Hour Traffic

The PM peak hour of traffic on Queen Kaahumanu Highway generally occurred between 4:00 PM and 5:00 PM. The left turn movement from westbound Hina Lani Street to southbound Queen Kaahumanu Highway operated at LOS "F", during the existing PM peak hour of traffic. Kanalani Street operates at LOS "F" at Hina Lani Street. The limited spacing between Kanalani Street and Queen Kaahumanu and the westbound queuing on Hina Lani Street restricts the left turn movement from Kanalani Street. The other intersections within the study area operated at satisfactory Levels of Service, during the existing PM peak hour of traffic.

Mamalahoa Highway carried about 1,200 vph, total for both directions, and operated at LOS "E", during the existing PM peak hour of traffic. Queen Kaahumanu Highway, in the vicinity of the project, carried about 1,460 vph and operated at LOS "E", during the existing PM peak hour of traffic. The PM peak direction for the highway corridor was split in the northbound and southbound directions. The PM peak direction of traffic on Mamalahoa Highway was in the northbound direction, while the PM peak direction of traffic on Queen Kaahumanu Highway was in the southbound direction. Figure 4 depicts the PM peak hour of traffic and the results of the capacity analysis.

III. Projected Traffic

A. External Traffic

The Hawaii Long Range Land Transportation Plan (HLRLTP), dated May 1998, was prepared for the State Department of Transportation (DOT). The transportation plan evaluated the regional transportation needs, based upon the updated Statewide population, employment, and visitor forecasts for the Year 2020. The HLRLTP estimated that by the Year 2020, the average daily traffic on Queen Kaahumanu Highway would increase to 29,300 vehicles per day between Keahole and

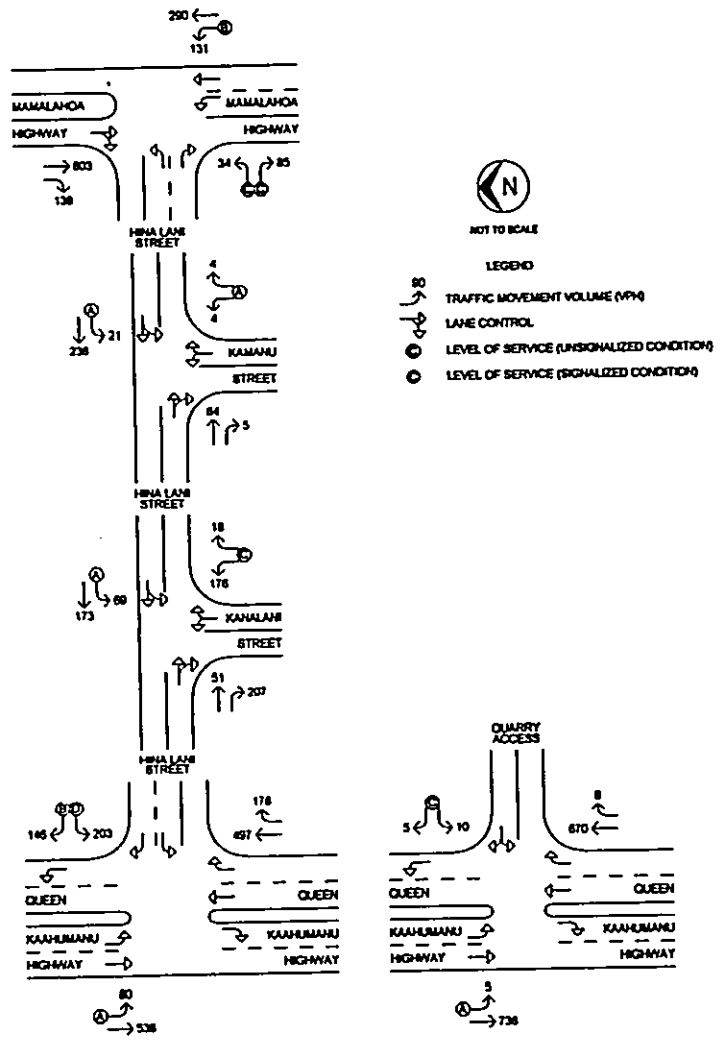

Figure 3. Existing AM Peak Hour Traffic

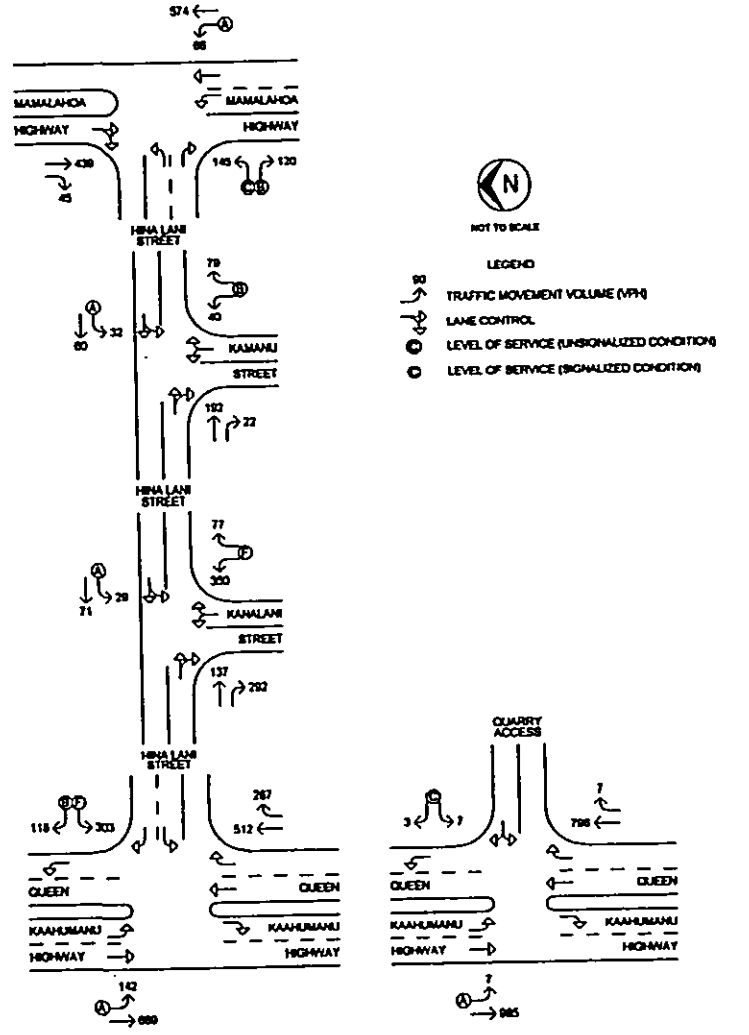

Figure 4. Existing PM Peak Hour Traffic

Kealakehe. The Year 2020 average daily traffic on Mamalahoa Highway is expected to increase to 18,400 vehicles per day. The Year 2020 traffic projections on Queen Kaahumanu Highway and Mamalahoa Highway represent a 3.4 percent annual increase in regional traffic, using 1999 as the base year.

B. Anticipated Future Development

1. General

The trips, generated by the proposed projects in the immediate vicinity of the proposed Kaloko-Honokohau Business Park, are added to the background growth in traffic in the region. Trips, generated from the planned developments of the TSA International Kaloko Industrial Park and the Y.O. Kaloko Subdivision to the north, Kaloko-Honokohau National Historic Park to the west, and the McClean Honokohau Project to the south, were added to background forecast to establish future traffic conditions without the proposed project. The HLRLTP traffic forecast is assumed to include all the future development beyond the immediate vicinity of the proposed Kaloko-Honokohau Business Park.

2. Kaloko Industrial Park

Kaloko Industrial Park is planning to expand in the mauka direction of the existing Phases I and II. "Traffic Impact Report for the Kaloko Industrial Park Phases III and IV" (Kaloko TIR) was prepared for TSA International, Ltd., dated May, 2000. Approximately 102.3 acres are planned for mixed commercial and light industrial uses, located mauka of the existing light industrial subdivision. Access would be provided along Kamanu Street. The trip generation volumes for Phases III and IV were estimated at 850 vph, during the AM peak hour of traffic, and 812 vph, during the PM peak hour of traffic. Kaloko TIR recommended the following improvements to mitigate its traffic impacts:

a. Widen/restripe westbound Hina Lani Street at Kamanu Street to provide an exclusive left turn lane for the left turn movement to Kamanu Street.

b. Widen/restripe westbound Hina Lani Street at Kamanu Street to provide a median shelter lane to facilitate the left turn movement from Kamanu Street.

The Kaloko TIR assumes that all 102.3 acres would be developed by the Year 2010. The trip generation and the traffic assignment developed in the Kaloko TIR were adopted for use in this traffic impact analysis. The improvements, recommended in the Kaloko TIR, were assumed to be implemented by the Year 2010.

3. Kaloko Subdivision

Y.O. Ltd. is planning a residential development along the mauka section of Hina Lani Street. The 400-acre property would ultimately contain a total of 2,154 single-family and multi-family dwelling units. For the purpose of this traffic impact analysis, it is assumed that 320 single-family dwelling units and 80 multi-family dwelling units will be developed within the time frame of this study.

4. McClean Honokohau Project

The McClean Honokohau Project is a residential/light industrial development located on the mauka side of Queen Kaahumanu Highway, immediately to the south of the project. The "McClean Honokohau Properties Traffic Study" was prepared for McClean Honokohau Properties, L.P. The McClean traffic study estimated that the Honokohau Project would generate a total of 338 vph during the AM peak hour of traffic, and 245 vph during the PM peak hour of traffic. The McClean traffic study recommended that Kealakehe Parkway should be widened to provide double left turn lanes to southbound Queen Kaahumanu Highway. The existing traffic count data, trip generation analysis, and traffic assignment developed for the McClean project were adopted for use in this traffic impact analysis.

The extension of Kamanu Street through the Kaloko-Honokohau Business Park would connect to Road G, which will be extended to Kealakehe Parkway by the McClean Project. Additional access would be provided from the McClean project on Kealakehe Parkway, via what was described in the Keahole to Kailua Development Plan as Main Street and the Mid-Level Road (also known as the Henry Street Extension).

5. Kaloko-Honokohau National Historic Park

The General Management Plan/Environmental Impact Statement Kaloko-Honokohau National Historic Park Hawaii (EIS) was prepared in July 1994. The Kaloko-Honokohau National Historic Park was established to provide the facilities for the study, preservation, and practice of the native Hawaiian culture. The park facilities include a visitor center, cultural education complex, and administration and maintenance buildings. Up to 370 parking stalls are planned. The EIS estimated the park attendance to exceed a half million visitors per year, about 1,500 persons per day, and 250 to 350 visitors at any time.

6. Kohanaiki Business Park

The Kohanaiki Business Park is located on a 70-acre property to the north of the Kaloko-Honokohau Business Park project. Access is provided at an at-grade, unsignalized, channelized intersection on Queen Kaahumanu Highway. The mauka boundary of the project site fronts the proposed Mid-Level Arterial (Henry Street Extension). The project is sold-out and individual lots are under construction at this writing.

7. Kealakehe Planned Community (Villages of La'i'opua)

The "Traffic Impact Assessment Report for Kealakehe Planned Community", dated July 1990, was prepared for State of Hawaii Housing Finance & Development Corporation (HFDC). The 960-acre development includes 4,379 residential dwelling units, a golf course, two school sites, a civic center, and three commercial areas, totaling 26 acres. The HFDC project is expected to generate a total of 5,021 vph during the AM peak hour and 6,636 vph during the PM peak hour. The HFDC traffic study concluded that by the Year 2010, two-lane Queen Kaahumanu Highway and two-lane Mamalahoa Highway would operate at LOS "F" during the AM and PM peak hours.

8. Keahole-Kona International Airport Expansion

The "Keahole Airport Traffic Circulation Plan", September 1990, was prepared for the State Department of Transportation as part of the master plan development of the Keahole Airport, renamed the Keahole-Kona International Airport. By the Year 2005, the Keahole-Kona International Airport is expected to generate 3,300 vehicles per hour (vph) during the airport peak hour of traffic.

9. West Hawaii State Lands

The West Hawaii State Lands consist of approximately 2,640 acres in North Kona, Hawaii. The site is located on the mauka (east) side of Queen Kaahumanu Highway, opposite the Keahole-Kona International Airport. Its northern most boundaries are located approximately one mile north of the Airport Access Road. The State Lands extend southward, about two miles south of Airport Access Road. The frontage of the State Lands on Queen Kaahumanu Highway begins near the Airport Access Road and extends about one mile to the north. The highway frontage of State Lands on Queen Kaahumanu Highway begins about one mile north of Hina Lani Street and extends another mile and one half to the north. The State Lands extend up to 2.7 miles mauka of Queen Kaahumanu Highway.

The proposed plan for the State Lands has not been developed at this writing. In general, the proposed project would include urban activities including, but not limited to, residential, commercial, industrial, and institutional land uses.

10. Hawaii Ocean Science & Technology Park and Natural Energy Laboratory of Hawaii

The "Traffic Impact Study for a Natural Energy Laboratory of Hawaii Authority Project" (NELHA), dated June 1992, was prepared for NELHA in Kailua-Kona Hawaii. The NELHA Study analyzed the traffic impacts resulting from the Hawaii Ocean Science & Technology (HOST) Park and Natural Energy Laboratory of Hawaii. The HOST/NELHA project is located immediately south of Keahole-Kona International Airport, on the makai side of Queen Kaahumanu Highway. The HOST/NELHA project is expected to generate an additional 95 vph and 89 vph during the AM and PM peak hours of traffic, respectively. The NELHA study concluded that the projected 1997 peak hour traffic demands on Queen Kaahumanu Highway would exceed the existing two lane capacity. Project access is proposed at a fully channelized, at-grade signalized intersection. The NELHA traffic study indicated that at-grade signalized access will be feasible only if Queen Kaahumanu Highway is widened to four lanes to accommodate future through traffic.

C. Anticipated Future Roadway Improvements

1. Queen Kaahumanu Highway Widening

Queen Kaahumanu Highway is proposed to be widened from a two-lane highway to a four-lane, divided highway from Henry Street in Kailua-Kona to the Keahole-Kona International Airport Access Road. The intersections of Queen Kaahumanu Highway at Hina Lani Street and at the access to Kaloko-Honokohau National Historic Park are expected to be signalized as part of the highway improvements.

Queen Kaahumanu Highway would consist of two through lanes in each direction, a bicycle lane in northbound direction, and a bicycle route/paved shoulder in the southbound direction. The existing two-lane highway would become the northbound through lanes of the highway improvements. The median and southbound lanes would be constructed on the makai (west) side of the existing highway. The proposed improvements are expected to be constructed within the existing 300-foot right-of-way.

For the purpose of this analysis, it was assumed that the South Access Road would intersect opposite the Kaloko-Honokohau National Historic Park Access Road to form a four-legged signalized intersection with fully channelized left turn and right turn lanes in both directions on Queen Kaahumanu Highway.

Queen Kaahumanu Highway was assumed to be signalized at its intersection with Hina Lani Street. The Queen Kaahumanu Highway improvements are expected to provide fully channelized left turn and right turn lanes at both the Hina Lani Street and Kealakehe Parkway intersections.

2. Kealakehe Parkway

The first phase of the Kealakehe Parkway has been completed, as part of the development of HFDC's Villages of La'i'opua. The makai portion of Kealakehe Parkway provides access to the initial phases of the Villages of La'i'opua and Kealakehe High School. Kealakehe Parkway is ultimately proposed as a four-lane arterial roadway through the Kealakehe area between Queen Kaahumanu Highway and Mamalahoa Highway.

3. Keahole to Kailua Development Plan

The "Keahole to Kailua Development Plan" (K-K Plan), April 1991, was prepared for the County of Hawaii Planning Department. The K-K Plan is intended to guide the urbanization of the region between Keahole-Kona International Airport and Kailua-Kona. The K-K roadway plan proposed four new roadways, which may affect the proposed project by providing north-south access, in addition to Queen Kaahumanu Highway and Mamalahoa Highway.

The Mid-Level Arterial (Henry Street Extension) would run roughly parallel to Queen Kaahumanu Highway, beginning at Palani Road and extending north of the Keahole to Kailua region. The alignment for the Mid-Level Arterial is located above the east (mauka) boundary of the Kaloko-Honokohau Business Park, about one mile mauka of Queen Kaahumanu Highway. The Mid-Level Arterial is classified as a four-lane minor arterial with a 120-foot right-of-way.

Waena Drive is proposed as a four-lane, north-south collector roadway, beginning at Palani Road and extending north of the Keahole to Kailua region. Waena Drive would be located mauka of and parallel to the Mid-Level Arterial. The section of Waena Drive between Palani Road and Kealakehe Parkway was constructed as part of the development of the Villages of La'i'opua.

Kealakaa Drive Extension is the third major north-south planned roadway, which would be located the furthest mauka in the Keahole to Kailua region. The existing Kealakaa Drive would be extended to the north of the Keahole to Kailua region, parallel to Waena Drive. Kealakaa Drive Extension is envisioned to be a four-lane undivided roadway. Figure 5 illustrates the existing and future roadways in the region.

D. Year 2010 Peak Hour Traffic Analysis Without the Project

1. General

The purpose of analyzing the future traffic conditions without the proposed project is to establish the base line conditions from which to assess the traffic impacts resulting from the proposed project. The travel forecast is assigned to the planned highway network to develop future traffic conditions without the proposed project.

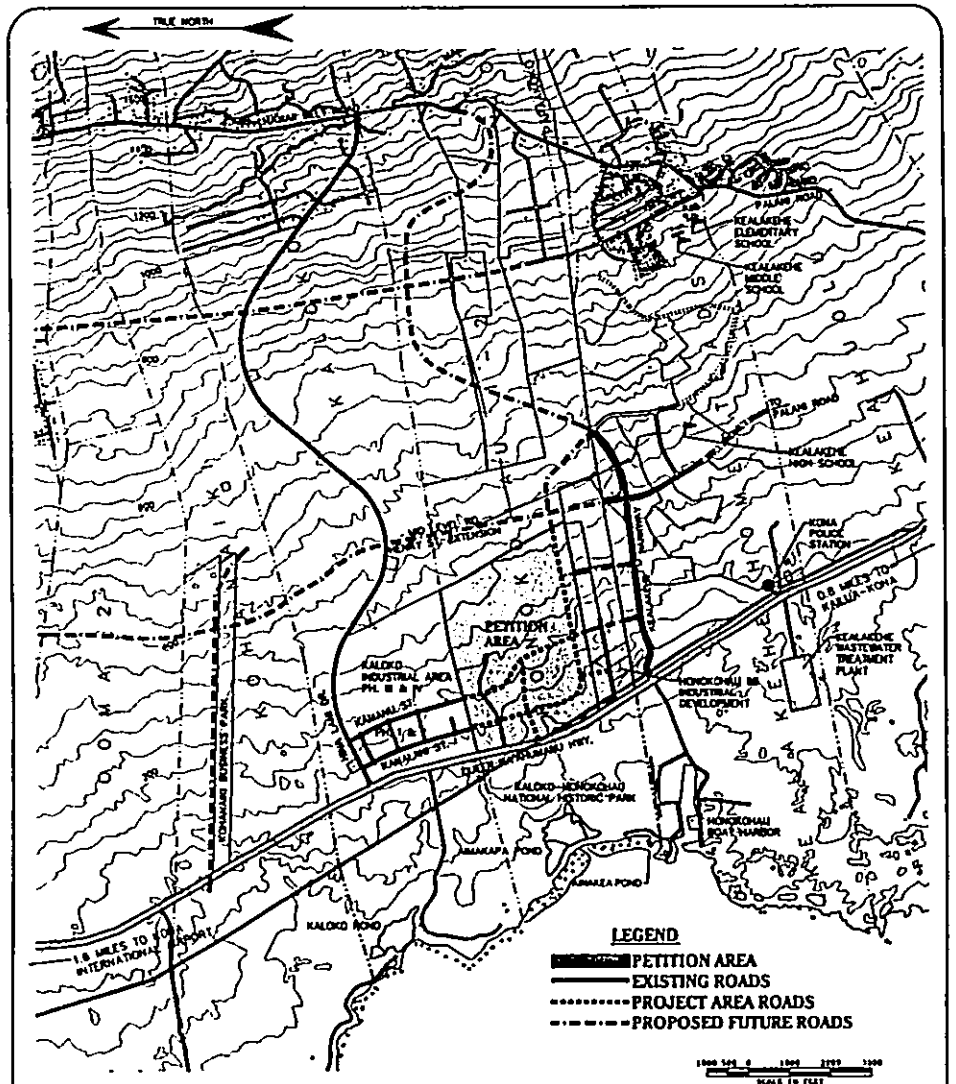

Figure 5

ROADWAY SYSTEM

PREPARED FOR: LANIHAU PARTNERS, L.P.
PREPARED BY: AKINAKA & ASSOCIATES, LTD.
SOURCE:

KALOKO-HONOKOHAU BUSINESS PARK
HONOKOHAU 1ST & 2ND
NORTH KONA, HAWAII

2. Year 2010 Traffic Improvements Without Project

This traffic analysis is based upon the assumption that the Queen Kaahumanu Highway Widening Project, between Kailua-Kona and the Keahole-Kona International Airport, would be completed by the Year 2010. This analysis does not take into account the construction of any future north-south roadways, as described in the Keahole to Kailua Development Plan. The following improvements are assumed to be implemented by the Year 2010:

a. Queen Kaahumanu Highway would be widened from two lanes to four lanes between Kailua and the Keahole Airport.

b. The intersection of Queen Kaahumanu Highway and Hina Lani Street would be signalized.

c. The intersection of Queen Kaahumanu Highway and the Kaloko-Honokohau National Historic Park Access Road would be signalized. Exclusive left turn and right turn lanes would be included in the intersection improvements in both directions on Queen Kaahumanu Highway, i.e., for access to the Kaloko-Honokohau National Historic Park and the proposed Kaloko-Honokohau Business Park.

d. Eastbound Hina Lani Street would be widened/restriped at Kanalani Street to provide a channelized right turn lane.

e. Westbound Hina Lani Street would be widened/restriped at Kanalani Street to provide an exclusive left turn lane.

f. Kanalani Street would be widened/restriped at Hina Lani Street to provide separate left turn and right turn lanes.

g. Westbound Hina Lani Street would be widened/restriped at Kamanu Street to provide an exclusive left turn lane, as recommended in the Kaloko TIR.

h. Westbound Hina Lani Street would be widened/restriped at Kamanu Street to provide a median storage lane, as recommended in the Kaloko TIR.

i. Kamanu Street would be widened/restriped at Hina Lani Street to provide exclusive left turn and right turn lanes, as recommended in the Kaloko TIR.

3. Year 2010 AM Peak Hour Traffic Analysis Without the Proposed Project

The four-lane Queen Kaahumanu Highway is expected to operate at LOS "B", during the 2010 AM peak hour without the proposed project. The two-lane Mamalahoa Highway is expected to operate at LOS "E" during the 2010 AM peak hour without the proposed project.

The intersection of Queen Kaahumanu Highway and Hina Lani Street is expected to operate at an overall LOS "B" with traffic signalization. Hina Lani Street is expected to operate at LOS "F" at Mamalahoa Highway under unsignalized conditions. The left turn movement on northbound Mamalahoa Highway at Hina Lani Street is expected to operate at LOS "D". The left turn movement from Kamanu Street onto westbound Hina Lani Street is expected to operate at LOS "F", during the 2010 AM peak hour without the proposed project. The other intersections in the study area are expected to operate at satisfactory Levels of Service. Figure 6 depicts the Year 2010 AM peak hour traffic without the proposed project and the results of the capacity analysis.

4. Year 2010 PM Peak Hour Traffic Analysis Without the Proposed Project

During the Year 2010 PM peak hour of traffic, Queen Kaahumanu Highway is expected to operate at LOS "B". Mamalahoa Highway is expected to continue to operate at LOS "F" during the 2010 PM peak hour without the proposed project.

The intersection of Hina Lani Street and Queen Kaahumanu Highway is expected to operate at an overall LOS "C". Mauka bound Hina Lani Street at Mamalahoa Highway is expected to operate at LOS "F". The right turn movement from Kamanu Street is expected to operate at LOS "F". The left turn movement from Kanalani Street onto Hina Lani Street also is expected to operate at LOS "F". The quarry access road is expected to operate at LOS "D" during the Year 2010 PM peak hour of traffic without the proposed project. Figure 7 depicts the Year 2010 PM peak hour traffic without the proposed project and the results of the capacity analysis.

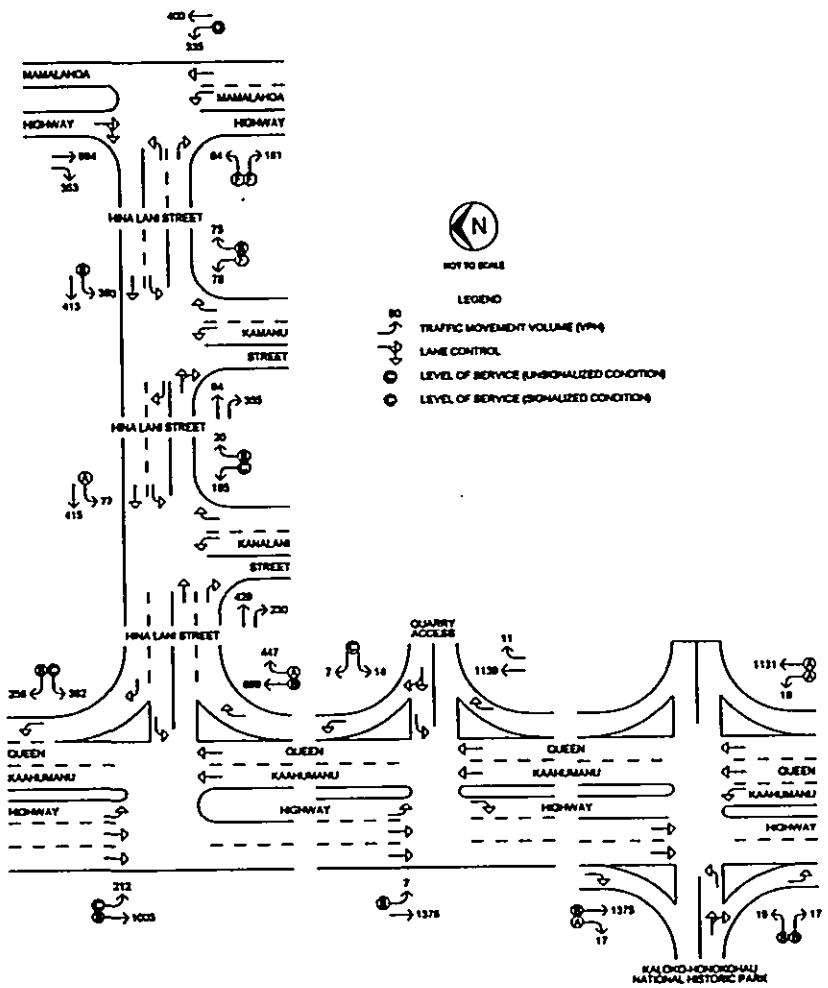

Figure 6. Year 2010 AM Peak Hour Traffic Without Project

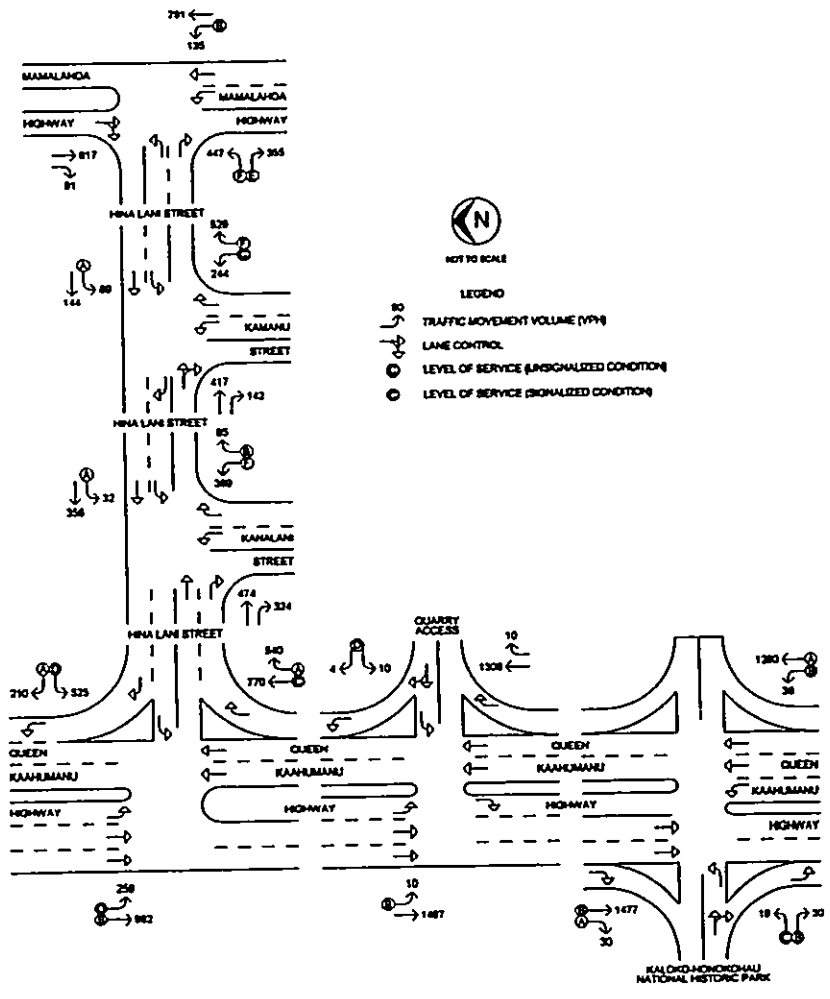

Figure 7. Year 2010 PM Peak Hour Traffic Without Project

E. Year 2020 Peak Hour Traffic Analysis Without the Project

1. Study Area

The study area for the Year 2020 traffic analysis without the proposed project was expanded to include the Queen Kaahumanu Highway intersection at Kealakehe Parkway. The intersection of Kealakehe Parkway and Road G also was included in the expanded study area.

2. Year 2020 Traffic Improvements Without the Proposed Project

The following traffic improvements would be required to mitigate deficiencies identified in the previous section and are assumed to be implemented for the Year 2020 traffic analysis without the proposed project:

a. The intersection of Mamalahoa Highway and Hina Lani Street would be signalized to mitigate LOS "F" conditions, identified in the previous section.

b. Mamalahoa Highway would be widened in both directions at its intersection with Hina Lani Street to provide two through lanes to mitigate the delay on Mamalahoa Highway resulting from traffic signalization. The two through lanes would merge into one lane beyond the intersection in both directions.

c. Eastbound Hina Lani Street would be widened to provide a channelized right turn deceleration lane to Kamanu Street .

d. Eastbound Hina Lani Street would be widened to provide a right turn acceleration lane from Kamanu Street to mitigate LOS "F" conditions, identified in the previous section.

3. Year 2020 AM Peak Hour Traffic Analysis Without the Proposed Project

The four-lane Queen Kaahumanu Highway is expected to continue to operate at LOS "B", during the Year 2020 AM peak hour without the proposed project. The two-lane Mamalahoa Highway is expected to operate at LOS "F" during the Year 2020 AM peak hour without the proposed project. The projected Year 2020 AM peak hour traffic demand on Mamalahoa Highway is expected to exceed the carrying capacity of the two lane highway.

The left turn movements at the intersection of Mamalahoa Highway and Hina Lani Street are expected to operate at LOS "D", however, the overall intersection is expected to operate at LOS "C". The left turn movement from

Kamanu Street to Hina Lani Street is expected to operate at LOS "F", during the Year 2020 AM peak hour without the proposed project. The left turn movement from Kanalani Street to Hina Lani Street is expected to operate at LOS "D".

The intersection of Queen Kaahumanu Highway and Hina Lani Street is expected to operate at an overall LOS "D" during the Year 2020 PM peak hour of traffic without the proposed project. The quarry access road is expected to operate at LOS "D". The intersection of Queen Kaahumanu Highway and Kealakehe Parkway also is expected to operate at an overall LOS "D". The Year 2020 AM peak hour traffic without the proposed project and the results of the capacity analysis are depicted on Figures 8a and 8b.

4. Year 2020 PM Peak Hour Traffic Analysis Without the Proposed Project

During the Year 2020 PM peak hour of traffic, Queen Kaahumanu Highway is expected to operate at LOS "B". Mamalahoa Highway is expected to continue to operate at LOS "F", during the 2020 PM peak hour without the proposed project. The projected Year 2020 PM peak hour traffic demand is expected to exceed the carrying capacity of the two lane highway.

The intersection of Hina Lani Street and Kamanu Street is expected to operate under satisfactory Levels of Service under the improved conditions. The left turn movement from Kanalani Street to Hina Lani Street is expected to operate at LOS "F".

The intersection of Hina Lani Street and Queen Kaahumanu Highway is expected to operate at an overall LOS "D". The quarry access road at Queen Kaahumanu Highway is expected to operate at LOS "F". The Kaloko-Honokohau National Historic Park Access Road is expected to operate at satisfactory Levels of Service at Queen Kaahumanu Highway. The intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at an overall LOS "E". The Year 2020 PM peak hour traffic demand, without the proposed project, is expected to exceed the carrying capacity of the intersection of Queen Kaahumanu Highway and Kealakehe Parkway. Figures 9a and 9b depict the Year 2020 PM peak hour traffic without the proposed project and the results of the capacity analysis.

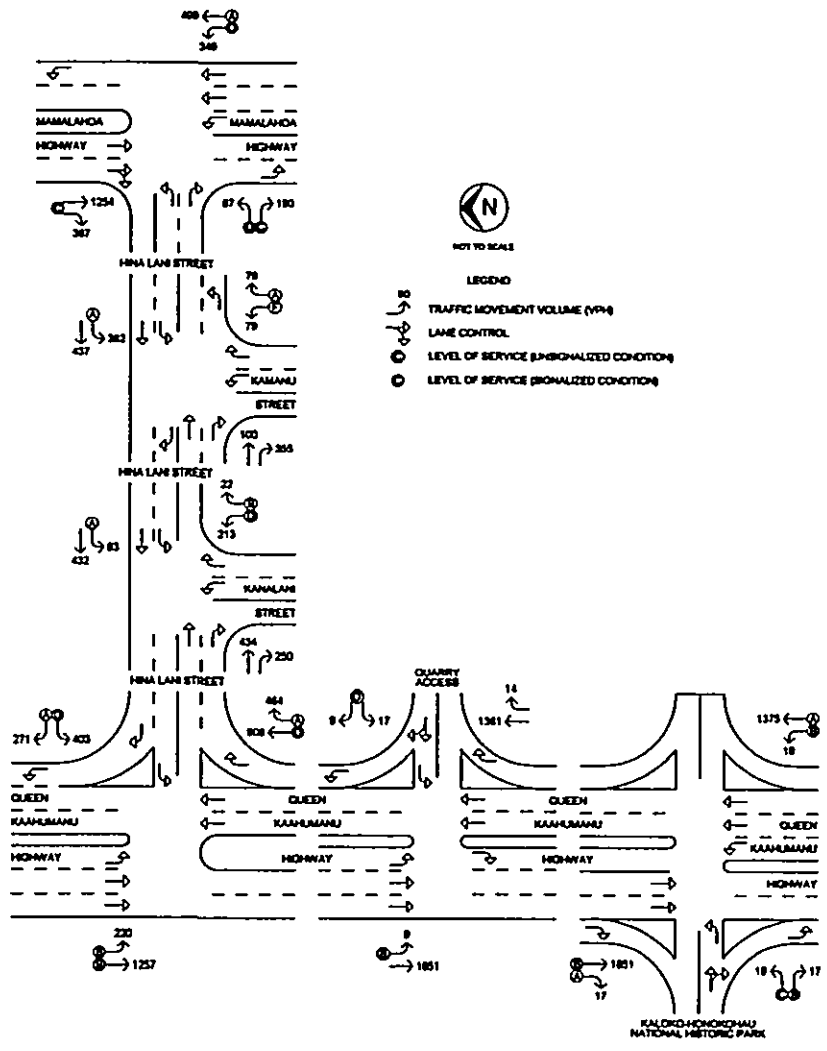

Figure 8a. Year 2020 AM Peak Hour Traffic Without Project

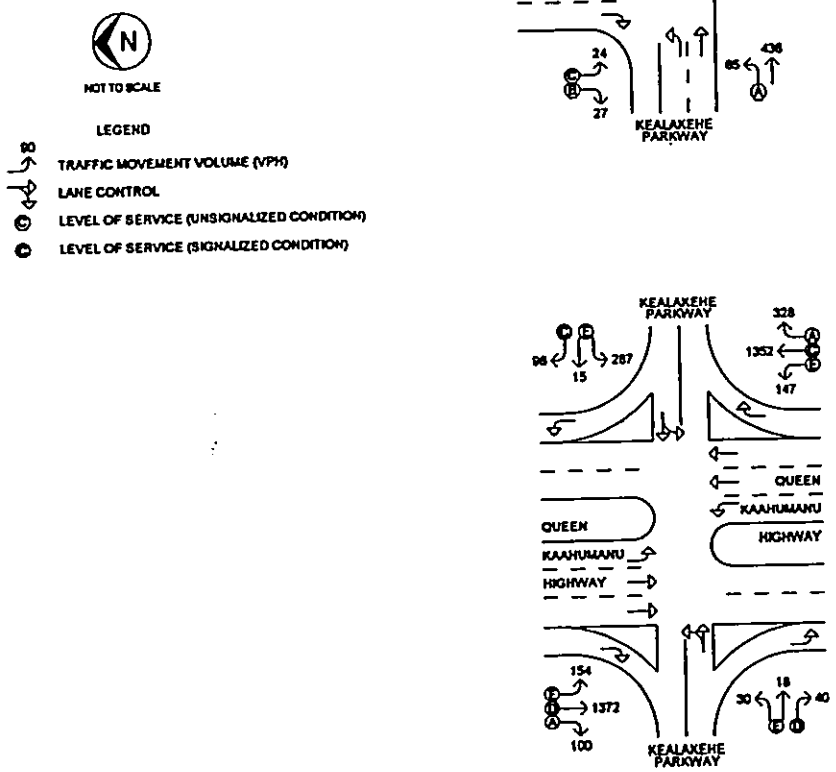

Figure 8b. Year 2020 AM Peak Hour Traffic Without Project

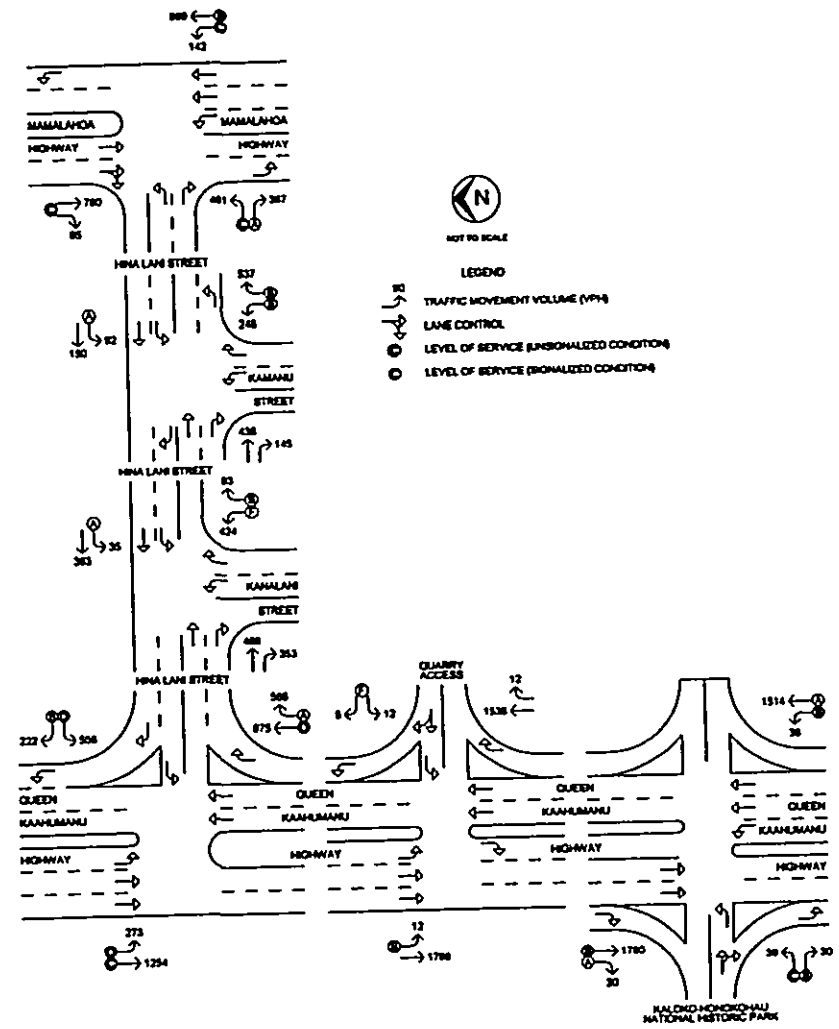

Figure 9a. Year 2020 PM Peak Hour Traffic Without Project

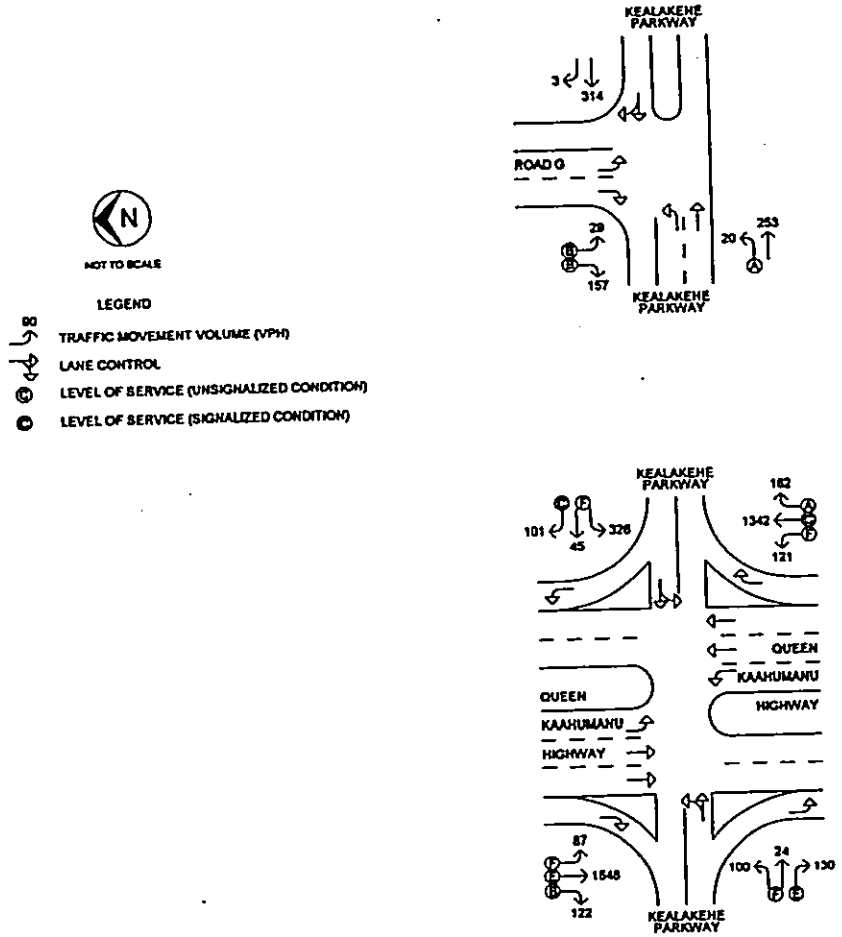

Figure 9b. Year 2020 PM Peak Hour Traffic Without Project

F. Trip Generation

1. Methodology

The trip generation methodology used in this study is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in "Trip Generation", 6th Edition, 1997. The ITE trip rates for commercial and residential activities are developed by correlating the vehicle trip generation data with various land use characteristics, such as vehicle trips per 1,000 square feet of gross leaseable floor area.

The total trips generated by a land development can be defined as driveway trips, i.e., traffic entering and exiting the project site. A portion of the trips, generated by a shopping center, can be considered "pass-by" trips, i.e., traffic already on the road stopping at a "secondary" destination. The remainder of the trips generated are considered "new" trips, i.e., drivers whose primary destination is the proposed project. Based upon travel surveys compiled by ITE, which correlate the pass-by trips with gross floor areas of retail land uses, the percentages of pass-by trips for this project vary between 29 percent and 32 percent.

2. Trip Generation Characteristics

The proposed Kaloko-Honokohau Business Park is expected to generate a total of 2,105 vehicles per hour (vph) during the AM peak hour and 3,135 vph during the PM peak hour. Table 2 summarizes the trip generation characteristics for the proposed development of the Kaloko-Honokohau Business Park.

Table 2. Trip Generation Summary

Phase	AM Peak Hour Traffic (vph)			PM Peak Hour Traffic (vph)		
	Enter	Exit	Total	Enter	Exit	Total
I	749	193	942	605	1,129	1,734
II	714	125	839	220	795	1,015
III	278	46	324	75	311	386
Project Totals	1,741	364	2,105	900	2,235	3,135

IV. Traffic Impact Analysis

A. Year 2010 Peak Hour Traffic Analysis With Phase I of the Proposed Project

1. Non-Project Related Traffic Improvements

The following roadway improvements were assumed to be constructed by the Year 2010 and are included in this traffic impact analysis. The traffic improvements would mitigate expected highway deficiencies without the proposed project.

a. Mamalahoa Highway should be signalized at its intersection with Hina Lani Street to mitigate LOS "F" conditions expected during the Year 2010 AM and PM peak hours of traffic without the proposed project.

b. Southbound Mamalahoa Highway should be widened to provide an exclusive right turn lane at Hina Lani Street as part of the traffic signalization.

c. Eastbound Hina Lani Street should be widened to provide a channelized right turn deceleration lane to Kamanu Street to mitigate LOS "F" conditions, identified in the previous section.

d. Eastbound Hina Lani Street should be widened to provide a right turn acceleration lane from Kamanu Street to mitigate the LOS "F" conditions, identified in a prior section.

2. Project-Related Improvements

The following "project-related" traffic improvements are associated with access improvements required by the proposed project, and off-site traffic improvements that may be necessary to mitigate the expected traffic deficiencies to which the proposed project may contribute.

a. The South Access Road would provide an exclusive left turn lane, a share through/left turn lane, and an exclusive right turn lane at Queen Kaahumanu Highway.

b. Channelized right turn deceleration and acceleration lanes would be provided on northbound Queen Kaahumanu Highway at the North Access Road.

c. Kanalani Street would be extended through the project site to the McClean project to the south.

d. Kamanu Street would be extended into the project site and terminate at the quarry site.

3. Phase I AM Peak Hour Traffic Impact Analysis

Queen Kaahumanu Highway is expected to operate at LOS "B" during the Year 2010 AM peak hour of traffic with Phase I of the proposed project. The two-lane Mamalahoa Highway is expected to operate at LOS "F".

The left turn movement from mauka bound Hina Lani Street to northbound Mamalahoa Highway is expected to operate at LOS "E", however the overall intersection is expected to operate at LOS "C", under signalized conditions. The left turn movement from Kamanu Street to Hina Lani Street is expected to operate at LOS "F". The left turn movement from Kanalani Street to Hina Lani Street is expected to operate at LOS "E". The project access intersections on Queen Kaahumanu Highway are expected to operate at satisfactory LOS. The Year 2010 AM peak hour traffic volumes with Phase I of the proposed project and the results of the capacity analysis are depicted on Figure 10.

4. Phase I PM Peak Hour Traffic Impact Analysis

During the Year 2010 PM peak hour traffic with Phase I of the proposed project, Queen Kaahumanu Highway is expected to continue to operate at LOS "B". Mamalahoa Highway is expected to operate at LOS "F" along its two lane roadway section.

The signalized intersection of Mamalahoa Highway and Hina Lani Street is expected to operate at an overall LOS "D". The left turn movement from northbound Kanalani Street to Hina Lani Street is expected to improve to operate at LOS "D", due to the expected diversion of Kanalani Street traffic to the South Access Road via the Kanalani Street extension. The intersection of Queen Kaahumanu Highway and Hina Lani Street is expected to operate at an overall LOS "C". The project access intersections on Queen Kaahumanu Highway are expected to operate at satisfactory Levels of Service. The Year 2010 PM peak hour volumes with Phase I of the proposed project and the results of the capacity analysis are depicted on Figure 11.

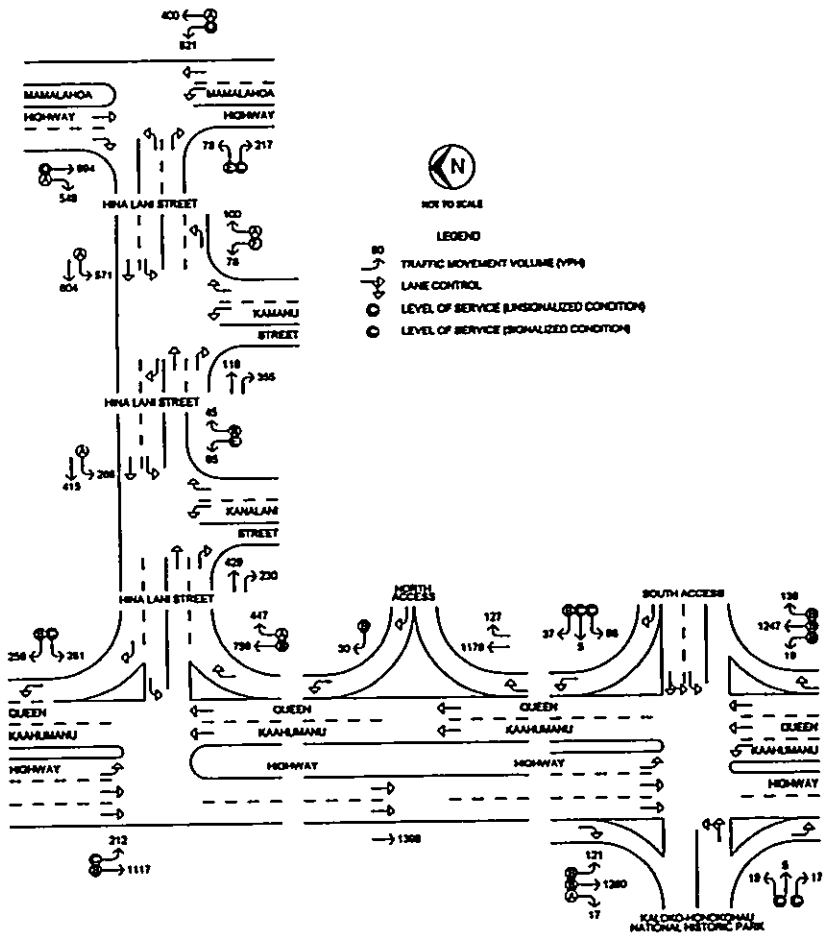

Figure 10. Year 2010 AM Peak Hour Traffic With Project

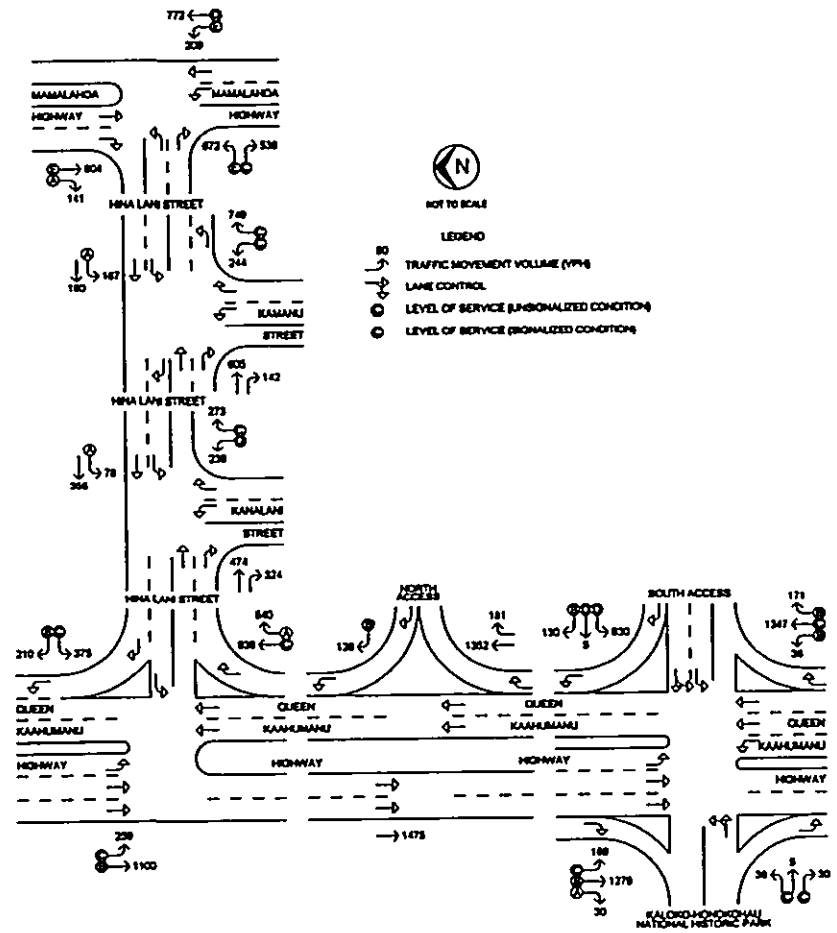

Figure 11. Year 2010 PM Peak Hour Traffic With Project

B. Year 2020 Peak Hour Traffic Impact Analysis With the Proposed Project

1. Non-Project-Related Traffic Improvements

The following improvements are assumed to be constructed by the Year 2020 as part of the development of the Villages of La'i'opua and the McClean Honokohau Project.

a. Kealakehe Parkway would be widened at Queen Kaahumanu Highway to provide an exclusive left turn lane in addition to the shared left turn/through lane. The traffic signal phasing also may have to be modified to accommodate the proposed double left turn lanes from makai bound Kealakehe Parkway.

b. An exclusive left turn lane would be constructed on mauka bound Kealakehe Parkway at Road G.

c. Separate left turn and right turn lanes would be constructed on Road G at Kealakehe Parkway.

d. Continuous north-south roadway(s) should be constructed between Palani Road and Kealakehe Parkway, such as the Mid-Level Arterial (Henry Street Extension), Kealakaa Drive, and Waena Drive, as described in the Keahole to Kailua Development Plan.

2. Project-Related Improvements

a. Northbound Queen Kaahumanu Highway should be widened at the South Access Road to provide an additional through traffic lane for a total of three through lanes to improve the overall intersection operation. The additional through lane would merge into the two northbound lanes, north of the South Access Road.

b. Southbound Queen Kaahumanu Highway should be widened to provide a total of three through lanes to improve the overall intersection operation. The additional through lane would merge into the two southbound lanes, south of the Kealakehe Parkway.

c. Southbound Mamalahoa Highway should be widened to provide an exclusive right turn lane at Hina Lani Street.

d. A median storage lane should be constructed on mauka bound Kealakehe Parkway at Road G to facilitate the left turn movement from Road G.

e. A channelized right turn lane should be constructed on makai bound Kealakehe Parkway at Road G.

3. AM Peak Hour Traffic Impact Analysis

During the Year 2020 AM peak hour traffic with full build-out of the proposed project, the four-lane Queen Kaahumanu Highway is expected to operate at LOS "C". The two lane Mamalahoa Highway is expected to continue to operate at LOS "F". The projected AM peak hour traffic demand is expected to exceed the capacity of a two-lane highway.

The left turn movement from Kamanu Street onto Hina Lani Street is expected to continue to operate at LOS "F". The left turn movement from Kanalani Street to Hina Lani Street also is expected to operate at LOS "F". The left turn demand is expected to be reduced due to the diversion of Kanalani Street traffic to the South Access Road. However, the increase in left turn traffic from westbound Hina Lani Street is expected to result in delays to traffic on Kanalani Street.

The project access intersections on Queen Kaahumanu Highway are expected to operate at satisfactory Levels of Service. The Year 2020 AM peak hour traffic volumes with full build-out of the proposed project and the results of the capacity analysis are depicted on Figures 12a and 12b.

4. PM Peak Hour Traffic Impact Analysis

Queen Kaahumanu Highway is expected to operate at LOS "C", during the Year 2020 PM peak hour of traffic with full build-out of the proposed project. Mamalahoa Highway is expected to operate at LOS "F". The capacity of the two-lane highway is expected to be exceeded by the Year 2020 PM peak hour traffic demand.

The intersection of Mamalahoa Highway and Hina Lani Street is expected to operate at an overall LOS "C". The left turn movement from Kanalani Street to Hina Lani Street is expected to continue to improve to LOS "C", while the

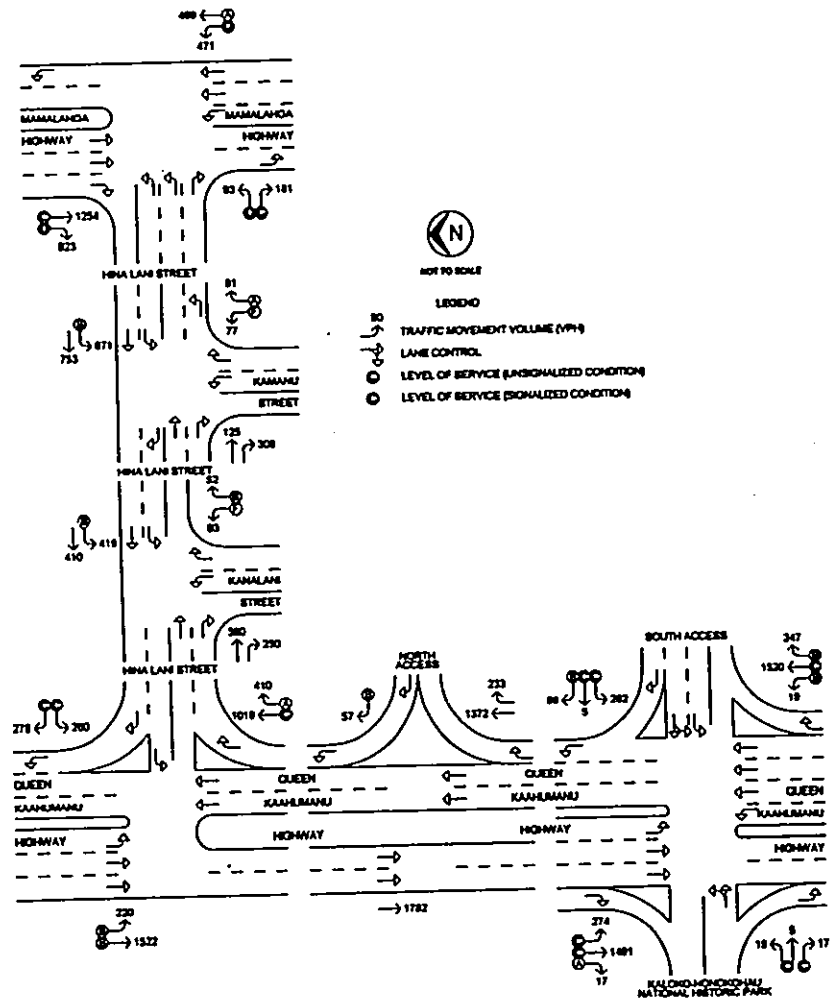

Figure 12a. Year 2020 AM Peak Hour Traffic With Project

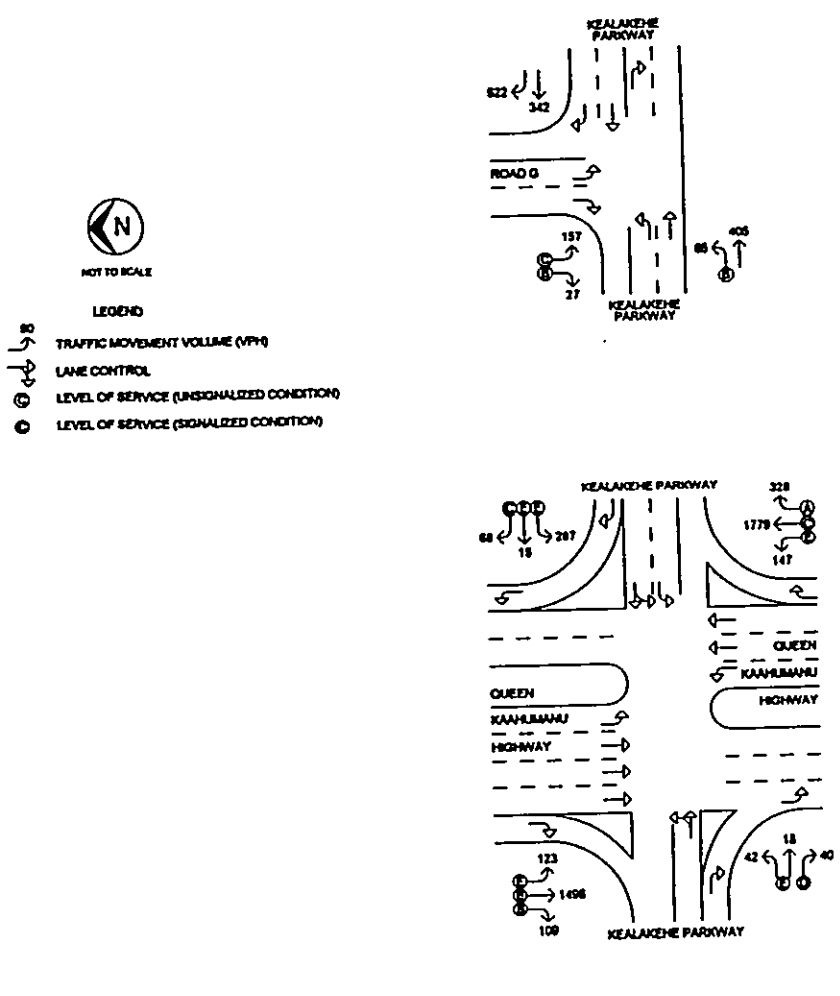

Figure 12b. Year 2020 AM Peak Hour Traffic With Project

right turn movement is expected to deteriorate to LOS "D". The intersection of Queen Kaahumanu Highway and Hina Lani Street is expected to operate at an overall LOS "B".

The left turn movements to and from the South Access Road are expected to operate at LOS "E". However, the overall intersection of Queen Kaahumanu Highway and the South Project Access Road/Kaloko-Honokohau National Historic Park Access is expected to operate at LOS "D", during the Year 2020 PM peak hour of traffic.

The intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "D". The left turn movement from Road G to Kealakehe Parkway is expected to operate at LOS "F". The Year 2020 PM peak hour traffic volumes with the proposed project and the results of the capacity analysis are depicted on Figures 13a and 13b.

V. Recommendations

A. Year 2010 Traffic Improvements Without Project

1. Queen Kaahumanu Highway

a. Queen Kaahumanu Highway should be widened from two lanes to four lanes between Kailua and the Keahole Airport, as recommended in the HLRLTP.

b. The intersection of Queen Kaahumanu Highway and Hina Lani Drive should be signalized, as part of the Queen Kaahumanu Highway widening project.

c. The intersection of Queen Kaahumanu Highway and the Kaloko-Honokohau National Historic Park should be signalized, as part of the Queen Kaahumanu Highway widening project. Exclusive left turn and right turn lanes should be constructed in both directions on Queen Kaahumanu Highway, i.e., for access to the Kaloko-Honokohau National Historic Park and the proposed Kaloko-Honokohau Business Park .

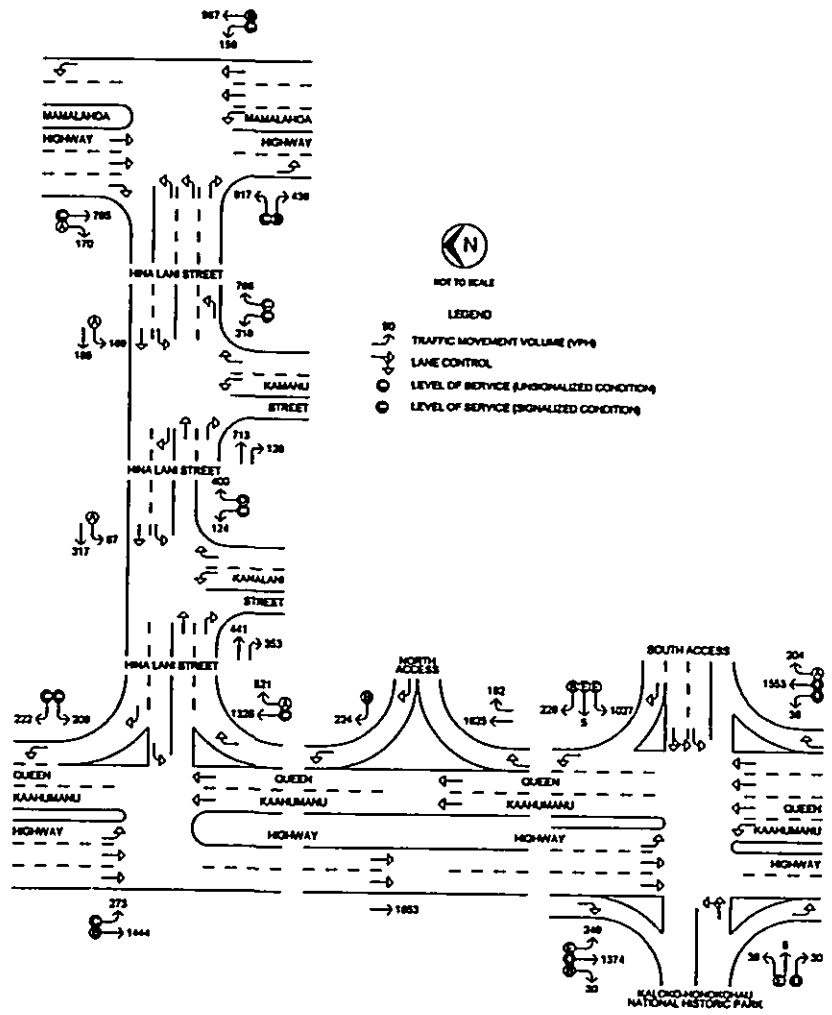

Figure 13a. Year 2020 PM Peak Hour Traffic With Project

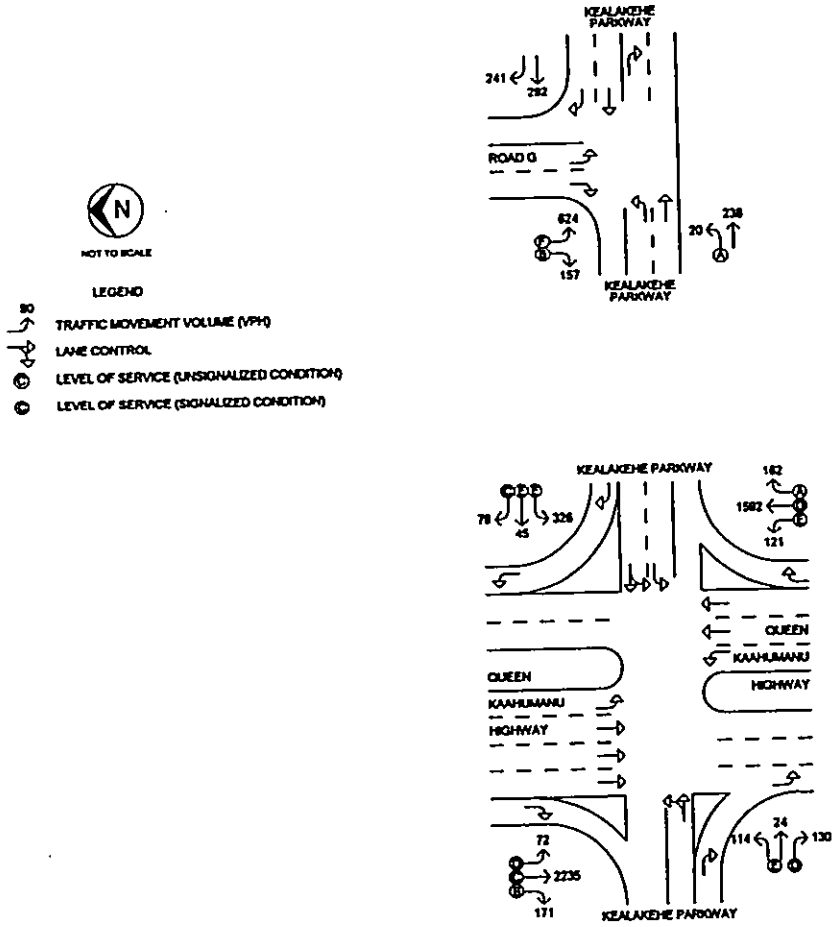

Figure 13b. Year 2020 PM Peak Hour Traffic With Project

2. Hina Lani Street and Kanalani Street

a. Eastbound Hina Lani Street should be widened/restriped at Kanalani Street to provide a channelized exclusive right turn lane.

b. Westbound Hina Lani Street should be widened/restriped at Kanalani Street to provide an exclusive left turn lane.

c. Kanalani Street should be widened/restriped at Hina Lani Street to provide separate left turn and right turn lanes.

d. The installation of traffic signals at the intersection of Hina Lani Street and Kanalani Street should be considered as the conditions become warranted.

3. Hina Lani Street and Kamanu Street

a. Westbound Hina Lani Street should be widened/restriped at Kamanu Street to provide an exclusive left turn lane.

b. Westbound Hina Lani Street should be widened/restriped to provide a median shelter lane to facilitate the left turn movement from Kamanu Street.

c. Kamanu Street should be widened/restriped at Hina Lani Street to provide separate left turn and right turn lanes.

4. Mamalahoa Highway and Hina Lani Street

a. The intersection of Mamalahoa Highway and Hina Lani Street should be signalized to mitigate LOS "F" conditions.

b. Southbound Mamalahoa Highway should be widened at Hina Lani Street to provide an exclusive right turn lane.

B. Year 2020 Traffic Improvements Without the Proposed Project

1. Mamalahoa Highway and Hina Lani Street

Mamalahoa Highway should be widened at its intersection with Hina Lani Street to provide two through lanes in each direction to mitigate the delay on Mamalahoa Highway, resulting from traffic signalization. The two through lanes would merge into one lane beyond the intersection in both directions.

2. **Hina Lani Street and Kamanu Street**

   a. Eastbound Hina Lani Street should be widened/restriped to provide an exclusive right turn deceleration lane at Kamanu Street.

   b. Eastbound Hina Lani Street should be widened to provide a right turn acceleration lane from Kamanu Street.

3. **Keahole-Kailua Development Plan Improvements**

   a. Kealakehe Parkway should be widened at Queen Kaahumanu Highway to provide an exclusive left turn lane in addition to the shared left turn/through lane.

   b. An exclusive left turn lane should be constructed on mauka bound Kealakehe Parkway at Road G.

   c. Separate left turn and right turn lanes should be constructed on Road G at Kealakehe Parkway.

   d. The Mid-Level Arterial (Henry Street Extension) should be completed between Palani Road to Kealakehe Parkway, as described in the Keahole to Kailua Development Plan.

   e. Kealakaa Drive should be extended to Kealakehe Parkway, as described in the Keahole to Kailua Development Plan.

C. Year 2010 Peak Hour Improvements With Phase I of the Proposed Project

The "project-related" traffic improvements are associated with access improvements required by the proposed project.

1. The South Access Road should provide an exclusive left turn lane, a share through/left turn lane, and a right turn lane at Queen Kaahumanu Highway.
2. Right turn deceleration and acceleration lanes should be provided on northbound Queen Kaahumanu Highway at the North Access Road.
3. Kanalani Street should be extended through the project site, intersecting with the North and South Access Roads.
4. Kamanu Street should be extended through the project site, intersecting with the North and South Access Roads.

D. Year 2020 Peak Hour Improvements With the Proposed Project

1. Northbound Queen Kaahumanu Highway should be widened at the South Access Road to provide an additional through traffic lane for a total of three through lanes to improve the overall intersection operation. The additional through lane would merge into the two northbound lanes, north of the South Access Road.
2. Southbound Queen Kaahumanu Highway should be widened at the Kealakehe Parkway to provide an additional through traffic lane for a total of three through lanes to improve the overall intersection operation. The additional through lane would merge into the two southbound lanes, south of the Kealakehe Parkway.
3. Southbound Mamalahoa Highway should be widened to provide an exclusive right turn lane to Hina Lani Street.
4. The installation of traffic signals at the intersection of Hina Lani Street and Kanalani Street should be considered as the conditions become warranted.
5. The installation of traffic signals at the intersection of Kealakehe Parkway and Road G should be considered as the conditions become warranted.

VI. Conclusions

The proposed Kaloko-Honokohau Business Park would be a mixed commercial-industrial project, similar to other existing and planned developments in the immediate vicinity. The extensions of Kamanu Street and Kanalani Street would improve the access for the proposed project, as well as other existing and future developments located between Hina Lani Street and the Kealakehe Parkway.

Table 3 summarizes the Level of Service analysis prepared for this study.

Table 3. Level of Service Analysis

Intersection	Scenario							
	Year 2010				Year 2020			
	W/O Project		W/Project		W/O Project		W/Project	
	AM	PM	AM	PM	AM	PM	AM	PM
Queen Kaahumanu Highway at								
Hina Lani Street	B	C	B	C	C	D	B	B
North Access	*C*	*D*	*B*	*B*	*D*	*F*	*B*	*B*
South Access	B	A	B	C	B	B	C	D
Kealakehe Parkway	•	•	•	•	D	E	C	D
Hina Lani Street at								
Kanalani Street	*C*	*F*	*E*	*D*	*D*	*F*	*F*	*F*
Kamanu Street	*F*	*F*	*F*	*C*	*F*	*B*	*F*	*C*
Mamalahoa Hwy.	*F*	*F*	C	D	C	C	D	C
Kealakehe Parkway at								
Kamanu Street	•	•	•	•	*C*	*B*	*C*	*F*

Notes: A - Intersection LOS (Signalized Condition)
A - Critical Movement LOS (Unsignalized Condition)
• - Not included in the analysis

The Year 2020 peak hour traffic demands on Mamalahoa Highway are expected to reach the capacity of the existing two-lane highway without the proposed project. The Environmental Assessment for the Queen Kaahumanu Highway Widening indicated that the proposed Mid-Level Arterial (Henry Street Extension) can be expected to divert up to 36 percent of the total corridor traffic demand, thereby relieving the over capacity

conditions expected on Mamalahoa Highway. Kealakaa Drive also could be extended to Kaiminani Drive to relieve Mamalahoa Highway. However, these regional roadway improvements were not taken into account for this traffic impact analysis.

The peak hour traffic, generated by the proposed Kaloko-Honokohau Business Park, is expected to impact traffic on the existing roadways in the surrounding area. The traffic improvements, proposed by others and those recommended in this report, are expected to mitigate the traffic impacts resulting from this project.

Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 12

Air Quality Report

AIR QUALITY STUDY

FOR THE PROPOSED

KALOKO-HONOKOHAU BUSINESS PARK PROJECT

NORTH KONA, HAWAII

Prepared for:

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December 2000

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2 Air Pollution Emissions Inventory for Island of Hawaii, 1993

3 Annual Summaries of Ambient Air Quality Measurements for Monitoring Stations Nearest Kaloko-Honokohau Business Park Project

4 Estimated Worst-Case 1-Hour Carbon Monoxide Concentrations at Selected Intersections Near Kaloko-Honokohau Business Park Project

5 Estimated Worst-Case 8-Hour Carbon Monoxide Concentrations at Selected Intersections Near Kaloko-Honokohau Business Park Project

6 Estimated Indirect Air Pollution Emissions from Kaloko-Honokohau Business Park Project Electrical Demand

1.0 SUMMARY

Lanihau Partners L.P. is proposing to develop a 280-acre site located in North Kona on the island of Hawaii. The project site is situated mauka of Queen Kaahumanu Highway near Honokohau. The proposed development will consist of a business park with 150 to 200 lots for mixed-use retail, commercial and light industrial activities and 15 to 30 lots for heavy industrial or quarry-related activities. Development is expected to occur in phases through the year 2020. This study examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities and suggests mitigative measures to reduce any potential air quality impacts where possible and appropriate.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are more stringent than the comparable national standards except for those pertaining to sulfur dioxide and particulate matter, which are equivalent.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the project area is very much affected by its near coastal situation and by nearby mountains. Winds are predominantly light and variable, although kona storms generate occasional strong winds from the south or southwest during winter. Temperatures in the project area are generally very consistent and moderate with average daily temperatures ranging from about 65°F to 85°F. The extreme minimum temperature recorded at the nearby Old Kona Airport is 47°F, while the extreme maximum temperature is

93°F. Average annual rainfall in the area amounts to about 25 inches with each month typically contributing about 2 inches.

Except for periodic impacts from volcanic emissions (vog) and possibly occasional localized impacts from traffic congestion, the present air quality of the project area is believed to be relatively good. The limited air quality data that are available for the area from the Department of Health indicate that (despite the vog) concentrations are well within state and national air quality standards.

If the proposed project is given the necessary approvals to proceed, it is inevitable that some short- and long-term impacts on air quality will occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during the project construction phase. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control

program. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

After construction, motor vehicles coming to and from the proposed development will result in a long-term increase in air pollution emissions in the project area. To assess the impact of emissions from these vehicles, an air quality modeling study was undertaken to estimate current ambient concentrations of carbon monoxide at intersections in the project vicinity and to predict future levels both with and without the proposed project. During worst-case conditions, model results indicated that present 1-hour and 8-hour carbon monoxide concentrations are probably well within both the state and the national ambient air quality standards. In the year 2010 without the project, carbon monoxide concentrations were predicted to increase due to the projected increase in traffic, but concentrations would likely remain well within the national and state standards. By the year 2020 without the project, worst-case carbon monoxide concentrations were predicted to potentially exceed the state standards at the intersection of Queen Kaahumanu Highway and Hina Lani Street but would likely remain within the less stringent national standards at this location.

With the project in the year 2010, carbon monoxide concentrations were estimated to remain nearly unchanged compared to the without-project case at the Hina Lani Street intersection, but concentrations were forecast to increase substantially at the intersection of Kaloko-Honokohau Park Access/South Project Access with Queen Kaahumanu Highway. At this latter location, worst-case concentrations would likely exceed the state standards but remain in compliance with the national standards. In the year

2020 with the project, worst-case concentrations were predicted continue to increase at both locations that were studied.

It appears that with or without the project worst-case carbon monoxide concentrations in the project area may exceed the state standards in the 2010 to 2020 timeframe, but compliance with the less stringent national standards will likely continue to be achieved. It should be noted that, because the state standards for carbon monoxide are set at such stringent levels, it is likely that the standards are currently exceeded at many locations in the state that have even moderate traffic volumes.

Options available to mitigate long-term, traffic-related air pollution are generally to improve roadways, to reduce individual vehicular emissions or to reduce traffic. However, in some cases, improving roadways may actually result in reduced air quality at some locations. Reducing individual vehicular emissions is probably beyond the control of the proposed project. Attempting to reduce traffic volumes through the promotion of bus service, bicycling and carpooling and by staggering local business hours could serve to reduce air quality impacts, but this mitigation measure is generally only partially successful. Another potential mitigation measure might be to provide added buffer zones between new walkways and roadways where space is available. Technically, however, the public would have to somehow be excluded from the buffer zones.

In view of the fact that the predicted worst-case carbon monoxide concentrations with the project are well within the national ambient air quality standards, that the more stringent state standards are probably currently exceeded near many roadway intersections in the state where traffic volumes are moderate to

high, and that the state standards are predicted to be exceeded in the project area with or without the project, implementing air quality mitigation measures for long-term traffic-related impacts from the proposed project is probably unwarranted.

At this time, the specific tenants of the proposed business park have not been identified, but most of the types of facilities that are expected to locate there are not significant sources of air pollution. Before any air pollution sources can be built anywhere in the state, an application must be submitted to the Department of Health for a permit to construct the facility, and detailed information concerning any air pollution emissions will need to be provided in the application. The Department of Health may at that time require the applicant to perform an air quality impact assessment and possibly air quality monitoring.

Depending on the demand levels, long-term impacts on air quality are also possible due to indirect emissions associated with a development's electrical power and solid waste disposal requirements. Quantitative estimates of these potential impacts were not made, but based on the estimated demand levels and emission rates involved, any significant impacts are unlikely. Nevertheless, incorporating energy conservation design features and promoting conservation and recycling programs within the proposed development could serve to further reduce any associated impacts and conserve the island's resources.

2.0 INTRODUCTION

Lanihau Partners L.P. is proposing to develop the Kaloko-Honokohau Business Park (KHBP) on approximately 280 acres of land in the North Kona District on the island of Hawaii (see Figure 1

for project location map). The proposed project includes 150 to 200 building-ready lots ranging in size from ¾-acre to several acres in size for mixed-use retail/commercial facilities and light industrial activities and 15 to 30 graded lots for heavy industrial or quarry related activities associated with the existing quarry operations. Project development is expected to occur in three phases. Phase I is planned for completion by the year 2010. Full build-out of the project is expected to occur by the year 2020.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short-term and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities. Measures to mitigate these impacts are suggested where possible and appropriate. As background information, the state and national ambient air quality standards are discussed and the regional and local climatology is described.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National

primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit, and the state 1-hour limit for ozone is more than two times as stringent as the national 1-hour standard. The national 1-hour ozone standard will be phased out (pending court appeal) the next few years in favor of the new (and more stringent) 8-hour standard.

The Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make the state standards essentially the same as the national limits. In 1993, the state also revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards have been challenged in federal court. To date, the Hawaii Department of Health has not updated the state particulate standards.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affect the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional and local climates within the state are caused by the mountainous topography.

The site of the proposed project is located near the midpoint of the western coast of the island of Hawaii. The topography of Hawaii Island is dominated by the great volcanic masses of Mauna Loa (13,653 feet), Mauna Kea (13,796 feet), and of Hualalai, the Kohala Mountains and Kilauea. The island consists entirely of the slopes of these mountains and of the broad saddles between them. Mauna Loa and Kilauea, located on the southern half of the island, are still active volcanoes.

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. Nearly the entire western coast of the island of Hawaii, however, is sheltered from the trade winds by high mountains, except when unusually strong trade winds sweep through the saddle between the Kohala Mountains and Mauna Kea and reach some areas to the lee. Due to wind shadow effects caused by the terrain, winds in the project area are predominantly light and variable. Local winds such as land/sea breezes and/or upslope/downslope winds dominate the wind pattern for the area. During the daytime, winds typically move onshore because of seabreeze and/or upslope effects. At night, winds generally are land breezes and/or drainage winds that move downslope and out to sea. During winter, occasional strong winds from the south or southwest occur in association with the passage of winter storm systems.

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentrations of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depends to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. The project site's leeward location results in a larger temperature profile compared to windward locations at the same elevation. At the Old Kona Airport, located about 2 miles south of the project site, average daily minimum and maximum temperatures are 67°F and 83°F, respectively [1]. The extreme minimum temperature

on record at this location is 47°F, and the extreme maximum is 93°F. Temperatures at the project site are very similar.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. It is often measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 is the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the Kona area, stability classes 5 or 6 typically occur during the nighttime or early morning hours when temperature inversions form due to radiational cooling or to drainage flow from the mountainous interior of the island. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, minimum mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. Low mixing heights may sometimes occur, however, at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land. Mixing heights in Hawaii typically are above 3000 feet (1000 meters).

Rainfall can have a beneficial affect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The climate of the project area is wetter than might be expected for a leeward location. This is due to the persistent onshore and upslope movement of marine air caused by both eddie and seabreeze or mountain slope effects. Some of the rainfall occurs during summer afternoons and evenings as a result of this onshore and upslope movement of moisture-laden marine air, and some occurs in conjunction with winter storms. At the Old Kona Airport, average annual rainfall amounts to about 25 inches with each month registering about 2 inches [1]. Rainfall at the project site is probably somewhere near this amount.

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from vehicular, industrial, natural and/or agricultural sources. Table 2 presents an air pollutant emission summary for the island of Hawaii for calendar year 1993. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the manmade particulate emissions on Hawaii originate from area sources, such as the mineral products industry and agriculture. Manmade sulfur oxides are emitted almost exclusively by point sources, such as power plants and other fuel-burning industries. Nitrogen oxides emissions emanate predominantly from area sources (mostly motor vehicle traffic), although industrial point sources contribute a significant share. The majority of carbon monoxide emissions occur from area sources

(motor vehicle traffic), while hydrocarbons are emitted mainly from point sources.

It should be noted that Hawaii Island is unique from the other islands in the state in terms of the natural volcanic air pollution emissions that occur. Volcanic emissions periodically plague the project area. This is especially so since the latest eruption phase of the Kilauea Volcano began in 1983. Air pollution emissions from the Hawaiian volcanoes consist primarily of sulfur dioxide. After entering the atmosphere, these sulfur dioxide emissions are carried away by the wind and either washed out as acid rain or gradually transformed into particulate sulfates or acid aerosols. Although emissions from Kilauea are vented on the other side of a mountain barrier more than 50 miles east of the project site, the prevailing wind patterns eventually carry some of the emissions into the Kona area. These emissions can be seen in the form of the volcanic haze (vog) which persistently hangs over the area.

The major industrial source of air pollution in the project vicinity is Hawaii Electric Light Company's Keahole Power Plant, which is located about 5 miles to the north. Air pollution emissions from Keahole Power Plant consist mostly of sulfur dioxide and oxides of nitrogen.

Queen Kaahumanu Highway, which borders the project site on the makai side, is the region's major arterial roadway. Prevailing onshore winds during the daytime when traffic is heaviest tend to carry emissions from motor vehicles traversing this roadway toward the project area.

The State Department of Health operates a network of air quality monitoring stations at various locations around the state. Unfortunately, very limited data are available for Hawaii Island, and even less data are available for the Kona area specifically. During 1997, the Department of Health established an air quality monitoring site in the Kealakekua area for measuring particulate matter and sulfur dioxide, but only data for calendar year 1999 have been published to date for this site. As indicated in Table 3, measurements of sulfur dioxide concentrations at this location during 1999 were consistently low with an annual average concentration of 6 $\mu g/m^3$, which represents about 8 percent of the state and national standard. The second-highest 3-hour and 24-hour concentrations (which are most relevant to the standards) were 43 and 18 $\mu g/m^3$, respectively; these are less than 5 percent of the applicable standards. No exceedances of the state/national 3-hour and 24-hour AAQS for sulfur dioxide were recorded. The annual average particulate concentration for 1999 was 15 $\mu g/m^3$, which equates to about 30 percent of the state/national standard. The second-highest 24-hour concentration of particulate matter, 27 $\mu g/m^3$, is about 18 percent of the state/national standard, and there were no violations of the state/national AAQS during the 1999 monitoring period.

At this time, there are no reported measurements of lead, ozone, nitrogen dioxide or carbon monoxide in the project vicinity. These are primarily motor vehicle related air pollutants. Lead, ozone and nitrogen dioxide typically are regional scale problems; concentrations of these contaminants generally have not been found to exceed AAQS elsewhere in the state. Carbon monoxide air pollution, on the other hand, typically is a microscale problem caused by congested motor vehicular traffic. In traffic congested areas such as urban Honolulu, carbon monoxide concentrations have been found to occasionally exceed the state AAQS. Present

concentrations of carbon monoxide in the project area are estimated later in this study based on computer modeling of motor vehicle emissions.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts related to slow-moving construction equipment traveling to and from the project site and from a temporary increase in local traffic caused by commuting construction workers.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [2] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions in the project area would likely be somewhere near that level. In any case, State of Hawaii Air

Pollution Control Regulations [3] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project property line could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are low and should be

relatively insignificant compared to vehicular emissions on nearby roadways.

Slow-moving construction vehicles traveling on roadways leading to and from the project site could obstruct the normal flow of traffic to such an extent that overall vehicular emissions are increased, but this impact can be mitigated by moving heavy construction equipment during periods of low traffic volume. Likewise, the schedules of commuting construction workers can be adjusted to avoid peak hours in the project vicinity. Thus, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

7.1 Roadway Traffic

After construction is completed, use of the proposed facilities will result in increased motor vehicle traffic on nearby roadways, potentially causing long-term impacts on ambient air quality in the project vicinity. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to a few years ago. In 1990, the Clean Air Act Amendments became law. This legislation requires further emission reductions which have been phased in since 1994. Just recently, President Clinton signed into law additional restrictions which will begin to take effect during the next decade. The added restrictions on emissions from new motor

vehicles will lower average emissions each year as more and more older vehicles leave the state's roadways. Carbon monoxide emissions, for example, will go down by an average of about 10 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

To evaluate the potential long-term indirect ambient air quality impact of the roadway traffic associated with a project such as this, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways leading to and from the project. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single new development.

For this project, five scenarios were selected for the carbon monoxide modeling study: (1) year 2000 with present conditions, (2) year 2010 without the project, (3) year 2010 with the project, year 2020 without the project and (5) year 2020 with the project. Year 2010 is the expected date for completion of Phase I of the project, and year 2020 is the expected date for full project buildout. To begin the modeling study, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. For this study, two of the same intersections identified by the project traffic engineers as being impacted by the project were selected for air quality analysis. These included the following:

- Queen Kaahumanu Highway at Kaloko-Honokohau Park/South Project Access;
- Queen Kaahumanu Highway at Hina Lani Street.

Intersection configurations and traffic conditions at these two locations are detailed in the traffic impact report for the project [4]. It should be noted that the Queen Kaahumanu Highway intersection at Kaloko-Honokohau Park/South Project Access does not currently exist, and thus only the 2010 and 2020 scenarios were studied for this location.

The main objective of the modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the five scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can be made. Comparison of the estimated values to the national and state AAQS was also used to provide another measure of significance.

Maximum carbon monoxide concentrations typically coincide with peak traffic periods. The traffic impact assessment report evaluated morning and afternoon peak traffic periods. These same periods were evaluated in the air quality impact assessment.

The EPA computer model MOBILE5A [5] was used to calculate vehicular carbon monoxide emissions for each year studied. One of the key inputs to MOBILE5A is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for the present study. Based on national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 61.6% light-duty gasoline-

powered automobiles, 27.6% light-duty gasoline-powered trucks and vans, 3.1% heavy-duty gasoline-powered vehicles, 0.3% light-duty diesel-powered vehicles, 6.8% heavy-duty diesel-powered trucks and buses, and 0.6% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change only slightly with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans.

Other key inputs to the MOBILE5A emission model are the cold/hot start fractions. Motor vehicles operating in a cold- or hot-start mode emit excess air pollution. Typically, motor vehicles reach stabilized operating temperatures after about 4 miles of driving. For traffic operating on roadways within the project area, it was assumed that about 21 percent of all vehicles would be operating in the cold-start mode and that about 27 percent would be operating in the hot-start mode. These are typical default (national average) values.

Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively. These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this, and emission estimates given by MOBILE5A are inversely proportional to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE5A, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [6] currently recommend that the computer model CAL3QHC [7] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [8] may be used. Until about two years ago,

CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because it was thought the model has become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Although CAL3QHC is intended primarily for assessing atmospheric dispersion near signalized roadway intersections, it can also be used to evaluate unsignalized intersections. This is accomplished by manually estimating queue lengths and then applying the same techniques used by the model for signalized intersections. Currently, the Hina Lani Street intersection with Queen Kaahumanu Highway is unsignalized; both Hina Lani Street and Kaloko-Honokohau Park access road were assumed to be signalized at Queen Kaahumanu Highway for the future scenarios.

Input peak-hour traffic data were obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings. All emission factors that were input to CAL3QHC for free-flow traffic were obtained from MOBILE5A based on an assumed free-flow vehicle speeds of 45 mph on Queen Kaahumanu Highway,

35 mph on Hina Lani Street and 25 mph on the Kaloko-Honokohau/South Project Access.

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid within the roadway mixing zone. The roadway mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied, whether or not sidewalks currently exist. All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for the morning case, and stability category 4 was assumed for the afternoon case. These are the most conservative stability categories that are generally used for estimating worst-case pollutant dispersion within suburban or rural areas for these periods. A surface roughness length of 100 cm and a mixing height of 1000 meters were used in all cases. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at low levels. Thus, background contributions of carbon monoxide from sources or

roadways not directly considered in the analysis were accounted for by adding a background concentration of 0.5 ppm to all predicted concentrations for 2000. Although increased traffic is expected to occur within the project area within the next several years with or without the project, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time. Hence, a background value of 0.5 ppm was assumed to persist for the future scenarios studied.

Predicted Worst-Case 1-Hour Concentrations

Table 4 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated worst-case carbon monoxide concentrations are presented in the table for five scenarios: year 2000 with existing traffic, year 2010 without the project, year 2020 without the project, year 2010 with the project and year 2020 with the project. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated 1-hour concentration within the project vicinity for the present (2000) case was 5.1 mg/m^3. This was projected to occur during the afternoon peak-traffic hour near the intersection of Queen Kaahumanu Highway and Hina Lani Street. The predicted worst-case 1-hour concentration in the project area for the 2000 scenario was well within both the national AAQS of 40 mg/m^3 and the state AAQS of 10 mg/m^3.

In the year 2010 without the proposed project, a worst-case 1-hour concentration of 7.8 mg/m^3 was predicted to occur during the morning peak-traffic hour near the intersection of Queen Kaahumanu Highway and Hina Lani Street. The next highest value for the project area was 6.8 mg/m^3 and occurred during the morning at the Queen Kaahumanu Highway/Kaloko-Honokohau Park Access intersection. These concentrations were higher than the worst-case value for the existing case due to the expected increase in ambient traffic by 2010, but predicted worst-case 1-hour concentrations for the 2010 without project scenario remained within both the national and state AAQS.

In the year 2020 without the proposed project, worst-case concentrations were predicted to decrease slightly at the intersection of Queen Kaahumnau Highway and Kaloko-Honokohau Park Access but increase at the intersection of Queen Kaahumanu Highway and Hina Lani Street. A worst-case 1-hour concentration of 10.2 mg/m^3 was predicted to occur during the morning peak-traffic hour near the intersection of Queen Kaahumanu Highway and Hina Lani Street, while a maximum concentration of 6.3 mg/m^3 was predicted during the morning at the Queen Kaahumanu Highway/Kaloko-Honokohau Park intersection. The predicted worst-case 1-hour concentrations for the 2020 without project scenario remained within both the national and the state AAQS at the Queen Kaahumanu Highway intersection with Kaloko-Honokohau Park Access but slightly exceeded the state standard at the intersection of Queen Kaahumanu Highway and Hina Lani Street.

Predicted worst-case 1-hour concentrations for the 2010 with-project scenario ranged from 6.4 mg/m^3 during the afternoon at the Hina Lani Street intersection with Queen Kaahumanu Highway to 10.6 mg/m^3 during the morning at the Queen Kaahumanu Highway/South Access (Kaloko-Honokohau Park Access) intersection. Compared to

the 2010 without-project case, predicted worst-case concentrations for 2010 with the project were substantially higher at the intersection of Queen Kaahumanu Highway and the South Access but slightly lower at the intersection of Queen Kaahumanu Highway and Hina Lani Street. Potential exceedance of the state standard was indicated at the intersection of Queen Kaahumanu Highway and the South Access, but compliance with both state and national standards was predicted at the intersection of Queen Kaahumanu Highway and Hina Lani Street.

Predicted worst-case 1-hour concentrations for the 2020 with-project scenario ranged from 7.0 mg/m^3 during the afternoon at the Hina Lani Street intersection with Queen Kaahumanu Highway to 12.6 mg/m^3 during the morning at the Queen Kaahumanu Highway/South Access intersection. The predicted morning and afternoon worst-case concentrations were substantially higher at the South Access intersection with Queen Kaahumanu Highway compared to the 2020 without-project case but nearly unchanged at the Hina Lani Street intersection with Queen Kaahumanu Highway. Similar to the 2010 with-project scenario, the potential exceedance of the state standard was indicated at the intersection of Queen Kaahumanu Highway and the South Access, but compliance with both state and national standards was predicted at the intersection of Queen Kaahumanu Highway and Hina Lani Street.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for

a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One recent study based on modeling [9] concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [10] recommend using a value of 0.7 unless a locally derived persistence factor is available. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 5. For the 2000 scenario, the estimated worst-case 8-hour carbon monoxide concentration for the project area was 2.6 mg/m^3 at the intersection of Queen Kaahumanu Highway and Hina Lani Street. This in compliance with both the state standard of 5 mg/m^3 and the national standard of 10 mg/m^3.

For the year 2010 without-project scenario, the predicted worst-case concentrations were 3.4 and 3.9 mg/m^3 at the two locations studied. The predicted concentrations for the 2010 without-project scenario are substantially higher than the estimated existing worst-case concentration at Hina Lani Street but still meet both the national and state AAQS.

In the year 2020 without the project, the worst-case concentrations were predicted to decrease slightly to 3.2 mg/m^3 at the intersection of Queen Kaahumanu Highway and Kaloko-Honokohau Park Access and increase to 5.1 mg/m^3 at the intersection of Queen Kaahumanu Highway and Hina Lani Street. Areas near the Hina Lani Street intersection would potentially exceed the state standard

but remain in compliance with the less stringent national standard.

For the 2010 with-project scenario, predicted worst-case concentrations were 3.8 mg/m^3 at Hina Lani Street and 5.3 mg/m^3 at the South Access. Compared to the 2010 without-project scenario, concentrations would remain nearly unchanged at Hina Lani Street while increasing substantially at the South Access. With the project in the year 2010, the area near Hina Lani Street would continue to comply with state and national standards while the area near the South Access intersection with Queen Kaahumanu Highway would potentially exceed the more stringent state standard.

In the year 2020 with the project, worst-case concentrations were predicted to increase by about 20 to 25 percent at both locations studied compared to the 2010 with-project case. Similar to the 2010 with-project case, areas near the South Access would potentially exceed the state standard while complying with the national standard. Areas near Hina Lani Street would continue to comply with both state and national standards, although the predicted worst-case concentration is only slightly under the state limit.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an

hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

7.2 Business Park

Air pollution emissions from commercial/industrial facilities locating at the proposed business park could potentially result in direct impacts on air quality. While the specific residents of the mixed-use commercial/light industrial portion of the proposed project have not yet been identified, it is expected these will not have the potential to emit significant amounts of air pollution. The types of businesses that are expected to locate within the mixed-use commercial/light industrial area of the project which will be zoned as MCX include the following:

Examples of permitted uses within the commercial/light industrial area that will be allowed	
• Automobile sales and rentals • Automobile service stations • Business services • Data processing facilities • Financial institutions • Food manufacturing and processing • Home improvement centers • Light manufacturing, processing and packaging establishments • Medical clinics • Meeting facilities	• Offices • Repair establishments • Restaurants • Retail establishments • Sales and service of agricultural machinery • Business schools • Self-storage facilities • Utility substations • Veterinary establishments • Warehousing • Wholesaling and distribution operations

The quarry area of the project will include continuation of the existing quarry operation through 2020 as well as related uses, including the ongoing support operations for a concrete pre-cast business and concrete batching operations. These support activities currently occupy approximately 15 acres of land within the designated "Quarry Area". These and other compatible industrial uses are proposed to be expanded as the quarry material is depleted. Examples of permitted uses within the Quarry Area (MG zoned district) that would be allowed include the following:

Examples of Permitted Uses within the Quarry Area that will be allowed	
• Automobile and truck storage facilities	• Freight movers
• Automobile body and fender establishments	• Lava rock or stone cutting or shaping facilities
• Automobile service stations	• Lumber yards and building material yards
• Concrete or asphalt batching and mixing plants and yards	• Recycling centers
• Contractor's yards for equipment, material, and vehicle storage, repair or maintenance	• Major and minor repair establishments
	• Restaurants
	• Convenience stores

Examples of permitted uses within the Quarry Area that would be excluded include the following:

Examples of Permitted Uses within the Quarry Area that will be excluded	
• Airfields, heliports and private landing strips	• Daycare centers
• Animal sales, stock and feed yards	• Dumping, disposal, incineration or reduction of refuse or waste matter
• Aquaculture activities and facilities	• Fertilizer manufacturing plants
• Bulk storage of flammable or explosive products	• Junk yards
• Cemeteries and mausoleums	• Marine railways, drydocks and ship or boat yards
• Cleaning and dyeing plants	• Public dumps

None of the permitted uses within the mixed-use commercial/light industrial area have the potential to emit significant amounts of air pollution. Within the Quarry Area, industries that would be permitted and allowed and that would potentially emit air pollution will likely be limited primarily to concrete or asphalt batching and mixing plants or yards. The types of air pollutants that typically emanate from such facilities include particulate matter and fuel combustion byproducts such as sulfur dioxide, carbon monoxide and nitrogen oxides.

Without specific information concerning stockpile sizes and locations and stack heights, stack gas temperatures, exit velocities and emission rates, air quality impacts from the potential industrial facilities locating within the proposed business park cannot be quantitatively estimated. At the present time, such detailed information is not available. However, Hawaii air pollution control rules [5] require that any activity that causes air pollution must obtain written approval from the director of the Hawaii Department of Health. This written approval generally involves applying for a permit to construct and operate a facility that emits air pollution. At the time of application, detailed information must be provided by the applicant concerning the type and nature of any air pollution emissions and the emission control technology that would be utilized. Depending on the magnitudes of the project emissions and other factors, air quality impact analyses and/or air quality monitoring may be required before the application to construct/operate is approved. Thus, even though an assessment of potential direct impacts from project air pollution emissions cannot be done at this time, state rules may require that such analyses be performed at a later date when specific businesses apply to locate and operate at the proposed business park.

7.3 Electrical Demand

The proposed project also will cause indirect air pollution emissions from power generating facilities as a consequence of electrical power usage. The peak electrical demand of the project when fully developed is expected to reach 6500 kW [11]. Assuming the average demand is approximately one-half the peak demand, the annual electrical demand of the project will reach approximately 28 million kilowatt-hours. Electrical power for the project will most probably be provided mainly by oil-fired generating facilities, but some of the project power may also be derived from geothermal energy, wind power or other sources. In order to meet the electrical power needs of the proposed project, power generating facilities will likely be required to burn more fuel and hence more air pollution will be emitted at these facilities. Given in Table 6 are estimates of the indirect air pollution emissions that would result from the project electrical demand assuming all power is provided by burning more fuel oil at local power plants. These values can be compared to the island-wide emission estimates for 1993 given in Table 2. The estimated indirect emissions from project electrical demand amount to less than 1 percent of the present air pollution emissions occurring on Hawaii Island even if all power is assumed to be derived from oil.

7.4 Solid Waste Disposal

Solid waste generated by the proposed development when fully completed and occupied is not expected to exceed about 6300 tons per year [12]. Currently, all solid waste on the island is buried at solid waste landfills. Thus, assuming this continues to be the method for solid waste disposal, the only associated air pollution emissions that will occur will be from trucking the

waste to the landfill and burying it. These emissions should be relatively minor.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The major potential short-term air quality impact of the project will occur from the emission of fugitive dust during construction. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of windscreens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the site that have been disturbed could be controlled by mulching or by the use of chemical soil stabilizers. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Paving of parking areas and establishment of landscaping early in the construction schedule will also help to control dust. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program and to adjust the program if necessary.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting

construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

After the proposed project is completed, emissions from project-related traffic will cause an increase in carbon monoxide concentrations near some roadway intersections in the project area. The greatest impact will likely occur at the intersection of Queen Kaahumanu Highway and the Kaloko-Honokohau Park Access/South Project Access. With the project, worst-case carbon monoxide concentrations may exceed the state standards at this location but should remain well within the less stringent national standards. Without the project, worst-case concentrations at the Hina Lani Street intersection with Queen Kaahumanu Highway would potentially exceed the state standards by the year 2010 while complying with the national limits. Thus, with or without the project, worst-case carbon monoxide concentration levels at some locations in the project area during the next several years may exceed the state standards while compliance with the less stringent national standards will likely be maintained.

Due to the low levels at which the state carbon monoxide standards are set, it may not be possible to achieve continuous compliance with the standards, at least within some small hot-spot areas near high-volume intersections in the project area. Because the state standards are set at such stringent levels, it is likely that the standards are currently exceeded at many locations in the state that have even moderate traffic volumes.

Options available to mitigate long-term, traffic-related air pollution are generally to improve roadways, to reduce individual vehicular emissions or to reduce traffic volumes. Improving

roadways may not always provide reductions in maximum carbon monoxide concentrations. In some cases, roadway improvements may actually result in higher maximum concentrations when, for example, traffic lanes are added and more traffic becomes concentrated near an intersection. Reduction of emissions from individual vehicles would have to be achieved through the promulgation of local, state or federal air pollution control regulations, which is beyond the scope or ability of the proposed project. Currently, the state standards for tailpipe emissions are not commensurate with the stringent state air quality standards. Also, Hawaii currently does not require annual inspections of motor vehicle air pollution control equipment, which would likely provide reduced emissions and improved air quality. Perhaps the only practical way for the proposed project to reduce air quality impacts would be to attempt to reduce project-related traffic during peak traffic hours, although this type of mitigation measure is generally considered only partially successful. Reducing traffic volumes could conceivably be achieved by promoting bus service, bicycle riding and carpooling to the proposed development and by staggering local business hours to begin and end during off-peak traffic periods.

Another potential mitigation measure might be to provide added buffer zones between new walkways and roadways where possible, although technically, the public would have to somehow be excluded from the buffer zones. The predicted worst-case concentrations in this report are based on a separation distance of 3 m (10 ft) between walkways and roadways. Doubling this distance to about 6 m (20 ft) would reduce maximum concentrations by about 10 to 15 percent.

Given that the predicted worst-case carbon monoxide concentrations are well within the national ambient air quality standards, that

the more stringent state standards are probably currently exceeded near many roadway intersections in the state where traffic volumes are moderate to high, and that the state standards are predicted to be exceeded in the project area with or without the project, implementing air quality mitigation measures for long-term traffic-related impacts is probably unwarranted.

At this time, sufficient detail is not available describing the industries that may be located within the business park included in the project to perform any quantitative impact assessments. However, most of the types of facilities currently being considered do not emit significant amounts of air pollution. Those that do will likely be associated with the existing quarry operations. Before any new air pollution sources can be built anywhere in the state, an application must be submitted to the Department of Health for a permit to construct the facility, and detailed information concerning any air pollution emissions will need to be provided at that time. Depending on the magnitude of the proposed emissions, the Department of Health may require that an impact assessment and possibly air quality monitoring be performed.

Any long-term impacts on air quality due to indirect emissions from supplying the project with electricity and from the disposal of waste materials generated by the project will likely be relatively small based on the magnitudes of the estimated emissions compared to the current island-wide emissions. To further moderate any impacts, indirect emissions from project electrical demand could likely be reduced somewhat by incorporating energy-saving features into project design requirements. This might include the use of solar water heaters, water heater timers or possibly hot water on demand systems; designing building space so that window positions maximize indoor light

without unduly increasing indoor heat; using landscaping where feasible to provide afternoon shade to cut down on the use of air conditioning; installation of insulation and double-glazed doors to reduce the effects of the sun and heat; movable, controlled openings for ventilation at opportune times; and possibly automated room occupancy sensors. Solid waste related air pollution could likely be reduced somewhat by the promotion of conservation and recycling programs within the proposed development.

REFERENCES

1. U.S. Department of Commerce, Weather Bureau, "Climatography of the United States No. 86-44, Decennial Census of the United States Climate, Climatic Summary of the United States, Supplement for 1951 through 1960, Hawaii and Pacific", Washington, D.C., 1965.

2. Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources, Fifth Edition, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, January 1995.

3. State of Hawaii. Hawaii Administrative Rules, Chapter 11-60, Air Pollution Control.

4. The Traffic Management Consultant, Pre-Final Traffic Impact Analysis Report for the Proposed Honokohau Business Park, September 11, 2000.

5. User's Guide to MOBILE5A (Mobile Source Emission Factor Model), U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Mobile Sources, Emission Control Technology Division, Test and Evaluation Branch, Ann Arbor, Michigan, May 1994.

6. Guideline on Air Quality Models (Revised), Including Supplements A and B, EPA-450/2-78-027R, U.S. Environmental Protection Agency, Research Triangle Park, NC, July 1986.

7. User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections, U.S. Environmental Protection Agency, November 1992.

8. CALINE4 - A Dispersion Model for Predicting Air Pollutant Concentrations Near Roadways, FHWA/CA/TL-84/15, California State Department of Transportation, November 1984 with June 1989 Revisions.

9. "Persistence Factors for Mobile Source (Roadway) Carbon Monoxide Modeling", C. David Cooper, Journal of the Air & Waste Management Association, Volume 39, Number 5, May 1989.

10. Guideline for Modeling Carbon Monoxide from Roadway Intersections, U.S. Environmental Protection Agency, EPA-454/R-92-005, November 1992.

11. Personal communication, W.T. Oki, P.E., Inc. to William L. Moore, William L. Moore Planning, "Estimated Electrical Demand for Kaloko-Honokohau Business Park Development", November 8, 2000.

12. "Project Description and Development Assumptions, Kaloko-Honokohau Business Park", William L. Moore Planning, November 3, 2000.

Figure 1 - PROJECT LOCATION MAP

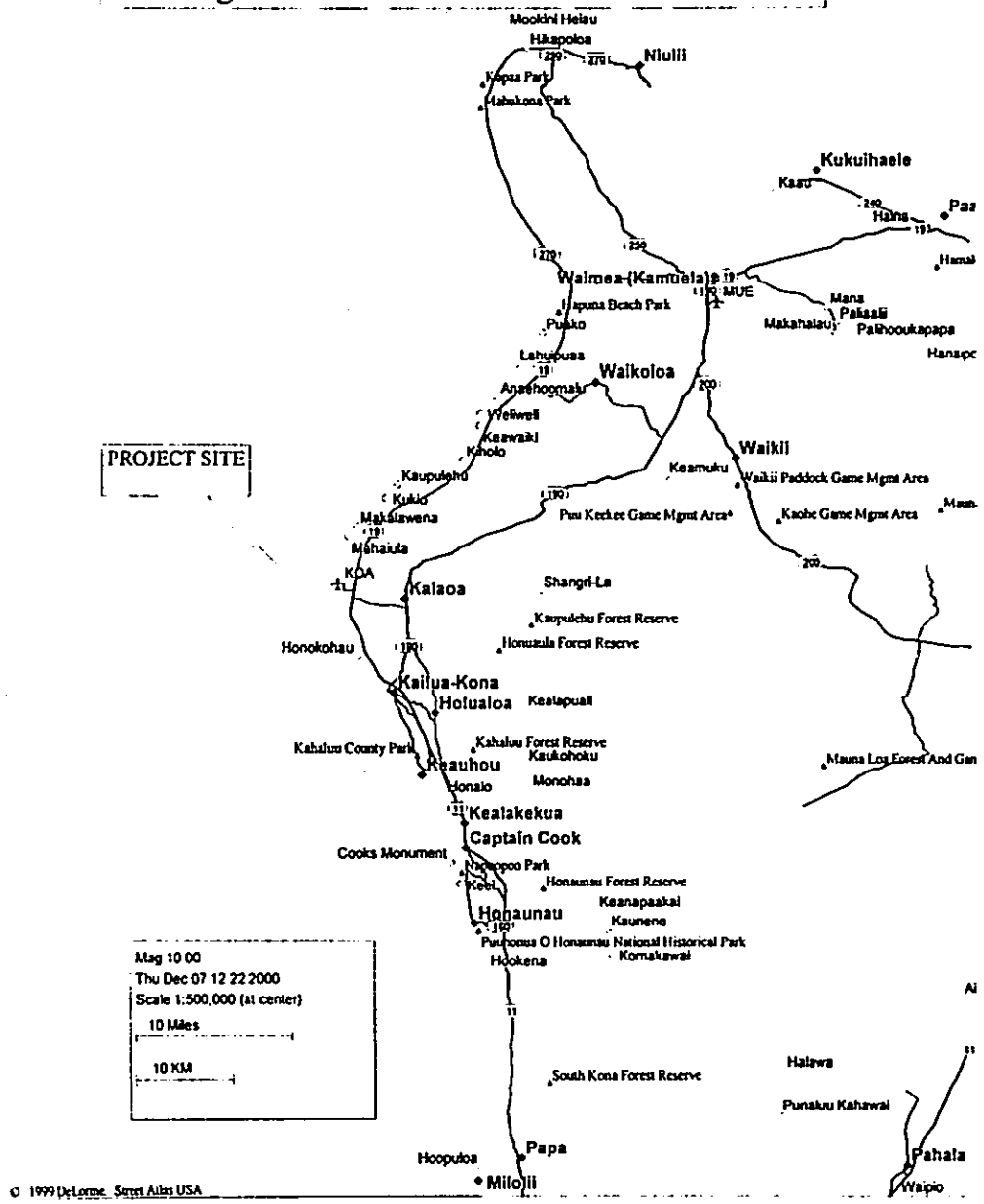

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	µg/m³	Annual 24 Hours	50[a] 150[b]	50[a] 150[b]	50 150[c]
Particulate Matter (<2.5 microns)	µg/m³	Annual 24 Hours	15[a] 65[d]	15[a] 65[d]	- -
Sulfur Dioxide	µg/m³	Annual 24 Hours 3 Hours	80 365[c] -	- - 1300[c]	80 365[c] 1300[c]
Nitrogen Dioxide	µg/m³	Annual	100	100	70
Carbon Monoxide	mg/m³	8 Hours 1 Hour	10[c] 40[c]	- -	5[c] 10[c]
Ozone	µg/m³	8 Hours 1 Hour	157[e] 235[f]	157[e] 235[f]	- 100[c]
Lead	µg/m³	Calendar Quarter	1.5	1.5	1.5
Hydrogen Sulfide	µg/m³	1 Hour	-	-	35[c]

[a] Three-year average of annual arithmetic mean.

[b] 99th percentile value averaged over three years.

[c] Not to be exceeded more than once per year.

[d] 98th percentile value averaged over three years.

[e] Three-year average of fourth-highest daily 8-hour maximum.

[f] Standard is attained when the expected number of exceedances is less than or equal to 1.

Note: Standards for particulate matter (<2.5 microns) and for 8-hour ozone are subject to court appeal.

Table 2

AIR POLLUTION EMISSIONS INVENTORY FOR
ISLAND OF HAWAII, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	30,311	9,157	39,468
Sulfur Oxides	9,345	nil	9,345
Nitrogen Oxides	4,054	8,858	12,912
Carbon Monoxide	3,357	23,934	27,291
Hydrocarbons	1,477	203	1,680

Source: Final Report, "Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii", prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 3

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR
MONITORING STATIONS NEAREST
KALOKO-HONOKOHAU BUSINESS PARK PROJECT

Parameter / Location	1999
Sulfur Dioxide / Kealakekua, Kona	
Period of Sampling (months)	12
3-Hour Averaging Period:	
No. of Samples	2859
Highest Concentration ($\mu g/m^3$)	60
2nd Highest Concentration ($\mu g/m^3$)	43
No. of State AAQS Exceedances	0
24-Hour Averaging Period:	
No. of Samples	360
Highest Concentration ($\mu g/m^3$)	18
2nd Highest Concentration ($\mu g/m^3$)	18
No. of State AAQS Exceedances	0
Annual Average Concentration ($\mu g/m^3$)	6
Particulate (PM-10) / Kealakekua, Kona	
Period of Sampling (months)	12
24-Hour Averaging Period:	
No. of Samples	47
Highest Concentration ($\mu g/m^3$)	28
2nd Highest Concentration ($\mu g/m^3$)	27
No. of State AAQS Exceedances	0
Annual Average Concentration ($\mu g/m^3$)	15

Source: State of Hawaii Department of Health, "Annual Summary, Hawaii Air Quality Data, 1999"

Table 5

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS
AT SELECTED INTERSECTIONS NEAR
KALOKO-HONOKOHAU BUSINESS PARK PROJECT
(milligrams per cubic meter)

Roadway Intersection	Year/Scenario				
	2000 Present	2010 Without Project	2020 Without Project	2010 With Project	2020 With Project
Queen Kaahumanu Highway at Kaloko-Honokohau Park/South Access	-	3.4	3.2	5.3	6.3
Queen Kaahumanu Highway at Hina Lani Street	2.6	3.9	5.1	3.8	4.8

Hawaii State AAQS: 5
National AAQS: 10

Table 4

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS
AT SELECTED INTERSECTIONS NEAR
KALOKO-HONOKOHAU BUSINESS PARK PROJECT
(milligrams per cubic meter)

Roadway Intersection	Year/Scenario									
	2000 Present		2010 Without Project		2020 Without Project		2010 With Project		2020 With Project	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Queen Kaahumanu Highway at Kaloko-Honokohau Park/South Access	-	-	6.8	4.3	6.3	3.9	10.6	8.2	12.6	10.7
Queen Kaahumanu Highway at Hina Lani Street	4.7	5.1	7.8	6.0	10.2	6.7	7.6	6.4	9.6	7.0

Hawaii State AAQS: 10
National AAQS: 40

Table 6

ESTIMATED INDIRECT AIR POLLUTION EMISSIONS FROM
KALOKO-HONOKOHAU BUSINESS PARK PROJECT ELECTRICAL DEMAND[a]

Air Pollutant	Emission Rate (tons/year)
Particulate	8
Sulfur Dioxide	70
Carbon Monoxide	6
Volatile Organics	<1
Nitrogen Oxides	31

[a]Based on U.S. EPA emission factors for utility boilers [2].
Assumes electrical demand of 28 million kilowatt-hrs per year and
low-sulfur oil used to generate power.

Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 13

Comments on Draft EIS and Responses

The following agencies and organizations commented on the Draft EIS.

• *Federal*
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Department of the Interior, Geological Survey
U.S. Army Corps of Engineers
U.S. Dept. of the Interior, Kaloko-Honokohau Nat. Historical Park

• *State*
Office of Environmental Quality Control
State Land Use Commission
Hawai`i State Environmental Center
DBEDT, Energy, Resources and Technology Division
DBEDT, Office of Planning
Department of Education
Department of Hawaiian Home Lands
Department of Health, Environmental Health Administration
Department of Accounting and General Services
Department of Land and Natural Resources, State Historic Preservation Division
Department of Land and Natural Resources, Comm. on Water Resource Management

• *County*
Department of Public Works
Department of Water Supply
Fire Department
Planning Department
Police Department

• *Elected Officials*
State Representative Jim Rath, House District 6

• *Organizations and Individuals*
McClean-Honokohau Properties
Hawai`i Leeward Planning Conference
Queen Liliuokalani Trust
West Hawai`i Concrete

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

GILBERT S. COLOMA-AGARAN
CHAIRPERSON

BRUCE S. ANDERSON
ROBERT G. GIRALD
BRIAN C. NISHIDA
DAVID A. NOBRIGA
HERBERT M. RICHARDS, JR.

LINNEL T. NISHIOKA
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

LAND USE COMMISSION
STATE OF HAWAII
2001 MAR 13 A 9:57

March 8, 2001

Bert Saruwatari
Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, HI 96804-2359

Dear Saruwatari:

Kaloko-Honokohau Business Park

Thank you for the opportunity to review the subject document. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas, which are important for the maintenance of streams and the replenishment of aquifers.

[x] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We recommend coordination with the Land Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[x] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[x] A Well Construction Permit and/or a Pump Installation Permit from the Commission would be required before ground water is developed as a source of supply for the project.

[ ] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the Commission would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] We are concerned about the potential for degradation of instream uses from development on highly erodible slopes adjacent to streams within or near the project. We recommend that approvals for this project be conditioned upon a review by the corresponding county's Building Department and the developer's acceptance of any resulting requirements related to erosion control.

[ ] If the proposed project includes construction of a stream diversion, the project may require a stream diversion works permit and amend the instream flow standard for the affected stream(s).

[ ] If the proposed project alters the bed and banks of a stream channel, the project may require a stream channel alteration permit.

[ ] OTHER:

If there are any questions, please contact Ryan Imata at 587-0255.

Sincerely,

LINNEL T. NISHIOKA
Deputy Director

ecometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Linnel Nishioka, Deputy Director
Commission on Water Resource Management
Hawai`i Department of Land and Natural Resources
P.O. Box 621
Honolulu HI 96809

Dear Ms. Nishioka:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of March 8, 2001 to Bert Saruwatari of the Hawai`i State Land Use Commission, in which you stated your agency's concern for efficient use of water resources through conservation measures and protection of water recharge areas.

As the author of the EIS for the project, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *Recommend coordination with County to incorporate project into Water Use and Development Plan.* The Hawai`i County Water Use and Development Plan (1991:p. 8-2) identified the Petition Area lands as part of the County's Urban Expansion Area. This area is served by the Department of Water Supply's (DWS) North Kona Water System. Lanihau will coordinate with DWS regarding the plan.
2. *Recommend approval for project be conditioned upon review by State Health Department and acceptance of water quality requirements.* The EIS has undergone review by DOH. Lanihau intends to comply with all applicable laws and regulations concerning water quality and has furthermore proposed extensive additional measures to protect water quality, as detailed in Section 4.2.2.2.3.2 of the Final EIS.
3. *Well Construction Permit and/or Pump Installation Permit will be required before groundwater can be used as supply for project.* Lanihau acknowledges that these permits are required for groundwater development and will seek them at the appropriate time.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC c/o Tsukazaki Yeh & Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

BRUCE S. ANDERSON, Ph.D., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

LAND USE COMMISSION
STATE OF HAWAII
2001 APR -2 A 10:57

March 23, 2001

Mr. Bert Saruwatari
Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Saruwatari:

This is in reference to the **Draft Environmental Impact Statement for the Kaloko-Honokohau Business Park, Honokohau, North Kona District, TMK (3rd): 7-4-8:13 (por.) and 30.**

1. Potential noise problems may occur in areas where commercial/industrial uses are adjacent to residential use. These areas should be designed as to minimize impacts on future residential areas.

2. Provisions for landscape setbacks or buffering distances where commercial/industrial uses are adjacent to residential use should be considered. Mitigative measures toward minimizing these impacts shall be implemented to comply with Chapter 11-46, Hawaii Administrative Rules, "Community Noise Control."

3. The contractor shall obtain a Community Noise Permit if the noise levels from the construction activities are expected to exceed the maximum permissible sound levels of the regulations as stated in Section 11-46-6(a), Hawaii Administrative Rules, Chapter 11-46, Community Noise Control.

4. Construction equipment and on-site vehicles requiring an exhaust of gas or air shall be equipped with mufflers as stated in Section 11-46-6(b)(1)(A).

5. The contractor shall comply with the requirements pertaining to construction activities as specified in the rules and the conditions issued with the permit as stated in Section 11-46-7(d)(4).

If there are any questions, please contact Russell S. Takata, Environmental Health Program Manager, Noise, Radiation and Indoor Air Quality Branch, at 586-4700.

Sincerely,

GARY GILL
Deputy Director
Environmental Health Administration

metrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Gary Gill, Deputy Director
Environmental Health Administration
Hawai'i State Department of Health
P.O. Box 3378
Honolulu, HI 96801

Dear Mr. Gill:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of March 23, 2001 to Bert Saruwatari of the Hawai'i State Land Use Commission. As the author of the EIS for the project, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *Design to reduce potential noise problems in areas adjacent to residential use.* As there are currently no residential uses within a half-mile of the site, no adverse noise impacts to existing residential units would occur. It should be noted that the major noise generator on the project site is an existing quarry, which has been operating under Conservation District Use Permit #HA-66/6/12-35 since 1967. Adjacent uses are industrial, commercial or grazing, and no adverse impacts have occurred or are projected to occur given these land uses. Currently, a residential area is proposed to the southeast of the quarry area, within the McLean-Honokohau Properties' land. It is recognized that depending upon the timing of the implementation of the housing project and the progress of quarrying on the Lanihau lands, a conflict may develop. This land use was shown on Figure 2-5 of the EIS in order to clearly identify the location of existing and proposed land uses and the potential for future incompatibility.
2. *Landscaping setbacks and buffers for areas adjacent to residential areas in order to comply with Chapter 11-46, HAR.* Through its General Plan and the *Keahole to Kailua Development Plan*, the County has identified the areas makai (west) of the future Mid-Level Road as being appropriate for commercial and industrial uses. While this does not preclude the establishment of residential uses within the general area, it does encourage the proposed commercial/industrial use. To the extent that residential uses are proposed adjacent to the Petition Area, Lanihau will work the County of Hawai'i during the rezoning process to minimize potential impacts to such uses, including the possible provision of landscaping or buffers.
3. *Community Noise Permit for construction if necessary.* As stated in the DEIS on p. 4-52, in cases where construction noise, as defined in Title 11, Chapter 46 HAR (Community Noise Control), is expected to exceed DOH "maximum permissible" property-line noise levels, contractors will obtain a permit in conformance with Title 11, Chapter 46, prior to construction. DOH will review the proposed activity, location, equipment, project purpose, and timetable in order to decide upon conditions and mitigation measures, such as restriction of equipment type, maintenance requirements, restricted hours, and portable noise barriers

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4. *Mufflers on construction equipment and on-site vehicles.* The Final EIS states that "Construction equipment and on-site vehicles will be equipped with mufflers as stated in Section 11-46–6(b)(1)(A)".
5. *Compliance with Section 11-46-7(d)(4).* The Final EIS states that "The contractor will comply with requirements pertaining to construction activities as specified in the rules and the conditions issued with the permit as stated in Section 11-46-7(d)(4), as determined to be necessary during consultation with DOH."

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

March 27, 2001

LAND USE COMMISSION
STATE OF HAWAII
2001 MAR 28 A 9:03

Civil Works Technical Branch

Mr. Bert Saruwatari
Hawaii State Land Use Commission
PO Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Saruwatari:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement (DEIS) for the Kaloko-Honokohau Business Park Project, North Kona, Island of Hawaii (TMK 7-4-8: por. 13 and 30). The following comments are provided in accordance with Corps of Engineers authorities to provide flood hazard information and to issue Department of the Army (DA) permits.

a. Based on the information provided, a DA permit will not be required for the project.

b. The flood hazard information provided on page 4-2 of the DEIS is correct.

Should you require additional information, please contact Ms. Jessie Dobinchick of my staff at (808) 438-8876.

Sincerely,

James Pennaz

James Pennaz, P.E.
Chief, Civil Works
Technical Branch

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

James Pennaz, P.E.
Civil Works Technical Branch
Department of the Army
U.S. Army Engineer District, Honolulu
Ft. Shafter, HI 96858-5440

Dear Mr. Pennaz:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of March 27, 2001 to Bert Saruwatari of the Hawai`i State Land Use Commission. As the author of the EIS for the project, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *Based on information provided, no D.A. permit will be required.* We acknowledge your statement that no permit is required, and Lanihau will inform your agency if conditions change or new conditions are discovered.
2. *Confirmation of DEIS flood hazard information.* Thank you for your review and concurrence that the information provided in the DEIS is correct.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

Harry Kim
Mayor

James S. Correa
Police Chief

County of Hawaii

POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-8869

March 29, 2001

Mr. Bert Saruwatari
Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, HI 96804-2359

Dear Mr. Saruwatari:

PROJECT NAME: KALOKO-HONOKOHAU BUSINESS PARK
TAX MAP KEY: (3RD): 7-4-8:13 (POR.) AND 30

In reviewing the EIS and plans for rezoning of the Kaloko-Honokohau Business Park, there were several concerns that directly affect both police services and the traffic movement issues.

Based on the extended 34 year build out for this project, the EIS notes that operating businesses would generate 6,915 permanent jobs on the site and an additional 3,357 off-site jobs. That totals to 10,272 new jobs in the Kailua area. Considering the existing job market in Kona and the lack of workers to perform work we can only guess that these new jobs will be filled with new residents to Kona.

Based on our current police manpower--1.8 officers to 1,000 residents-- this project would require additional 18 officers assigned to the patrol section alone. This figure would be much more appropriate in analyzing public safety services needed by this development.

Queen Kaahumanu Highway is supposed to be a limited use highway and all intersections were supposed to be grade separated. The EIS plans show a North and South entrance on Queen Kaahumanu Highway.

Due to the existing problems we already have with traffic along the highway, we recommend that ingress and egress to this industrial subdivision be via Hinalani or Kealakahehe Parkway with the connection of Kamanu and Kanalani Streets. This way,

traffic would be exiting or entering the industrial park through the existing intersection rather than creating two more traffic lights on Queen Kaahumanu Highway.

Sincerely,

JAMES S. CORREA
POLICE CHIEF

THOMAS J. HICKCOX
ASSISTANT POLICE CHIEF
FIELD OPERATIONS BUREAU

cc: Office of Environmental Quality Control
Lanihau Properties LLC
GeoMetrician Associates

metrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Thomas Hickcox, Asst. Police Chief
Field Operations Bureau
Hawai`i County Police Department
349 Kapiolani St.
Hilo HI 96720

Dear Mr. Hickcox:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of March 29, 2001, to Bert Saruwatari of the Hawai`i State Land Use Commission, in which you stated that your agency had concerns regarding police services and traffic movement. As the author of the EIS for the project, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *New jobs mean equivalent number of new residents.* The businesses expected to occupy the facility are either already operating (in the case of the quarry and related businesses) or are primarily service-type industries that depend upon, but do not measurably induce, population growth. Such businesses may be contrasted with operations such as: a) resort hotels, which often require a substantial new labor force and thus may induce migration; or b) resort residential, for which new (usually out-of-state) residents are an intrinsic characteristic. The proposed project, which will be occupied over a twenty to thirty year period, is not expected to induce any significant in-migration to Kona, but rather to service primarily the needs of the growing population, which will also supply a growing source of labor.
2. *Need for additional police officers.* We agree that as population in Kona grows, additional police services will be required. As stated in the Draft EIS in Section 4.3.4.3, the benefit-cost relationship is highly favorable for the County. In other words, the County tax revenues generated by the project will far exceed the cost of services that the project will impose upon the County, including police services.
3. *Queen Ka`ahumanu as limited access highway.* The State has very long-range plans that call for Queen Ka`ahumanu Highway to be converted to a six-lane, limited-access highway with grade-separated interchanges, and a frontage road. Our understanding is that this conversion is not likely to be undertaken within the next 20 years. However, in February of 2002 the State Department of Transportation (HDOT) announced that in June 2003 work would commence on widening Queen Ka`ahumanu Highway to a four-lane divided highway between Henry Street and Kona International Airport. The first phase of the project will extend between Henry Street and Kealakehe Parkway (entirely to the south of Petition Area) and will take about two years to complete. The timetable for the balance of the project has not been set. The Business Park project is thus being planned for a four-lane highway that will take access from several points, including two on the highway, which are currently referred to as North and South Roads. This access plan has been developed in close consultation with HDOT. If the limited-access highway is eventually implemented, the project will take access from the frontage road.

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4. *Access should be restricted to Hinalani Street and Kealakehe Parkway.* Access will be provided from Hinalani Street, and, eventually, from Kealakehe Parkway as well. Limiting access to these two points, however, would not reduce impacts but simply concentrate them at two points. The traffic studies presented in the DEIS indicate that adequate Level of Service can be maintained on all roadways through the proposed access scheme, given the planned mitigation. Therefore, we do not believe that general traffic circulation will be improved by restricting access in this way.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Harry Kim
Mayor

Edward Bumatay
Fire Chief

County of Hawaii
FIRE DEPARTMENT
80 Pauahi Street • Suite 101 • Hilo, Hawaii 96720
(808) 961-8297 • Fax (808) 961-8296

March 6, 2001

Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, HI 96804-2359

Attention: Bert Saruwatari

SUBJECT: Kaloko-Honokohau Business Park
North Kona, Hawaii
Tax Map Key: (3rd) 7-4-8:13 (por.) and 30

We have reviewed the Draft Environmental Impact Statement for the above-referenced project and have no comments.

EDWARD BUMATAY
Fire Chief

EB/mo

cc: Director, Office of Environmental Quality Control
Lanihau Properties, LLC, c/o Tsukazaki, Yeh and Moore
✓GeoMetrician Associates

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Chief
Hawai`i County Fire Department
80 Pauahi Street, Suite 101
Hilo, Hawai`i 96720

Dear Chief:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

We received and hereby acknowledge your no-comment letter of March 6, 2001 to Bert Saruwatari of the Hawai`i State Land Use Commission. As the author of the EIS for the project, and on behalf of Lanihau Properties, LLC ("Lanihau"), we thank you for your review of our document.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

GeoMetrician

BENJAMIN J. CAYETANO
GOVERNOR

PAUL G. LeMAHIEU, Ph.D.
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF THE SUPERINTENDENT

March 15, 2001

MEMO TO: Mr. Bert Saruwatari, Interim Executive Officer
Land Use Commission

F R O M: Paul G. LeMahieu, Ph.D., Superintendent
Department of Education

SUBJECT: Kaloko-Honokohau Business Park Draft EIS

The Department of Education has no comment on the subject draft environmental impact statement.

Thank you for the opportunity to respond.

PLeM:hy

cc: P. Yoshioka, DAS
G. Salmonson, OEQC
M. Moore, Lanihau Properties LLC
R. Terry, GeoMetrician Associates ✓

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ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Supt. Of Education
Hawai'i State Dept. of Ed.
P.O. Box 2360
Honolulu HI 96804

Dear Superintendent:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

We received and hereby acknowledge your no-comment letter of March 15, 2001 to Bert Saruwatari of the Hawai'i State Land Use Commission. As the author of the EIS for the project, and on behalf of Lanihau Properties, LLC ("Lanihau"), we thank you for your review of our document.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

(P)1196.1

MAR 20 2001

TO: Mr. Bert Saruwatari
Land Use Commission

SUBJECT: Kaloko - Honokohau Business Park
Draft Environmental Impact Statement

Thank you for the opportunity to review and comment on the subject project's Draft Environmental Impact Statement. The proposed land use reclassification does not impact any of our facilities, therefore, we have no comments.

If there are any questions regarding the above, please have your staff call Mr. Tyler Fujiyama of the Planning Branch at 586-0492.

Gordon Matsuoka

GORDON MATSUOKA
Public Works Administrator

TF:mo
c: Office of Environmental Quality Control
Tsukazaki, Yeh and Moore
✓GeoMetrician Associates

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March 19, 2002

Gordon Matsuoka, Public Works Administrator
Hawai`i Dept. of Accounting and General Services
P.O. Box 119
Honolulu HI 96810

Dear Mr. Matsuoka:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of March 20, 2001, to Bert Saruwatari of the Hawai`i State Land Use Commission, in which you stated that the proposed reclassification has no impact on your facilities. As the author of the EIS for the project, and on behalf of Lanihau Properties, LLC ("Lanihau"), we thank you for your review of the document.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

APR 6 REC'D

JM
- NBH
- RM
- file

HOUSE OF REPRESENTATIVES

STATE OF HAWAII
STATE CAPITOL
HONOLULU, HAWAII 96813

April 03, 2001

James S. Greenwell, President
Lanihau Properties, LLC
3465 Waialae Avenue, Suite 260
Honolulu HI 96816

Dear James,

I have received your letter of March 30, 2001 concerning the Kaloko-Honokohau Business Park and have subsequently reviewed the DEIS, which was on file in my office.

This project is consistent with the County General Plan. The K to K Plan and will provide needed space for economic growth on the Kona Coast.

I have no comments to add other than to wish you a successful venture.

With best regards,

Jim

Jim Rath

Copy to Bill + Ron faxed 4/6/01.

House District 6 – South Kohala, North Kona
Mailing address: State Capitol Room 427 Honolulu, HI 96813 • ph: 586-8510 fax 586-8514

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ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Representative Jim Rath
State Capitol
Honolulu HI 96813

Dear Representative Rath:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 3, 2001, to James S. Greenwell of Lanihau, in which you stated that the proposed project was consistent with the County General Plan and would provide needed space for economic growth on the Kona Coast. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we thank you for your review of the document.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

United States Department of the Interior

GEOLOGICAL SURVEY
Hawaiian Volcano Observatory
P. O. Box 51
(Courier address: 1 Crater Rim Drive)
Hawaii National Park, HI 96
U. S. A.718
Voice: (808) 967-8863 or 967-8819
Fax: (808) 967-8890 or 967-8819
E-mail: donswan@usgs.gov

April 7, 2001

Bert Saruwatari
Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, HI 96804-2359

Dear Mr. Saruwatari:

Thank you for giving the Hawaiian Volcano Observatory the opportunity to review the Draft Environmental Impact Statement for the Kaloko-Honokohau Business Park in North Kona. I have looked through the report for statements pertaining to the geology of the area and find them to be correct.

Sincerely yours,

Donald A. Swanson
Scientist-in-Charge

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March 19, 2002

Dr. Donald A. Swanson, Scientist in Charge
United States Geological Survey
Hawaiian Volcano Observatory
Hawai'i National Park, HI 96718-0051

Dear Dr. Swanson:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 7, 2001, to Bert Saruwatari of the Hawai'i State Land Use Commission, in which you have noted that the statements pertaining to the geology of the area in the EIS were correct. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we thank you for your review of the document.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

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KAUPULEHU DEVELOPMENTS
KEALAKEKUA RANCH LIMITED
KEALIA RANCH
KEAUHOU KONA CONSTRUCTION CORP.
KIEWIT PACIFIC COMPANY
KONA TRANSPORTATION
LANIHAU PARTNERS, L.P.

HAWAII LEEWARD PLANNING CONFERENCE
P.O. BOX 2159 • KAMUELA, HAWAII 96743-2159

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THE NATURE CONSERVANCY OF HAWAII
THE QUEEN EMMA FOUNDATION
WAIKOLOA LAND COMPANY
WAIMEA WATER SERVICES, INC.
WB KUKIO RESORT, LLC
WEST HAWAII CONCRETE
WIMBERLY ALLISON TONG & GOO

April 9th, 2001

Mr. Bert Saruwatari
Hawaii State Land Use Commission
Post Office Box 2359
Honolulu, HI 96804-2359

TESTIMONY

RE:

Project Name: Kaloko-Honokohou Business Park
Location: Island: Hawaii District: North Kona
Tax Map Key Number: (3rd), 7-4-8:13 (por.) and 30

I am John Ray, President of Hawaii Leeward Planning Conference, and I thank you for the opportunity to comment on the Draft EIS. We have reviewed the document and find it thorough and complete.

The project is consistent with existing and proposed County and State plans. Its location is ideal for this type of development. Situated along a major highway scheduled for expansion, the site is both accessible to the major population center and far enough removed to mitigate environmental and social impacts. The quarry and heavy industrial uses significantly support businesses in Kona and have existed for decades with no adverse effects.

This is clearly an in-fill project, which will facilitate the regional infrastructure grid. The intersection improvements and expansion of the road system reasonably addresses the traffic situation. The project will install dry sewer lines for future connection to the County Treatment Plant, and in the interim will treat sewage in a dispersed manner on individual lots to ensure that the groundwater and particularly the National Park will suffer no negative effects.

We find the archaeological and historical work impressive, particularly the extensive oral histories and archival research. The landscaping design with extra setbacks and appropriate use of plants is both sensitive to the National Park and the gateway to Kailua-Kona from the north.

Growth in West Hawaii clearly supports the need for this project. It will appropriately phase in needed inventory in a location well suited for this development, and set a high standard for industrial park development.

Thank you for the opportunity to testify.

JQ B. Ray

John B. Ray
President
Hawaii Leeward Planning Conference

Cc:

Director, Office of Environmental Quality Control
Lanihau Properties, LLC, c/o Tsukazaki, Yeh and Moore ATTN: Michael Moore
Ron Terry, GeoMetrician Associates

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March 19, 2002

John Ray, President
Hawai'i Leeward Planning Conference
P.O. Box 635
Kailua-Kona, HI 96745

Dear Mr. Ray:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 9, 2001, to Bert Saruwatari of the Hawai'i State Land Use Commission. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *Consistency with government plans and appropriateness of land use.* We concur with your evaluation.
2. *Infill project that will help connect and extend infrastructure in reasonable manner.* We concur with your evaluation.
3. *Review of archaeological and historical work and landscaping plan.* We appreciate the recognition of the thoroughness of the work accomplished as part of the EIS, and we hope that we have made a substantial contribution to the historical knowledge of the area. We look forward to providing a landscape that will harmonize with its surroundings and present an attractive gateway.
4. *Need for project/high standard for industrial parks.* We concur with your evaluation. Lanihau looks forward to developing the kind of project of which all Kona residents can be proud.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

WEST HAWAII CONCRETE

April 10, 2001

Hawaii State land Use Commission
PO Box 2359
Honolulu, Hawaii 96804-2359
Attention Bert Saruwatari

Draft Environmental Impact Statement dated February, 2001

Project Name: Kaloko-Honokohau Business Park
Location" Island of Hawaii and District of North Kona
TMK (3rd), 7-4-8:13 (por.) and 30

We received and reviewed the above documents and appreciate the opportunity to comment. We commend this project for providing a badly needed site for quarrying and related heavy industry services in West Hawaii.

West Hawaii Concrete and its predecessor companies have provided building material to support the growth of West Hawaii for close to 50 years now using Hawaii's most abundant building material resource, namely its high quality rock. This resource can be environmentaly friendly, helps support local jobs and reduces our dependence on importing other building materials.

While the resource is abundant on the Island of Hawaii there have always been a lack of sites where it is appropriate to produce the building materials this resource can supply. We think this project provides an excellent site for such activities. It is close enough to the need in Kailua-Kona to be economically viable. In every urban community we are aware of such sites are provided to be able to support the communities need for these kinds of building materials. Yet it is located far enough away from other activities so as not to cause noise or view nuisances. It has been used for the proposed use for many years. We know of no other development that is planning to provide sites for this type of use in the Kailua-Kona area.

Again we appreciate the opportunity to comment

Carl L. Simons
President

CC to Director of Environmental Quality Control
Lanihau Properties, LLC
GeoMetrician Associates

P.O. Box 1390
Kailua-Kona
Hawaii
96745-1390

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(808) 329-3561
(808) 329-2267 Fax

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March 19, 2002

Carl L. Simons, President
West Hawai`i Concrete
P.O. Box 1390
Kailua-Kona 96745-1390

Dear Mr. Simons:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 10, 2001, to Bert Saruwatari of the Hawai`i State Land Use Commission. As the author of the EIS, and *on behalf of* Lanihau Properties, LLC ("Lanihau"), we concur with your evaluations. We agree that the project provides a badly-needed site for quarrying and related activities, which are vital to the economic health of Kona, while minimizing noise and view nuisances.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

APR 18 RECD

Trustees of the

QUEEN LILI'UOKALANI TRUST

David M. Peters, Thomas K. Kaulukukui, Jr., First Hawaiian Bank
P.O. Box 3708, Honolulu, Hawaii 96811

April 14, 2001

Mr. James S. Greenwell, President
Lanihau Properties, LLC
3465 Waialae Avenue, Suite 260
Honolulu, HI 96816

Re: Koloko-Honokohau Business Park

Dear Jimmy:

Thank you for your letter dated March 30, 2001, asking for comments concerning Lanihau's Draft Environmental Impact Statement. We believe the proposed development follows the logical pattern of growth of Kailua-Kona. The Trustees have no further comments at this time other than to wish you the best.

Aloha,

Sincerely,

First Hawaiian Bank
Asset Manager

Frank G. Jahrling
Vice President

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integrating geographic science and planning

March 19, 2002

Frank Jahrling
Queen Liliuokalani Trust
P.O. Box 308
Honolulu HI 96811

Dear Mr. Jahrling:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 14, 2001, to James Greenwell of Lanihau, in which you stated that the proposed development follows the logical pattern of growth in Kona. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we thank you for your review of the document.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P.O. Box 50004
Honolulu, HI
96850

Our People...Our Islands...In Harmony

April 19, 2001

Mr. Bert Saruwatari
Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Saruwatari:

Subject: Draft Environmental Impact Statement (DEIS) - Kaloko-Honokohau Business Park, Hawaii

We have reviewed the above mentioned document and have the following comments to offer:

One of the primary concerns regarding this project would be related to waste byproduct disposal and runoff. Since this is an industrial site, there will be solvents, paints, fuels, and a wide array of possible chemical/industrial materials in use. In addition, the creation of impervious surfaces will cause increased runoff on the project site. The most common method of dealing with the additional runoff is to construct dry wells or vertical drains that take the water down into a subsurface matrix. Along the coastal zone there are brackish and freshwater portions for the Ghyben-Herzberg lens that are tidally influenced. Any intrusion of chemical/industrial waste either incidentally or intentionally reaching this tidally influenced subsurface water regime through the dry well system has the potential to impact the USFWS Kaloko Wildlife Refuge ponds and associated biota. One of the few large coral reef communities in West Hawaii is located in the coastal reach of the park and the pond is a habitat for endangered Hawaiian birds.

The EIS document details regulatory requirements for most of the proposed activities in the park but can give no guarantees that all requirements will be followed or understood by the many tenants and potentially diverse groups for industrial users. Potential injection well construction, along with the associated regulatory requirements are as well, discussed in the document.

The real issue lies in the difficulty of developing long risk assessment and threat to the refuge and makai areas from expanded industrial growth in the adjacent mauka areas. It is recommended that all lease and rent agreements for industrial users contain clauses specific to the hazards and penalties associated with disposal of waste byproducts in the immediate area. It should be further recommended that all vertical drains be stenciled with "No Dumping – Protect Groundwater" or "No Dumping – Goes to Ocean" type slogans for increased awareness and visibility of the potential connection between the Kaloko-Honokohau Business Park generated waste and ground and coastal water resources.

Care should be taken to protect valuable cultural and natural resource areas from degradation as Kona expands.

Thank you for the opportunity to review this document.

Sincerely,

ACTING FOR

KENNETH M. KANESHIRO
State Conservationist

Cc:
Ms. Genevieve Salmonson, Office of Environmental Quality Control, 235 South Beretainia Street, Suite 702, Honolulu, HI 96813
Mr. Michael Moore, Lanihau Properties LLC, c/o Tsukazaki, Yeh, and Moore, 100 Pauahi Street, Suite 204, Hilo, Hawaii 96720
Mr. Ron Terry, GeoMetrician Associates, HC2 Box 9575, Keaau, Hawaii 96749

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integrating geographic science and planning

March 19, 2002

Kenneth Kaneshiro, State Conservationist
U.S. Natural Resources Conservation Service
U.S. Department of Agriculture
P.O. Box 50004
Honolulu HI 96850

Dear Mr. Kaneshiro:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 19, 2001, to Bert Saruwatari of the Hawai`i State Land Use Commission. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), I offer the following response to your comment, which concerned potential water pollution.

Your comment notes that penetration of chemical/industrial waste into the groundwater has the potential to adversely impact the quality of water, and thus the ecosystems, of pond and nearshore environments. You note that the creation of impervious surfaces will create additional runoff. The comment goes on to state that there are no guarantees that the procedures required by law and regulation to prevent such an occurrence will be strictly adhered to by each and every industrial user in the subdivision at all times. This is followed by a recommendation that "all lease and rent agreements for industrial users contain clauses specific to the hazards and penalties associated with disposal of waste byproducts in the immediate area..." Your further recommendation is to stencil drains with slogans for increased awareness and visibility.

We agree that preservation of water quality in the ponds and nearshore waters downslope of the project is of vital concern. The Draft EIS presented information on existing water quality, calculated expected impacts, and outlined the measures provided by law and regulation that would minimize adverse water quality impacts and provide protection to sensitive resources.

Since publication of the Draft EIS, Lanihau has developed a number of additional mitigation measures that will increase water quality protection. These include:

- Commitment to working with the County to extend the sewer system to the Petition Area, including participating on a fair and equitable basis in an improvement district.
- In the interim period between the start of the project and connection to the Kealakehe Wastewater Treatment Plant (WWTP), Lanihau will require the use of an individual wastewater system (IWS) with an enhanced treatment system, where the IWS and absorption field are designed to remove no less than 80 percent of the Total Nitrogen as well as offering additional phosphorus removal. It is anticipated that no more than 15 percent of the ultimate total lot count would be built on and occupied before connection to the County's WWTP.

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- Development of Conditions, Covenants, and Restrictions (CC&Rs) for the Petition Area to contain spills and prevent materials associated with light industrial uses attributable to the operations on the property, including petroleum products, chemicals, or other pollutants from leaching or draining into the ground or subsurface storm drain collection areas, to the extent practicable. These CC&Rs shall be subject to approval by the Hawai'i State Department of Health, upon consultation with the National Park Service and the County of Hawaii. The CC&Rs will mandate adherence to a Pollution Prevent Plan that will address each use permissible in the Petition Area, by specifically designating Best Management Practices (BMPs) tailored to each specific use and activity. Emphasis shall be given to structural BMPs to prevent industrial pollutants from being released into the environment, including reaching the groundwater.
- The CC&Rs will also help disseminate critical information about pollution prevention laws, regulations, and required practices and will establish an owners' association with power to oversee and report violations as a second line of defense against pollution violations.
- The CC&Rs will incorporate requirements to stencil messages concerning water pollution prevention next to all stormwater inlets in the Business Park.
- Lanihau will participate in a ground water monitoring program as established by the Land Use Commission.
- Lanihau is agreeable to restricting certain land uses within the proposed Petition Areas. The restricted uses will include uses which are allowed in the General Industrial (MG) zoned lands and which may be generally considered to be offensive or have some element of danger, including heliports, bulk storage of flammable products (tank farms), landfills for dumping or disposal of refuse or waste matter (except possibly for green waste/composting facilities), fertilizer manufacturing plants, junkyards, refining of petroleum products, slaughterhouses and power plants.

In response to your concerns regarding increased runoff, the increased storm water flow generated by a more impervious surface will be collected and disposed of through injection wells. Storm water disposal is regulated by the State and County through the Department of Health and Department of Public Works respectively. In general, any additional stormwater runoff generated by the pavement of building construction must be disposed of on-site. Any existing storm water that flows through the area can continue in the same channel; however, the volume and velocity of the flow cannot be increased by any development. As such, there should be no additional off-site runoff.

As indicated above, the proposed CC&Rs will require that storm drains should be stencilled with slogans such as those you recommend. These have proven effective in raising environmental awareness in urban areas, where the link between the built environment of streets and buildings and the marine ecosystems is not obvious to the general public.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII

RAYNARD C. SOON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOBIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

April 20, 2001

Mr. Ron Terry
Geometrician Associates
HC 2 Box 9575
Kea'au, Hawaii 96749

Dear Mr. Terry:

Subject: Kaloko-Honokohau Business Park
Draft Environmental Impact Statement

Thank you for allowing our review of the subject draft report dated February 2001. Extensive information is provided to support the proposed district boundary amendment from Conservation to Urban to allow mixed light industrial and commercial uses on the subject 337 acres identified as Tax Map Key 7-4-08:13 (por.) and 30.

The report would be enhanced if it incorporated additional information and analyses to demonstrate that lands in the area that are now in the Urban District do not provide a sufficient reserve for foreseeable urban growth.

If you have any questions, please call Joe Chu at 587-6421.

Aloha,

Raynard C. Soon, Chairman
Hawaiian Homes Commission

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Raynard C. Soon, Chairman
Hawaiian Homes Commission
Hawai`i Dept. of Hawaiian Home Lands
P.O. Box 1879
Honolulu HI 96804

Dear Mr. Soon:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 20, 2001, in which you suggest that additional information is needed to demonstrate that lands in the area that are now in the Urban District do not provide a sufficient reserve for foreseeable urban growth.

In Section 4.3.4.1, the Market Study for the project undertook a detailed analysis of the West Hawai`i industrial market sector which included quantification of demand, identification of supply, and correlation of indicators. Based on population, business expansion and general economic trends, total additional demand is forecast at 388.5 gross acres and 3.18 million square feet over the next 20 years, more than double the present inventory. The existing in-place supply of industrial/business land in the Keahole-to-Kailua-Kona corridor will be sufficient to meet market demands for only another three or four years. After that time, additional properties will be required if the sector is to maintain an appropriate demand/supply balance. The recent offerings at Kaloko Industrial Park Phase II, Honokohau Iki, and Kohanaiki, while serving to fill pent-up demand that accumulated during the past decade, are almost fully absorbed, mostly by owner-user purchasers who plan on building and occupying the finished space over the next five years. Other existing projects (such as at NELHA and Kawaihae) are not competitive in the general market sector for reasons of restrictions or geography. While there are other large-acreage industrial additions proposed in the region, virtually all would have to be developed in a timely manner in order to meet demand levels. Although there would be an oversupply if all were approved and built during the projection period, this is considered highly unlikely. Several of the projects are second phases of existing parks that have yet to be scheduled; others are not yet approved, some have a leasehold land tenure that will not appeal to businesses requiring fee ownership; and some will probably be put to commercial uses. Sufficient industrial/commercial type land for projected future demand is not present in West Hawai`i. As it would be inadvisable to convert other types of State Land Use Urban land (e.g., residential) to industrial uses, we therefore conclude that lands in the area that are now in the Urban District do not provide a sufficient reserve to foreseeable urban growth.

As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we thank you for your review of the document.

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

use and activity. Emphasis shall be given to structural BMPs to prevent industrial pollutants from being released into the environment, including reaching the groundwater. The CC&RS will also establish an owners' association with power to oversee and report violations as a second line of defense against pollution violations.

Sincerely,

Ron Terry

cc: *Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore*
Anthony J.H. Ching, State Land Use Commission

HONOKOHAU PROPERTIES

Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, Hawaii 96804-2359

April 21, 2001

Re; Draft Environmental Impact Statement—
Kaloko-Honokohau Business Park

Gentlemen;

We take this opportunity to comment on the DEIS referred to above. Kaloko-Honokohau Business Park is a well-planned development that will make a substantial contribution to the economy of West Hawaii;

1. It will generate needed tax dollars.

2. It will provide heavy industrial sites, which are needed in our community.

3. The proposed extension of "Hamanu Street" from Costco through the proposed project to Honokohau Industrial Park which then connects to Kealakehe Parkway will provide a badly needed vehicular by-pass to lighten the traffic load on Queen Kaahumanu Highway.

Thank you for your consideration of our comments.

Sincerely,

Honokohau Properties

Robert S. Mc Clean

Robert S. Mc Clean
General Partner

P.O. Box 3000 / Kailua-Kona, Hawaii 96745 / 808-329-8277

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Robert S. McClean, General Partner
McClean-Honokohau Properties
P.O. Box 3000
Kailua-Kona HI 96745

Dear Mr. McClean:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 21, 2001, to Bert Saruwatari of the Hawai'i State Land Use Commission. We concur with your observations that the project will contribute to the economy and infrastructure of West Hawai'i through generation of tax dollars, provision of areas for quarry-related heavy industry, and in-fill of roadways connecting Hina Lani Street with Kealakehe Parkway. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), We thank you for your review of the document.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

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BENJAMIN J. CAYETANO
GOVERNOR

GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

April 23, 2001

Mr. Bert Saruwatari, Acting Executive Officer
State Land Use Commission
235 South Beretania Street, 4th Floor
Honolulu, Hawai'i 96813

Dear Mr. Saruwatari:

Subject: Draft EIS for the Kaloko-Honokohau Industrial Park, Hawai'i

Thank you for the opportunity to review the subject document. We have the following comments.

1. Using standards developed by the Department of Water Supply, the estimated demand for water use would be 1,120,000 gallons per day. However, the petitioner is estimating that the project would use only 367,000 gallons of water per day. Please consult with the Department of Water Supply to confirm that the lower estimate is acceptable for this project.

2. Using standards developed by the Department of Public Works, the estimated demand for wastewater generation would be 896,000 gallons per day. However, the petitioner is estimating that the project would generate only 200,000 gallons of wastewater per day. Please consult with the Department of Public Works to confirm that the lower estimate is acceptable for this project.

3. Please consider applying sustainable building techniques as presented in the enclosed "Guidelines for Sustainable Building Design in Hawaii."

4. The petitioner is proposing to implement Best Management Practices to avoid or minimize various impacts associated with this project. Please specify in more detail the actions that will be taken to implement and enforce these BMPs.

Should you have any questions, please call Jeyan Thirugnanam at 586-4185.

Sincerely,

Genevieve Salmonson
Director

Guidelines for Sustainable Building Design in Hawai`i

A planner's checklist

(Adopted by the Environmental Council on October 13, 1999)

Introduction

Hawai`i law calls for efforts to conserve natural resources, promote efficient use of water and energy and encourage recycling of waste products. Planning a project from the very beginning to include sustainable design concepts can be a critical step toward meeting these goals.

The purpose of the state's environmental review law (HRS Ch. 343) is to encourage a full, accurate and complete analysis of proposed actions, promote public participation and support enlightened decision making by public officials. The Office of Environmental Quality Control offers the following guidelines for preparers of environmental reviews under the authority of HRS 343 to assist agencies and applicants in meeting these goals.

These guidelines do not constitute rules or law. They have been refined by staff and peer review to provide a checklist of items that will help the design team create projects that will have a minimal impact on Hawai`i's environment and make wise use of our natural resources. In a word, projects that are *sustainable*.

A sustainable building is built to minimize energy use, expense, waste, and impact on the environment. It seeks to improve the region's sustainability by meeting the needs of Hawai`i's residents and visitors today without compromising the needs of future generations. Compared to conventional projects, a resource-efficient building project will:

I. Use less energy for operation and maintenance
II. Contain less *embodied* energy (e.g. locally produced building products often contain less *embodied* energy than imported products because they require less energy-consuming transportation.)
III. Protect the environment by preserving/conserving water and other natural resources and by minimizing impact on the site and ecosystems
IV. Minimize health risks to those who construct, maintain, and occupy the building
V. Minimize construction waste
VI. Recycle and reuse generated construction wastes

VII. Use resource-efficient building materials (e.g. materials with recycled content and low embodied energy, and materials that are recyclable, renewable, environmentally benign, non-toxic, low VOC (Volatile Organic Compound) emitting, durable, and that give high life cycle value for the cost.)

VIII. Provide the highest quality product practical at competitive (affordable) first and life cycle costs.

In order to avoid excessive overlapping of items, the checklist is designed to be read in totality, not just as individual sections. This checklist tries to address a range of project types, large scale as well as small scale. Please use items that are appropriate to the type and scale of the project.

Although this list will help promote careful and sensitive planning, mere compliance with this checklist does not confirm sustainability. Compliance with and knowledge of current building codes by users of this checklist is also required.

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I. Pre Design

___1. Hold programming team meeting with client representative, Project Manager, planning consultant, architectural consultant, civil engineer, mechanical, electrical, plumbing (MEP) engineer, structural engineer, landscape architect, interior designer, sustainability consultant and other consultants as required by the project. Identify project and sustainability goals. Client representatives and consultants need to work together to ensure that project and environmental goals are met.

___2. Develop sustainable guideline goals to insert into outline specifications as part of the Schematic Design documents. Select goals from the following sections that are appropriate for the project.

___3. Use Cost-Benefit Method for economic analysis of the sustainability measures chosen. (Cost-Benefit Method is a method of evaluating project choices and investments by comparing the present and life cycle value of expected benefits to the present and life cycle value of expected costs.)

___4. Include "Commissioning" in the project budget and schedule. (Building "Commissioning" is the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained in accordance with specifications that meet the owner's needs, and recognize the owner's financial and operational capacity. It improves the performance of the building systems, resulting in energy efficiency and conservation, improved air quality and lower operation costs. *Refer to Section IX.*)

II. Site Selection & Site Design

A. Site Selection

___1. Analyze and assess site characteristics such as vegetation, topography, geology, climate, natural access, solar orientation patterns, water and drainage, and existing utility and transportation infrastructure to determine the appropriate use of the site.

___2. Whenever possible, select a site in a neighborhood where the project can have a positive social, economic and/or environmental impact.

___3. Select a site with short connections to existing municipal infrastructure (sewer lines, water, waste water treatment plant, roads, gas, electricity, telephone, data communication lines and services). Select a site close to mass transportation, bicycle routes and pedestrian access.

B. Site Preparation and Design

___1. Prepare a thorough existing conditions topographic site plan depicting topography, natural and built features, vegetation, location of site utilities and include solar information,

rainfall data and direction of prevailing winds. Preserve existing resources and natural features to enhance the design and add aesthetic, economic and practical value. Design to minimize the environmental impact of the development on vegetation and topography.

___2. Site building(s) to take advantage of natural features and maximize their beneficial effects. Provide for solar access, daylighting and natural cooling. Design ways to integrate the building(s) with the site that maximizes and preserves positive site characteristics, enhances human comfort, safety and health, and achieves operational efficiencies.

___3. Locate building(s) to encourage bicycle and pedestrian access and pedestrian oriented uses. Provide bicycle and pedestrian paths, bicycle racks, etc. Racks should be visible and accessible to promote and encourage bicycle commuting.

___4. Retain existing topsoil and maintain soil health by clearing only the areas reserved for the construction of streets, driveways, parking areas, and building foundations. Replant exposed soil areas as soon as possible. Reuse excavated soils for fill and cut vegetation for mulch.

___5. Grade slopes to a ratio of less than 2 : 1 (run to rise). Balance cut and fill to eliminate hauling. Check grading frequently to prevent accidental over excavation.

___6. Minimize the disruption of site drainage patterns. Provide erosion and dust controls, positive site drainage, and siltation basins as required to protect the site during and after construction, especially, in the event of a major storm.

___7. Minimize the area required for the building footprint. Consolidate utility and infrastructure in common corridors to minimize site degradation, and cost, improve efficiency, and reduce impermeable surfaces.

___8. For termite protection, use non toxic alternatives to pesticides and herbicides, such as Borate treated lumber, Basaltic Termite Barrier, stainless steel termite barrier mesh, and termite resistant materials.

III. Building Design

___1. Consider adaptive re-use of existing structures instead of demolishing and/or constructing a new building. Consult the State Historic Preservation Officer for possible existing historic sites that may meet the project needs.

___2. Plan for high flexibility while designing building shell and interior spaces to accommodate changing needs of the occupants, and thereby extend the life span of the building.

___3. Design for re-use and/or disassembly. (For recyclable and reusable building products, see Section VII).

___4. Design space for recycling and waste diversion opportunities during occupancy.

___5. Provide facilities for bicycle and pedestrian commuters (showers, lockers, bike racks, etc.) in commercial areas and other suitable locations.

___6. Plan for a comfortable and healthy work environment. Include inviting outdoor spaces, wherever possible. *(Refer to Section VIII.)*

___7. Provide an Integrated Pest Management approach. The use of products such as Termi-mesh, Basaltic Termite Barrier and the Sentricon "bait" system can provide long term protection from termite damage and reduce environmental pollution.
___8. Design a building that is energy efficient and resource efficient. *(See Sections IV, V, VII.)* Determine building operation by-products such as heat gain and build up, waste/gray-water and energy consumption, and plan to minimize them or find alternate uses for them.
___9. For natural cooling, use
   a. Reflective or light colored roofing, radiant barrier and/or insulation, roof vents
   b. Light colored paving (concrete) and building surfaces
   c. Tree Planting to shade buildings and paved areas
   d. Building orientation and design that captures trade winds and/or provides for convective cooling of interior spaces when there is no wind.

IV. Energy Use

___1. Obtain a copy of the State of Hawai`i Model Energy Code (available through the Hawai`i State Energy Division, at Tel. 587-3811). Exceed its requirements. (Contact local utility companies for information on tax credits and utility-sponsored programs offering rebates and incentives to businesses for installing qualifying energy efficient technologies.)
___2. Use site sensitive orientation to :
   a. Minimize cooling loads through site shading and carefully planned east-west orientation.
   b. Incorporate natural ventilation by channeling trade winds.
   c. Maximize daylighting.
___3. Design south, east and west shading devices to minimize solar heat gain.
___4. Use spectrally selective tints or spectrally selective low-e glazing with a Solar Heat Gain Coefficient (SHGC) of 0.4 or less.
___5. Minimize effects of thermal bridging in walls, roofs and window systems.
___6. Maximize efficiencies for lighting, Heating, Ventilation, Air Conditioning (HVAC) systems and other equipment. Use insulation and/or radiant barriers, natural ventilation, ceiling fans and shading to avoid the use of air conditioning whenever appropriate.
___7. Eliminate hot water in restrooms when possible.
___8. Provide tenant sub-metering to encourage utility use accountability.
___9. Use renewable energy. Use solar water heaters and consider the use of photovoltaics and Building Integrated Photovoltaics (BIPV).
__10. Use available energy resources such as waste heat recovery, when feasible.

A. Lighting

___1. Design for at least 15% lower interior lighting power allowance than the Energy Code.
___2. Select lamps and ballasts with the highest efficiency, compatible with the desired level of illumination and color rendering specifications. Examples that combine improved color rendering with efficient energy use include compact flourescents and T8 flourescents that use tri-phosphor gases.
___3. Select lighting fixtures which maximize system efficacy and which have heat removal capabilities
___4. Reduce light absorption on surfaces by selecting colors and finishes that provide high reflectance values without glare.
___5. Use task lighting with low ambient light levels.
___6. Maximize daylighting through the use of vertical fenestration, light shelves, skylights, clerestories, building form and orientation as well as through translucent or transparent interior partitions. Coordinate daylighting with electrical lighting for maximum electrical efficiency.
___7. Incorporate daylighting controls and/or motion activated light controls in low or intermittent use areas.
___8. Avoid light spillage in exterior lighting by using directional fixtures.
___9. Minimize light overlap in exterior lighting schemes.
__10. Use lumen maintenance procedures and controls.

B. Mechanical Systems

___1. Design to comply with the Energy Code and to exceed its efficiency requirements.
___2. Use "Smart Building" monitor/control systems when appropriate.
___3. Utilize thermal storage for reduction of peak energy usage.
___4. Use Variable air volume systems to save fan power.
___5. Use variable speed drives on pumping systems and fans for cooling towers and air handlers.
___6. Use air-cooled refrigeration equipment or use cooling towers designed to reduce drift.
___7. Specify premium efficiency motors.
___8. Reduce the need for mechanical ventilation by reducing sources of indoor air pollution. Use high efficiency air filters and ultraviolet lamps in air handling units. Provide for regular maintenance of filtration systems. Use ASHRAE standards as minimum.
___9. Locate fresh air intakes away from polluted or overheated areas. Locate on roof where possible. Separate air intake from air exhausts by at least 40 ft.
__10. Use separate HVAC systems to serve areas that operate on widely differing schedules and/or design conditions.
__11. Use shut off or set back controls on HVAC system when areas are not occupied.
__12. Use condenser heat, waste heat or solar energy. (Contact local utility companies for information on the utility-sponsored Commercial and Industrial Energy Efficiency

Programs which offer incentives to businesses for installing qualifying energy efficient technologies.)

__13. Evaluate plug-in loads for energy efficiency and power saving features.

__14. Improve comfort and save energy by reducing the relative humidity by waste reheat, heat pipes or solar heat.

__15. Minimize heat gain from equipment and appliances by using:
   a. Environmental Protection Agency (EPA) Energy Star rated appliances.
   b. Hoods and exhaust fans to remove heat from concentrated sources.
   c. High performance water heating that exceeds the Energy Code requirements.

__16. Specify HVAC system "commissioning" period to reduce occupant exposure to Indoor Air Quality (IAQ) contaminants and to maximize system efficiency.

V. Water Use

A. Building Water

___1. Install water conserving, low flow fixtures as required by the Uniform Plumbing Code.

___2. If practical, eliminate hot water in restrooms.

___3. Use self closing faucets (infrared sensors or spring loaded faucets) for lavatories and sinks.

B. Landscaping and Irrigation

(See Section VI.)

VI. Landscape and Irrigation

___1. Incorporate water efficient landscaping (xeriscaping) using the following principles:
   a. Planning, Efficient irrigation: Create watering zones for different conditions. Separate vegetation types by watering requirements. Install moisture sensors to prevent operation of the irrigation system in the rain or if the soil has adequate moisture. Use appropriate sprinkler heads.
   b. Soil analysis/improvement: Use (locally made) soil amendments and compost for plant nourishment, improved water absorption and holding capacity.
   c. Appropriate plant selection: Use drought tolerant and/or slow growing hardy grasses, native and indigenous plants, shrubs, ground covers, trees, appropriate for local conditions, to minimize the need for irrigation.
   d. Practical turf areas: Turf only in areas where it provides functional benefits.

e. Mulches: Use mulches to minimize evaporation, reduce weed growth and retard erosion.

Contact the local Board of Water Supply for additional information on xeriscaping such as efficient irrigation, soil improvements, mulching, lists of low water-demand plants, tours of xeriscaped facilities, and xeriscape classes.

___2. Protect existing beneficial site features and save trees to prevent erosion. Establish and carefully mark tree protection areas well before construction.

___3. Limit staging areas and prevent unnecessary grading of the site to protect existing, especially native, vegetation.

___4. Use top soil from the graded areas, stockpiled on the site and protected with a silt fence to reduce the need for imported top soil.

___5. Irrigate with non-potable water or reclaimed water when feasible. Collect rainwater from the roof for irrigation.

___6. Sub-meter the irrigation system to reduce water consumption and consequently water and sewer fees. Contact the local county agency to obtain irrigation sub-metering requirements and procedures. Locate irrigation controls within sight of the irrigated areas to verify that the system is operating properly.

___7. Use pervious paving instead of concrete or asphalt paving. Use natural and man-made berms, hills and swales to control water runoff.

___8. Avoid the use of solvents that contain or leach out pollutants that can contaminate the water resources and runoff. Contact the State of Hawai`i Clean Water Branch at 586-4309 to determine whether a NPDES (National Pollutant Discharge Elimination System) permit is required.

___9. Use Integrated Pest Management (IPM) techniques. IPM involves a carefully managed use of biological and chemical pest control tactics. It emphasizes minimizing the use of pesticides and maximizing the use of natural process

__10. Use trees and bushes that are felled at the building site (i.e. mulch, fence posts). Leave grass trimmings on the lawn to reduce green waste and enhance the natural health of lawns.

__11. Use recycled content, decay and weather resistant landscape materials such as plastic lumber for planters, benches and decks.

VII. Building Materials & Solid Waste Management

A. Material Selection and Design

___1. Use durable products.

___2. Specify and use natural products or products with low embodied energy and/or high recycled content. Products with recycled content include steel, concrete with glass,

drywall, carpet, etc. Use ground recycled concrete, graded glass cullet or asphalt as base or fill material.

___3. Specify low toxic or non-toxic materials whenever possible, such as low VOC (Volatile Organic Compounds) paints, sealers and adhesives and low or formaldehyde-free materials. Do not use products with CFCs (Chloro-fluoro-carbons).

___4. Use locally produced products such as plastic lumber, insulation, hydro-mulch, glass tiles, compost.

___5. Use advanced framing systems that reduce waste, two stud corners, engineered structural products and prefabricated panel systems.

___6. Use materials which require limited or no application of finishing or surface preparation. (i.e. finished concrete floor surface, glass block and glazing materials, concrete block masonry, etc.).

___7. Use re-milled salvaged lumber where appropriate and as available. Avoid the use of old growth timber.

___8. Use sustainably harvested timber.

___9. Commit to a material selection program that emphasizes efficient and *environmentally* sensitive use of building materials, and that uses locally available building materials. (A list of Earth friendly products and materials is available through the Green House Hawai`i Project. Call Clean Hawai`i Center, Tel. 587-3802 for the list.)

B. Solid Waste Management, Recycling and Diversion Plan

___1. Prepare a job-site recycling plan and post it at the job-site office.

___2. Conduct pre-construction waste minimization and recycling training for employees and sub-contractors.

___3. Use a central area for all cutting.

___4. Establish a dedicated waste separation/diversion area. Include Waste/Compost/Recycling collection areas and systems for use during construction process and during the operational life cycle of the building.

___5. Separate and divert all unused or waste cardboard, ferrous scrap, construction materials and fixtures for recycling and/or forwarding to a salvage exchange facility. Information on "Minimizing C&D (construction and demolition) waste in Hawai`i" is available through Department of Health, Office of Solid Waste Management, Tel. 586-4240.

___6. Use all green waste, untreated wood and clean drywall on site as soil amendments or divert to offsite recycling facilities.

___7. Use concrete and asphalt rubble on-site or forward the material for offsite recycling.

___8. Carefully manage and control waste solvents, paints, sealants, and their used containers. Separate these materials from C&D (construction and demolition) waste and store and dispose them of them carefully.

___9. Donate unused paint, solvents, sealants to non-profit organizations or list on HIMEX (Hawai`i Materials Exchange). HIMEX is a free service operated by Maui Recycling

Group, that offers an alternative to landfill disposal of usable materials, and facilitates no-cost trades. See web site, www.himex.org.

__10. Use suppliers that re-use or recycle packaging material whenever possible.

VIII. Indoor Air Quality

___1. Design an HVAC system with adequate supply of outdoor air, good ventilation rates, even air distribution, sufficient exhaust ventilation and appropriate air cleaners.

___2. Develop and specify Indoor Air Quality (IAQ) requirements during design and contract document phases of the project. Monitor compliance in order to minimize or contain IAQ contaminant sources during construction, renovation and remodeling.

___3. Notify occupants of any type of construction, renovation and remodeling and the effects on IAQ.

___4. Inspect existing buildings to determine if asbestos and lead paint are present and arrange for removal or abatement as needed.

___5. Supply workers with, and ensure the use of VOC (Volatile Organic Compounds)-safe masks where required.

___6. Ensure that HVAC systems are installed, operated and maintained in a manner consistent with their design. Use UV lamps in Air Handling Units to eliminate mold and mildew growth. An improperly functioning HVAC system can harbor biological contaminants such as viruses, bacteria, molds, fungi and pollen, and can cause Sick Building Syndrome (SBS).

___7. Install separate exhaust fans in rooms where air polluting office equipment is used, and exhaust directly to the exterior of the building, at sufficient distance from the air intake vents.

___8. Place bird guards over air intakes to prevent pollution of shafts and HVAC ducts.

___9. Control indoor air pollution by selecting products and finishes that are low or non-toxic and low VOC emitting. Common sources of indoor chemical contaminants are adhesives, carpeting, upholstery, manufactured wood products, copy machines, pesticides and cleaning agents.

__10. Schedule finish application work to minimize absorption of VOCs into surrounding materials e.g. allow sufficient time for paint and clear finishes to dry before installing carpet and upholstered furniture. Increase ventilation rates during periods of increased pollution.

__11. Allow a flush-out period after construction, renovation, remodeling or pesticide application to minimize occupant exposure to chemicals and contaminants.

IX. Commissioning & Construction Project Closeout

___1. Appoint a Commissioning Authority to develop and implement a commissioning plan and a preventative maintenance plan. Project Manager's responsibilities must include coordination of commissioning activities during project closeout.
___2. Commissioning team should successfully demonstrate all systems and perform operator training before final acceptance.
___3. Provide flush-out period to remove air borne contaminants from the building and systems.
___4. Provide as-built drawings and documentation for all systems. Provide data on equipment maintenance and their control strategies as well as maintenance and cleaning instructions for finish materials.

X. Occupancy and Operation

A. *General Objectives*

___1. Develop a User's Manual for building occupants that emphasizes the need for Owner/Management commitment to efficient sustainable operations.
___2. Management's responsibilities must include ensuring that sustainability policies are carried out.

B. Energy

___1. Purchase EPA rated, Energy Star, energy-efficient office equipment, appliances, computers, and copiers. (Energy Star is a program sponsored by U.S. Dep. Of Energy. Use of these products will contribute to reduced energy costs for buildings and reduce air pollution.)
___2. Institute an employee education program about the efficient use of building systems and appliances, occupants impact on and responsibility for water use, energy use, waste generation, waste recycling programs, etc.
___3. Re-commission systems and update performance documentation periodically per recommendations of the Commissioning Authority, or whenever modifications are made to the systems.

C. Water

___1. Start the watering cycle in the early morning in order to minimize evaporation.
___2. Manage the chemical treatment of cooling tower water to reduce water consumption.

D. Air

___1. Provide incentives which encourage building occupants to use alternatives to and to reduce the use of single occupancy vehicles.

___2. Provide a location map of services within walking distance of the place of employment (child care, restaurants, gyms, shopping).
___3. Periodically monitor or check for indoor pollutants in building.
___4. Provide an IAQ plan for tenants, staff and management that establishes policies and documentation procedures for controlling and reporting indoor air pollution. This helps tenants and staff understand their responsibility to protect the air quality of the facility.

E. Materials and Products

___1. Purchase business products with recycled content such as paper, toners, etc.
___2. Purchase Furniture made with sustainably harvested wood, or with recycled and recycled content materials, which will not off gas VOC's.
___3. Remodeling and painting should comply with or improve on original sustainable design intent.
___4. Use low VOC, non-toxic, phosphate and chlorine free, biodegradable cleaning products.

F. Solid Waste

___1. Collect recyclable business waste such as paper, cardboard boxes, and soda cans.
___2. Avoid single use items such as paper or Styrofoam cups and plates, and plastic utensils.

XI. Resources

Financing: Energy Efficiency in Buildings. U.S. Department of Energy, DOE/EE-0152, May, 1998 (Call Tel.1-800-DOE-EREC or visit local office)

Building Commissioning: The Key to Quality Assurance. U.S. Department of Energy, DOE/EE-0153, May, 1998 (Call Tel.1-800-DOE-EREC or visit local office)

Guide to Resource-Efficient Building in Hawaii. University of Hawai`i at Manoa, School of Architecture and Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, October 1998. (Call Tel. 587-3804 for publication)

Hawaii Model Energy Code. Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, November 1997 (Call Tel. 587-3810 for publication)

Photovoltaics in the Built Environment: A Design Guide for Architects and Engineers. NREL Publications, DOE/GO #10097-436, September 1997 (Call Tel.1-800-DOE-EREC or visit local office)

Building Integrated Photovoltaics: A Case Study. NREL Publications #TP-472-7574, March 1995 (Call Tel.1-800-DOE-EREC or visit local office)

Solar Electric Applications: An overview of Today's Applications. NREL Publications, DOE/GO #10097-357, Revised February, 1997 (Call Tel.1-800-DOE-EREC or visit local office)

Green Lights: An Enlightened Approach to Energy Efficiency and Pollution Prevention. U.S. Environmental Protection Agency, Pacific Island Contact Office (Call Tel. 541-2710 for publication.)

Healthy Lawn, Healthy Environment. U.S. Environmental Protection Agency, Pacific Island Contact Office. (Call Tel. 541-2710 for this and related publications)

How to Plant a Native Hawaiian Garden. Office of Environmental Quality Control (OEQC), Department of Health, State of Hawai`i (Call Tel. 586-4185 for publication)

Buy Recycled in Hawai`i. Clean Hawai`i Center, Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, November 1997. (Call Tel. 587-3802 for publication)

Hawai`i Recycling Industry Guide and other recycling and reuse related fact sheets. Clean Hawai`i Center, Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, July 1999. (Call Tel. 587-3802 for publication)

Minimizing Construction and Demolition Waste. Office of Solid Waste Management, Department of Health and Clean Hawai`i Center, Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, February 1998. (Call Tel. 586-4240 for publication)

Contractor's Waste Management Guide and Construction and demolition Waste Management Facilities Directory. Clean Hawai`i Center, Energy, Resources and Technology Division, Department of Business, Economic Development and Tourism, 1999. (Call Tel. 587-3802 for publication)

Waste Management and Action: Construction Industry. Department of Health, Solid and Hazardous Waste Branch (Call Tel. 586-7496 for publication)

Business Guide For reducing Solid Waste. U.S. Environmental Protection Agency, Pacific Island Contact Office, Tel. 541-2710 (Call for publication.)

The Inside Story: A Guide to Indoor Air Quality. U.S. Environmental Protection Agency, Pacific Island Contact Office, Tel. 541-2710 (Call for this and related publications.) Additional information is available from the American Lung Association, Hawai'i, Tel. 537-5966

Selecting Healthier Flooring Materials. American Lung Association and Clean Hawai'i Center, February 1999. (Call Tel. 537-5966 x307)

Office Paper Recycling: An Implementation Manual. U.S. Environmental Protection Agency, Pacific Island Contact Office, Tel. 541-2710 (Call for publication.)

Acknowledgments

OEQC and the Environmental Council would like to thank Allison Beale, Gary Gill, Nick H. Huddleston, Gail Suzuki-Jones, Purnima McCutcheon, Virginia B. MacDonald, Steve Meder, Ramona Mullahey, Thomas P. Papandrew, Victor Olgay, Howard Tanaka, and Howard Wiig for their assistance with this project.

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Genevieve Salmonson, Director
Hawai'i State Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

Dear Ms. Salmonson:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 23, 2001, to Bert Saruwatari of the Hawai'i State Land Use Commission. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *Consult with DWS to confirm lower water use estimate is acceptable.* The Hawai'i County Department of Water Supply (DWS) has been consulted throughout development of the project and was supplied with a copy of the DEIS for review. It bears emphasis that the estimate based on DWS standards of 1,120,000 gallons per day (GPD) will indeed be the amount used to assist engineers in sizing storage and transmission facilities, and will be used by the County in assessing the amount of aquifer and water system capacity that the proposed project would involve. The lower figure was employed to provide a more realistic estimate of expected water use, and is based on actual Department of Water Supply records of water use within the existing Kaloko Industrial Park as well as actual use from the quarry and related operations within the Petition Area. Lanihau will continue to coordinate with the Hawai'i County DWS regarding water use.
2. *Consult with DPW to confirm lower estimate of wastewater generation is acceptable.* As with DWS, the Hawai'i County Department of Public Works (DPW) has been consulted throughout development of the project and was supplied with a copy of the DEIS for review. DPW, in their response letter to the DEIS, clarified that they do not yet have published standards, and instead usually employ the City and County of Honolulu standards. Just as with water supply, the higher estimate based on Honolulu standards of 896,000 gallons per day (GPD) will indeed be the amount used to assist engineers to determine how much of the sewage treatment system's capacity the proposed project would utilize. The lower figure was employed to provide a more realistic estimate of actual projected wastewater generation, based on long-term records of the quarry and related activities, and industrial/commercial operations in similar areas of Kona.
3. *Sustainable building design.* Thank you for forwarding this helpful summary. Lanihau plans to supply a copy to lot buyers and others who plan construction on the site, along with other information concerning solar energy and pollution prevention.
4. *Implementation and enforcement of BMPs.* The BMPs are required by law and will be enforced by appropriate agencies, as detailed in Section 4.2.2.2. Furthermore, Lanihau proposes to use the Conditions, Covenants, and Restrictions (CC&Rs) as the vehicle for developing and implementing a Pollution Prevention Plan that will address each use permissible in the Petition Area, by specifically designating Best Management Practices (BMPs) tailored to each specific

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use and activity. Emphasis shall be given to structural BMPs to prevent industrial pollutants from being released into the environment, including reaching the groundwater. The CC&RS will also establish an owners' association with power to oversee and report violations as a second line of defense against pollution violations.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission

BENJAMIN J. CAYETANO
GOVERNOR
SEIJI F. NAYA, Ph.D
DIRECTOR
SHARON S. NARIMATSU
DEPUTY DIRECTOR
DAVID W. BLANE
DIRECTOR, OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

ENERGY, RESOURCES & TECHNOLOGY DIVISION
235 South Beretania Street, State Office Tower, 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804
Web site: www.hawaii.gov/dbedt/ert

Telephone: (808) 587-3807
Fax: (808) 586-2536

April 23, 2001

Mr. Bert Saruwatari
Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Saruwatari:

Subject: Kaloko-Honokohau Business Park
North Kona, Hawaii
Tax Map Key: 7-4-8:13 (por.) and 30

Thank you for the opportunity to provide comments on the Draft Environmental Impact Statement (DEIS) for the reclassification of land in the Conservation District to allow mixed light industrial and commercial uses and to allow the retention and expansion of the existing quarrying and quarry-related uses. We would like to call your attention to: (1) State energy conservation goals, (2) energy saving design practices and technologies, and (3) recycling and recycled-content products.

1. **State energy conservation goals.** Project buildings, activities, and site grounds should be designed with energy saving considerations. The mandate for such consideration is found in Chapter 344, HRS ("State Environmental Policy") and Chapter 226 ("Hawaii State Planning Act"). In particular, we would like to call to your attention HRS 226 18(c)(4) which includes a State objective of promoting all cost-effective energy conservation through adoption of energy-efficient practices and technologies.

We recommend that you consult the Hawaii County Energy Code early on in your project. Hawaii Electric Light Co., Inc may also have demand-side management programs that offer rebates for installation of energy efficient technologies.

2. **Energy saving design practices and technologies.** We recommend that energy efficient design practices and technologies be specifically addressed. Some of the methods and technologies that could be considered, as appropriate, include:

- Use of natural ventilation to increase comfort of occupants;
- Maximum use of natural lighting without heat gain;
- Use of high efficiency compact fluorescent lighting;
- Use of insulation/radiant barrier for an equivalent R-19 value in ceiling; use of ceiling fans; and
- Us of landscaping for dust control and to minimize heat gain to area.

3. **Recycling and recycled-content products.**

- Develop a job-site recycling plan for construction and recycle as much construction and demolition waste as possible;
- Incorporate provisions for recycling into the project – a collection system and space for bins for recyclables; and
- Specify and use products with recycled content such as: steel, concrete aggregate fill, drywall, carpet and glass tile.

Please refer to the enclosed *Guidelines for Sustainable Building Design In Hawaii: A planner's checklist* and *A Contractor's Waste Management Guide"* for additional information.

Sincerely,

Maurice H. Kaya
Energy, Resources, and Technology
Program Administrator

Enclosures

c: OEQC
Lanihau Properties LLC, c/o Tsukazaki, Yeh and Moore
GeoMetrician Associates

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Maurice H. Kaya
Hawai`i DBEDT, Energy, Resources & Tech. Div.
P.O. Box 2359
Honolulu HI 96804

Dear Mr. Kaya:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 23, 2001, to Bert Saruwatari of the Hawai`i State Land Use Commission. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *State energy conservation goals.* Project buildings, activities and site grounds will be designed with consideration for energy saving strategies and designs. As stated in the DEIS, lot buyers will be encouraged to utilize passive and active solar strategies in planning. Lanihau will provide a detailed energy information packet for all prospective tenants and initial lot buyers. The packet would provide a basic overview of the energy issues including photovoltaic opportunities, solar water heating, passive and active energy conservation strategies, and "designing for solar" (i.e., planning buildings and parking lots to accommodate potential solar facilities and avoiding the need for future retrofits). For you information, Lanihau has already initiated discussions with HELCO on such matters.
2. *Specific energy saving design practices and technologies.* We endorse the strategies you name in your letter, and Lanihau plans to include them in the above-mentioned informational packet.
3. *Recycling and using recycled-content products.* Lanihau will consider your recommendations for maximizing job-site recycling and providing opportunities for ongoing recycling. As far as specifications for products with recycled content, we agree in principle, but we would observe that the businesses that will be located in the business park will tend to utilize recycled-content products to the extent that they are suitable, available and competitive in price.
4. *"Guidelines for Sustainable Buildings..." and "Contractor's Waste Management Guide."* Thank you for referring these publications to our attention. Lanihau plans to supply a copy to lot buyers and others who plan construction on the site, along with other information concerning solar energy and pollution prevention.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

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BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P.O. Box 2359
Honolulu, HI 96804-2359
Telephone: 808-587-3822
Fax: 808-587-3827

April 25, 2001

Fax (808/969-1531 & Mail)
Michael Moore, Esq.
Tsukazaki, Yeh, and Moore
85 W. Lanikaula Street
Hilo, Hawaii 96720

Fax (808/966-7593 & Mail)
Mr. Ron Terry
Geometrician Associates
HC 2 Box 9575
Keaau, Hawaii 96749

Dear Messrs. Moore and Terry:

Subject: LUC Docket No. A00-730/Lanihau Partners L. P.

This is to acknowledge receipt of your letter dated February 21, 2001 transmitting copies of the Draft Environmental Impact Statement ("DEIS"), the Office of Environmental Quality Control, Department of Health ("OEQC") Bulletin Publication Form, mailing lists, and project summary.

Based upon review of the DEIS, we have the following comments:

1. In regard to Section 2.3, Project Cost and Schedule, the Phase 3 development, which includes Area D, is slated to start around year 2015 or year 2020. The Final Environmental Impact Statement ("FEIS") should clarify whether incremental districting would be more appropriate for this phase, inasmuch as full development of the Petition Area cannot substantially be completed within 10 years.

2. In regard Section 4.1, Basic Orientation to Site, the FEIS should clarify the length of time granted for the Conservation District Use Permit ("CDUP"). A copy of the CDUP, Appendix 1, indicated that the intended use of the permit area was for 40 years from July 8, 1966.

Also, the FEIS should clarify what will be done with the excavated areas no longer yielding aggregate materials.

3. In regard to Section 4.2.2.2.1, Potential Impacts to Groundwater and Mitigation, we recommend that the FEIS include discussion of mitigative and/or treatment measures for generated stormwater runoff. The DEIS identified the use of Best Management Practices ("BMPs") to mitigate potential contamination, but there are no measures addressing treatment options. For your information, the Kaloko-Honokohau National Historical Park ("KAHO") expressed concerns over potential contamination of its fishponds, anchialine ponds, and coastal resources from untreated stormwater runoff to the Commission through its intervention in the hearing proceedings of *LUC* Docket No. A00-732/TSA Corporation ("Kaloko Industrial Park II and IV"). In addition, the Office of Planning acknowledged that surface runoff may contribute to the potential contamination and that there should be discussion of specific treatment measures.

4. In regard to Section 4.2.2.2.3.2, Mitigation for Potential Impacts from Toxic Substances, we recommend that the FEIS clarify if the Conditions, Covenants and Restrictions ("CC&Rs") of the proposed Kaloko-Honokohau Business Park will include BMPs that may not be required by existing laws and regulations, and how these measures will be implemented by individual lot owners, tenants, or users.

5. In regard to Section 4.3.2, Archaeological and Historic Site Resources, we recommend that the FEIS identify preservation areas for those sites containing significant archaeological resources such as lava tube associated with burials, sections of the old mauka-makai trails, petroglyphs, and other resources identified in the DEIS. Also, we recommend discussion on how these sites will be preserved, such as incorporation of buffers, reconfiguration of proposed lots, or other methods.

6. In regard to Section 4.3.3.4, Impacts to Valued Natural, Cultural and Historical Resources and Mitigation, we recommend that the FEIS identify future discussions with KAHO and community organizations in the design of the Business Park, and landscaping plans that may incorporate native species common to the Petition Area and region.

7. In regard to Sections 4.3.4.2, Economic Impact Analysis, we recommend that the FEIS clarify why there will not be any socio-economic impacts in light of the estimated 174,683 worker years during construction and estimated increases of 6,915 permanent on-site jobs and 3,357 off-site jobs. During the proceedings of the Kaloko Industrial Park III and IV, the Commission pointed out that the estimated increases in employment from that project may result in socio-economic impacts relating to affordable housing and traffic. The Commission believed that workers for the project will most likely commute

from other areas because of high housing costs in Kona, and the time and distance spent on commuting may impact their health and safety.

8. In regard to Section 4.3.5, Roads and Traffic, we recommend correcting Table 4-12, Existing Traffic Conditions. The table incorrectly identified the southbound movement from Hina Lani Street to Queen Kaahumanu Highway as a right turn and the northbound movement as a left turn, these movements are reversed. Also, on Tables 4-13, Traffic Conditions at Year 2010, With and Without Project, and 4-14, Traffic Conditions at Year 2020, With and Without Project, we recommend that the FEIS identify the respective right and left turns that are being assessed at the respective intersections. It is unclear which movements are being assessed.

   We recommend that the FEIS include analysis of projected traffic impacts generated by the proposed Phases III and IV of the Kaloko Industrial Park. Also, it is unclear if the projected traffic analysis considered the impacts from the adjoining Kaloko Industrial Park III and IV. We understand that TSA Corporation will be revising its traffic impact analysis. We recommend that the FEIS include the revised analysis of TSA Corporation in assessing the intersections that will be used in common.

We have no further comments to offer on the DEIS for the subject docket. If you have questions regarding this matter, please contact me or Russell Kumabe of our office at 587-3822.

Sincerely,

BERT SARUWATARI
Acting Executive Officer

c: OEQC

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Mr. Anthony J.H. Ching, Executive Officer
State Land Use Commission
Department of Business, Economic Development and Tourism
P.O. Box 2359
Honolulu HI 96804-2359

Dear Mr. Ching:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for the comment letter of April 25, 2001. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *Incremental districting.* Lanihau believes incremental districting will not be appropriate for the planned project in that development of Phase III will commence as the market conditions warrant. Under the most favorable circumstances, development could commence in 2011 in conjunction with the Phase II development. However, a reasonable scenario would anticipate commencement of Phase III development in around 2015. The actual development schedule will depend on market conditions and may vary according to the economy, market demand, financing, permits and approvals, and available infrastructure. In addition, the inclusion of the Phase III area as part of the SLU Urban district will facilitate the road network of the County's *Keahole to Kailua Development Plan*, which calls for the extension of a new collector road ("Main Street") through the mauka portions of the Petition Area to better provide for the regional circulation of this portion of Kona. While the timing of the construction of this collector road has not been determined, its implementation may also affect the timing of development of the Phase III. For your information, Figure 4-7, *Roadway System*, has been revised to better reflect the County's current proposed road network, including the inclusion of the new collector road (equivalent to "Main Street") through the Phase III area in response to comments by the County of Hawai'i's Department of Public Works and Planning Department.
2. *Conservation District Use Permit duration and use of former quarry areas.* Upon reviewing the application and permit conditions for CDUP HA-35, the Hawai'i State Department of Land and Natural Resources determined in a letter of February 23, 2001, to Mel Macy of West Hawai'i Concrete that "there is no specific permit condition requiring that the permit expire at any time, [and] there is no requirement that the uses approved by the permit cease on any given date." A copy of this letter is attached. The discussion on p. 2-3 of the DEIS has been supplemented in the Final EIS by the statement that excavated areas no longer yielding aggregate materials will be converted to industrial use.
3. *Mitigative treatment to stormwater runoff; other agencies' concerns.* Through comment letters to the DEIS, the National Park and the Office of Planning have stated their concerns, which Lanihau shares. Storm water disposal is regulated by the State and County through the Department of Health and Department of Public Works respectively. In general, any additional

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stormwater runoff generated by the pavement of building construction must be disposed of on-site. Any existing storm water that flows through the area can continue in the same channel; however, the volume and velocity of the flow cannot be increased by any development.

An important purpose of the BMPs for urban land uses is to *prevent* contamination of stormwater at the source. The Draft EIS presented extensive information on the measures provided by law and regulation that would minimize contamination of stormwater. Since publication of the Draft EIS, Lanihau has developed a number of additional mitigation measures that will further reduce such contamination at its source. Such measures include:

- Development of Conditions, Covenants, and Restrictions (CC&Rs) for the Petition Area to contain spills and prevent materials associated with light industrial uses attributable to the operations on the property, including petroleum products, chemicals, or other pollutants from leaching or draining into the ground or subsurface storm drain collection areas, to the extent practicable. These CC&Rs shall be subject to approval by the Hawai'i State Department of Health, upon consultation with the National Park Service and the County of Hawaii. The CC&Rs will mandate adherence to a Pollution Prevent Plan that will address each use permissible in the Petition Area, by specifically designating Best Management Practices (BMPs) tailored to each specific use and activity. Emphasis shall be given to structural BMPs to prevent industrial pollutants from being released into the environment, including reaching the groundwater.
- The CC&Rs will also help disseminate critical information about pollution prevention laws, regulations, and required practices and will establish an owners' association with power to oversee and report violations as a second line of defense against pollution violations.
- The CC&Rs will incorporate requirements to stencil messages concerning water pollution prevention next to all stormwater inlets in the Business Park.
- Lanihau is agreeable to restricting certain land uses within the proposed Petition Areas. The restricted uses will include uses which are allowed in the General Industrial (MG) zoned lands and which may be generally considered to be offensive or have some element of danger, including heliports, bulk storage of flammable products (tank farms), landfills for dumping or disposal of refuse or waste matter (except possibly for green waste/composting facilities), fertilizer manufacturing plants, junkyards, refining of petroleum products, slaughterhouses and power plants.

This information has also been added to the FEIS in Section 4.2.2.2.3.2.

4. *Those mitigation practices for impact from toxic substances not required by law or regulation.* Please see the response to the previous question for a detailed listing of such mitigation.

5. *Identification of preservation areas and discussion of preservation methods.* Since the publication of the Draft EIS, the State Historic Preservation Division of the Department of Land and Natural Resources has approved the Inventory Survey and recommended mitigation proposals. All sites recommended for preservation are identified in the Final EIS, including all burials. As noted by SHPD, the next step in the historic preservation process is the preparation of a detailed preservation plan and data recovery plan. These will be developed in consultation with the Kaloko-Honokohau National Historical Park staff as well as SHPD. Until these plans are prepared and approved, it is still premature to outline preservation areas or plans in any more detail than currently presented in the DEIS. It is recognized, however, that Lanihau is committed to preservation and appropriate treatment of all sites identified as significant for preservation in place, including preservation of representative sections of significant trails.

6. *Identify discussions with KAHO and other groups concerning design and landscaping as an element of mitigation for impacts to valued natural, cultural and historical resources.* Lanihau

has been meeting with and will continue discussions with such groups. The FEIS has been amended in Section 4.3.3.4 to identify this process as a mitigation element.

7. *Socio-economic impacts in terms of affordable housing and traffic resulting from providing jobs.* The businesses expected to occupy the facility are either already operating (in the case of the quarry and related businesses) or are primarily service-type industries that depend upon, but do not measurably induce, population growth. Such businesses may be contrasted with operations such as: a) resort hotels, which may often require a substantial new labor force and thus induce migration; or b) resort residential, for which new (usually out-of-state) residents are an intrinsic characteristic. The proposed project, which will be occupied over a twenty to thirty year period, is not expected to induce any significant in-migration to Kona, but rather to service primarily the needs of the growing population, which will also supply a growing source of labor. Specifically concerning housing, Lanihau understands and is committed to abiding by Chapter 11 of the Hawai'i County Code, which presents the requirements for affordable housing in relationship to rezoning. As for traffic, the traffic impact analysis presented in the EIS included consideration of commuter traffic in the project and regional roadways.

8. *Roads and Traffic.* Thank you for drawing our attention to the error; Table 4-12 has been corrected in the FEIS. Tables 4-13 and 4-14 are meant to provide a concise summary of traffic performance under the With- and Without-Project scenarios. With all due respect, we believe that adding detailed information on each turning movement for every intersection to the tables in the body of the EIS would add a level of unnecessary complexity that would frustrate interpretation. For clarification, as indicated in the notes accompanying each table, the listed LOS pertains to the overall intersection performance at signalized intersections; at unsignalized intersections, the LOS pertains to the critical movement, i.e., the movement with the greatest number of vehicles. Readers interested in more detailed information on intersection performance can refer to the series of maps included in Appendix 11, which includes information for all turning movements.

As stated in various places in Section 4.3.5 (please see p. 4-93, 4-94, 4-95, 4-96, and 4-99), consideration of the traffic generated by Phases III and IV of the Kaloko Industrial Park was an integral part of the traffic study conducted for the DEIS. We have reviewed the letter that accompanied the traffic study submitted for the October 2000 version of the traffic study for the Kaloko Industrial Park EIS, and there do not appear to be any revisions in conditions or data that would necessitate any revision of our traffic analysis.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Genevieve Salmonson, Office of Environmental Quality Control

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

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND DIVISION
STATE PARKS
WATER RESOURCE MANAGEMENT

FEB 23 2001

Ref.: PB:EAH
File No.: Correspondence HA 01-35

Mr. Mel D. Macy
West Hawaii Concrete
P.O. Box 1390
Kailua-Kona, HI 96745

Dear Mr. Macy,

Subject: Request for Review of Construction Plans to Replace Old Scale and Quarry Office at West Hawaii Concrete, Lanihau Quarry, Portion of Land Commission Award 11216 Apana 36 and Royal Patent 7587, Honokohau, North Kona, County of Hawaii, TMK 3rd 7-4-08: por. 13, Pursuant to Conservation District Use Permit (CDUP) HA-35, July 8, 1966

Thank you for your request dated December 1, 2000, regarding the subject Old Scale and Quarry Office at the Lanihau Quarry. We understand that you intend to replace the present scale and quarry office structures with new larger structures. We understand that the remodeled and enlarged scale and quarry office structures will be used in connection with the operation of the quarry and the removal and processing of natural materials.

CDUP HA-35 provides for a quarrying operation and the removal and processing of natural materials, pursuant to certain methods contained in the application, on a 231.723 acre portion of a parcel at the subject location in the General Subzone of the State Land Use Conservation District. The approval is subject to Paragraph C and Paragraph F of Section 2, Regulation No. 4, Department of Land and Natural Resources, 1964.

The issue regarding the possible automatic expiration of the subject permit was discussed during the review of your request. The 1966 application for CDUP HA-35 also appears to provide that the uses approved therein must cease in July, 2006. However, upon further review of the application and permit, it has been determined, as there is no specific permit condition requiring that the permit expire at any time, that there is no requirement that the uses approved by the permit cease on any given date. Therefore, the approved uses do not necessarily have to cease in July, 2006.

As such, your request to replace the present scale and quarry office structures with new larger structures is hereby approved. This approval is contingent upon the remodeled and enlarged structures being used in connection with on-site office space or operational needs. Please keep us informed of any changes in the project's construction plans.

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Should you have any further questions regarding this matter, please contact Eric Hill of our Land Division's planning staff at (808) 587-0380.

Aloha,

GILBERT S. COLOMA-AGARAN
Chairperson

c. Hawaii Board Member
DBEDT(OP/LUC)
County of Hawaii, Department of Planning

University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
Krauss Annex 19• 2500 Dole Street • Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

April 27, 2001
RE: 0715

Mr. Michael Moore
Lanihau Partners, LP
c/o Tsukazaki, Yeh, and Moore
85 W. Lanikaula St.
Hilo, Hawaii 96720

Dear Mr. Moore:

Draft Environmental Impact Statement
Kaloko-Honokohau Business Park
Honokohau,Hawai'i

The applicant, Lanihau Partners, LP, proposes to reclassify 336.984 acres of Conservation District land to the Urban District in Honokohau, North Kona in the county of Hawai'i. The land will be utilized for the development of light industrial and commercial usage, and for expansion of existing quarry related use. The estimated cost of the project is approximately $9,000,000.

This review was prepared with the assistance of George Curtis, Department of Natural Sciences, University of Hawaii at Hilo and Niyati Ni, Environmental Center.

General Comments

The proposed project is a commercial development on mostly poor land. The draft environmental impact statement (DEIS) does an adequate job in describing potential impacts and mitigative measures; however, there are deficiencies in the discussions of water and electrical supply sections that should be addressed. There also seems to be a noticeable lack of discussions of alternatives to the proposed project in Section 3.3. The Hawaii Administrative Rules 11-200-17(f) states that " The draft EIS shall describe in a separate and distinct section alternatives which could attain the objectives of the action, regardless of cost, in sufficient detail to explain why they were rejected." Therefore, it is difficult to discuss alternatives when there are none listed except the "no action" option. We expect a serious discussion of other options, should be made, and while residential or commercial usages are briefly mentioned, they are quickly dismissed without much analysis.

Water Supply

Section 4.4.2 states that for the proposed project there is an estimated demand of 1,120,000 gallons per day. However, later in the same paragraph it is stated that a lesser amount of 367,000 GPD will be needed. The lower estimate is according to the DEIS "based on very similar land use elsewhere in Kona, along with information from the existing quarry and related operations." What are the other projects that are being used for comparison? Where are they located? Why is there such a large disparity between the two figures? Can the Department of Water Supply handle the 1,120,000 GPD or the 367,000 GPD?

Electrical Supply

The electrical demand of the completed project is unknown, yet it will certainly be a large amount. The electrical supply should be discussed in view of the continued growth of West Hawaii coupled with the state not yet permitting additional generation at Keahole nor a system at Kawaihae. Mitigation which includes providing each prospective tenant with an alternative energy packet is dependent on each tenant deciding to use an alternative energy sources such as solar which may not be feasible if the majority decide to use current electrical energy despite high prices due to the fact that initial costs of "designing for solar" are too high. Additionally, there is no guarantee that electrical utililities will adopt renewable energy sources, such as solar, geothermal, or wind power will become the norm as is suggested by the DEIS. It would seem more feasible to estimate the demand that Koloko-Honokoahu Business Park will need in the future, and then evaluate Hawaiian Electric Light Company resources to meet the additional power sources needed in the future.

Water Quality

The proximity of the Petition Area to the Kaloko-Honomokau National Park is still cause for concern. Are the mitigations of Best Management Practices sufficient to prevent toxic chemicals from the proposed development from affecting the water at study area ponds? It is stated in Section 4.2.2.2.3.2 of the DEIS that "hazardous waste issues are anticipated to be minimal and hazardous waste releases would be unlikely to migrate to groundwater and impact the ponds. " Considering that the Petition Area would be composed of light industrial/commercial processing usage the mitigative measures which might occur in case of a spill are not dwelt upon in much detail. We agree with the recommendation that Kaloko and Aimakapa ponds be regularly monitored for changes in water quality in order to prevent pollution problems.

Historical/Cultural Resources

We concur with the DEIS that "it is particularly important to recognize that native Hawaiian cultural beliefs and practices are continually affected by the loss of land to development that intrudes into the natural setting, changes the landscape and disturbs traditional sites"(4-75) Consequently, in view of the fact that according to the DEIS there are 73 Historical Sites within the petition area we think that a longer and more thorough study should be conducted to determine the effects on Hawaiian cultural resources. In addition to the responses of oral interviewers procedures mentioned in the EIS, a description of methods adopted by the preparer to identify, locate and select the persons interviewed would have been helpful as well.

Conclusion

In summary, alternatives to the proposed project need to be discussed in some detail in the DEIS in order to facilitate further discussion of options available. There is also need for more detailed explanations of water and electrical supply.

We thank you for the opportunity to review this Draft Environmental Impact Statement.

Sincerely,

Peter Rappa
Environmental Review Coordinator

cc: OEQC
Ron Terry
George Curtis
James Moncur, WRRC
Niyati Ni

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Peter Rappa, Environmental Review Coordinator
Hawai`i State Environmental Center
2550 Campus Road, Room 317
Honolulu HI 96822

Dear Mr. Rappa:

Subject: Comment Letter in Response to Draft Environmental Impact Statement *(DEIS) for Kaloko-Honokohau Business Park*

Thank you for your comment letter of April 27, 2001, to Bert Saruwatari of the Hawai`i State Land Use Commission. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *Discussion on Alternatives.* Section 3 of the EIS described in a separate and distinct section all the alternatives that could achieve the goals of the action, and described in detail the reason they were rejected. Besides No-Action, residential, exclusively commercial and combinations of the two were considered. Residential uses are clearly incompatible with a quarry, which is a permitted, ongoing use that will continue whether or not the boundary amendment request is adopted. While the analytical background for eschewing a strictly commercial development is not presented in detail, we would note that Lanihau considered it and rejected it for primarily economic reasons. We do not interpret the EIS rules as requiring detailed analyses (e.g., professional market studies) concerning options that a private developer has no intention and is under no obligation to pursue. There are truly two viable alternatives for the land in question, and they have been considered in full. Since the time of the Draft EIS, Lanihau has also chosen to consider a modified alternative in which only Phase 1 and 2 development areas are reclassified to the State Land Use Urban District and the Phase 3 area is reclassified to the Agricultural district. The implications of this sub-alternative are described in detail in Chapter 3 of the FEIS.
2. *Water Supply.* The estimate of expected water usage for the Kaloko-Honokohau Business Park is based on actual Department of Water Supply records of water use within the existing Kaloko Industrial Park as well as actual usage from the quarry and related operations within the Petition Area. The difference between the two figures is based on the fact that DWS standards cover an average "worst-case" water usage to ensure appropriate supply. Actual users, of course, are under incentive to conserve water in order to save money, among other reasons. It bears emphasis that the estimate based on DWS standards of 1,120,000 gallons per day (GPD) will indeed be the amount used to assist engineers in sizing storage and transmission facilities, and will be used by the County in assessing the amount of aquifer and water system capacity that the proposed project would involve.
3. *Electrical Supply.* The peak electrical demand of the project when fully developed is expected to reach 6,500 (kilowatt-hours) (kW). Assuming the average demand is approximately one-half the peak demand, the annual electrical demand of the project will reach approximately 28 million kWh. This information was included in Section 4.3.6 (Air Quality) but was inadvertently omitted from Section 4.4.1 (Utilities). The FEIS adds this information. While we agree that the issue of

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how to meet the Big Island's growing demand for electrical power is important, we do not presume to plan for the utility. We recognize the importance of alternative sources of energy, and look forward to the possibility of the lot buyers and tenants utilizing active and passive solar energy generation and conservation techniques, as detailed in Section 4.4.1 of the EIS.

4. *Detail on Mitigation for Spills and Toxics; Groundwater Monitoring.* A summary of information on spill prevention and response was presented on pp. 4-20 to 4-22. Please note that a detailed Pollution Prevention Plan including such measures will be developed as part of proposed Covenants, Conditions and Restrictions (CC&Rs). In addition, Lanihau will participate in a ground water monitoring program as established by the Land Use Commission (see Section 4.2.2.2.3.2 of the Final EIS for description of these and other mitigation commitments to minimize impacts from toxic substances that have been developed subsequent to the Draft EIS).

5. *Historical/Cultural Resources.* We respectfully disagree with the commenter's suggestion that a longer and more thorough study is needed. In fact, the study by Kepa Maly, (*Nā Honokōhau: Nā Hono I Nā Hau 'Elua (Honokōhau: Bays of the Two Wind-born Dews* - available at all regional and University libraries), is probably one of the most extensive and highly-detailed cultural analyses of an ahupua'a that has ever been conducted in association with an EIS. It fully covered the historical and present cultural uses of the property, and was the basis for the cultural impact assessment. A brief discussion of the methods used to identify, locate and select the informants for the oral history interviews has been added to the FEIS. Potential interviewees were identified in part through previous work in the region by the author, and through conversations with various individuals and agency representatives. As discussed in the Draft EIS, all of the interview participants have either lived upon or worked the lands of Honokohau Nui and Iki (dating back to 1913), or frequented the coastal village while visiting family members or fishing (dating back to ca. 1927). Please note that of the 73 archaeological sites in the Petition Area, only eight are recommended for preservation in place, and 31 are significant for information content only. Data Recovery and Preservation Plans will ensure that historic sites are properly cared for.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Harry Kim
Mayor

Christopher J. Yuen
Director

Roy R. Takomoto
Deputy Director

County of Hawaii
PLANNING DEPARTMENT
25 Aupuni Street, Room 109 • Hilo, Hawaii 96720-4252
(808) 961-8288 • Fax (808) 961-8742

April 27, 2001

Mr. Bert Saruwatari
Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, HI 96804-2359

Dear Mr. Saruwatari:

Draft Environmental Impact Statement for Kaloko-Honokohau Business Park
TMK: 7-4-08: 13 (por) and 30; Honokohau, North Kona, Hawaii

We apologize for our delay in providing our comments to you regarding the above-described draft environmental impact statement. We have completed our review and provide the following comments for your consideration:

1. Information within the draft environmental impact statement (DEIS) relative to the Hawaii County General Plan, Hawaii County Zoning Code, and the Keahole to Kailua Development Plan (Part 5-Consistency with Government Plans and Policies) are generally accurate.

2. We do have a concern regarding Part 4.3.5-Roads and Traffic, which define existing and proposed roadway systems within the vicinity of the project site. Figure 4-7 graphically depicts the existing and proposed roadway systems as defined by the Hawaii County General Plan and the Keahole to Kailua Development Plan. However, we should point out that there are some inconsistencies between Figure 4-7 of the DEIS and the roadway systems as depicted by these County planning documents. Most notably, Figure 4-7 depicts "Waena Drive" as terminating at the "Mid-Level Arterial", contrary to the General Plan and the Keahole to Kailua Development Plan that show "Waena Drive" continuing in a north-south direction parallel to the "Mid-Level Arterial". In addition, there should be discussion of how the proposed project will accommodate "Main Street" as defined within the Keahole to Kailua Development Plan. The Final Environmental Impact Statement for Kaloko Industrial Park, Phases III and IV identified Kamanu Street as accommodating this proposed alignment. While casually discussed and depicted

within the DEIS, the accommodation of the "Main Street" alignment within the project should be confirmed.

3. In Section 4.2.2.2.1-Potenital Impacts to Groundwater and Mitigation and Section 4.4.3-Wastewater both describe the potential use of "enhanced" individual wastewater systems (IWS). In order to properly assess the effects such an "enhanced" IWS will have upon groundwater quality, the DEIS should provide, at the very least, a basic description of how such an "enhanced" IWS will work and how such a system compares with a typical wastewater disposal system.

4. Wastewater Disposal: Impacts. Section states that *"Enhanced treatment removes the majority of the nutrients. If this occurs, the nutrient load in the groundwater will greatly decrease . . . .".* Should this statement not indicate that it is the nutrient load within the wastewater itself that will greatly decrease, not the nutrient load in the groundwater, which may increase slightly due to nutrients introduced by wastewater.

We appreciate the opportunity to comment on the DEIS. Again, we apologize for the delay in our response. We look forward to the submittal of the Final Environmental Impact Statement. May we request two (2) copies of the Final Environmental Impact Statement, one each for our Hilo and West Hawaii offices. In the meantime, please contact Daryn Arai of our West Hawaii Office should you have any questions.

Sincerely,

CHRISTOPHER J. YUEN
Planning Director

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cc: Office of Environmental Quality Control
Lanihau Properties, LLC w/o Tsukazaki, Yeh and Moore
GeoMetrician Associates
West Hawaii Office

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Christopher J. Yuen, Director
Hawai'i County Planning Department
25 Aupuni Street, Room 109
Hilo HI 96720

Dear Mr. Yuen:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 27, 2001, to Bert Saruwatari of the Hawai'i State Land Use Commission. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *GP, Zoning, and CDP plan info generally correct.* Thank you for your confirmation.
2. *Roads and Traffic.* Based on discussion with the County Planning Department and the Office of the Mayor, it is our understanding that the road network as presented on Figure 4-7 is generally consistent with the roadway network plan that is currently being developed by the County. With respect to "Main Street" as shown on the *Keahole to Kailua Development Plan's* Circulation Plan, the proposed Kamanu Street Extension will allow for connection between Kealakehe Parkway and Hina Lani Street, and fulfill the basic function of "Main Street. In addition, Figure 4-7, Roadway System, has been revised to include a second collector road extending from the Honokohau Business Park area in the south to the Kaloko Industrial Park in the north through the Phase III area. Section 4.3.5 of the FEIS relating to Roads and Traffic has been revised to better discuss the accommodation of "Main Street" alignment through the project.
3. *Description of Enhanced Wastewater System.* Enhanced treatments for IWS that are under consideration as the interim wastewater disposal method include but are not limited to Aerobic Treatment Units (ATU), which provide digestion and clarification of the sewage by an aeration and sedimentation process. This treatment process would result in a reduction of nutrients (phosphates and nitrates), total suspended solids (TSS) and biological oxygen demand (BOD). Please note that since the Draft EIS, Lanihau has committed to the use of enhanced treatment during the interim period.
4. *Wastewater Disposal.* The wording has been changed to "as compared to a standard septic tank and leach field system...."

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

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OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Ref. No. P-9062

April 23, 2001

Mr. Bert Saruwatari
Acting Executive Officer
Land Use Commission
P.O. Box 2359
Honolulu, Hawaii 96804-2359

Dear Mr. Saruwatari:

Subject: Draft Environmental Impact Statement (DEIS)
Lanihau Partners, LP
Kaloko-Honokohau Business Park
TMK: 7-4-08: por. 13, and 30, North Kona, Hawaii
Land Use Commission Docket No. A00-730

We have reviewed the above referenced DEIS to support a Land Use Commission petition for the reclassification of 336.984 acres of land from the Conservation to the Urban Land Use District. The Petitioner proposes to continue and expand the approximately 100 acres of quarry related uses and to develop a subdivision of finished lots for mixed light industrial and commercial uses. The proposed lots will range in size from ½ acre to over 5 acres of land within the Mixed Commercial and Industrial area, and from 1 to 25 acres within the proposed quarry area. The Petitioner plans to develop and market the area in 3 phases over a period of about 23 years. Phase I will consist of approximately 40 to 75 lots, Phase II approximately 40 to 60 lots and Phase III approximately 20 to 30 lots. The final lot count and lot size will depend on market conditions and demand at the time of subdivision approval.

The Petitioner intends to use a range of alternatives, including equity contributions, conventional financing, joint venture partners and/or independent developers to finance the project.

The impacts to the Kaloko-Honokohau National Historical Park makai of Queen Kaahumanu Highway is a major public concern. The State's Natural Energy Laboratory of Hawaii (NELH) and the Hawaii Ocean Science and Technology (HOST) Park at Keâhole Point are dependent on clean class "AA" ocean waters off the Kona Coast. The DEIS includes consultant studies on the environmental impacts and mitigation measures regarding coastal and ground water quality, wastewater disposal, water resources and supply, drainage and flooding, traffic, historic/archaeological/cultural.resources, flora, fauna, and viewplanes.

We have met with the Petitioner and their consultants prior to and during the preparation of this DEIS. We remain concerned about groundwater and ocean water quality, the lack of a municipal wastewater treatment and disposal system, impacts to the National Park, given the proposed expansion of the adjacent TSA Corporation's Kaloko Industrial Park (LUC Docket No. A00-732) and the proliferation of other light industrial/commercial developments planned for the area.

Furthermore, we question the justification for more commercial/industrial development in the Kona area prior to adequate infrastructure such as roadway and highway systems that must be developed in conjunction with the transmission network of a municipal sewer system. A municipal system is essential for long term groundwater and ocean water quality.

Sincerely,

David W. Blane, AICP
Director
Office of Planning

cc: Office of Environmental Quality Control
Lanihau Properties, LLC c/o Tsukazaki, Yeh and Moore
✓ GeoMetrician Associates

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

David Blane, Director
Office of Planning
Department of Business, Economic Development and Tourism
P.O. Box 2359
Honolulu HI 96804-2359

Dear Mr. Blane:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 23, 2001, to Bert Saruwatari of the Hawai`i State Land Use Commission. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *Concern about groundwater and ocean water quality.* We agree that preservation of water quality in the ponds and nearshore waters downslope of the project is of vital concern. The Draft EIS presented information on existing water quality, calculated expected impacts, and outlined the measures provided by law and regulation that would minimize adverse water quality impact and provide protection to sensitive resources.

Since publication of the Draft EIS, Lanihau has developed a number of additional mitigation measures that will increase water quality protection. These include:

- Commitment to working with the County to extend the sewer system to the Petition Area, including participating on a fair and equitable basis in an improvement district.
- In the interim period between the start of the project and connection to the Kealakehe Wastewater Treatment Plant (WWTP), Lanihau will require the use of an individual wastewater system (IWS) with an enhanced treatment system, where the IWS and absorption field are designed to remove no less than 80 percent of the Total Nitrogen as well as offering additional phosphorus removal. It is anticipated that no more than 15 percent of the ultimate total lot count would be built on and occupied before connection to the County's WWTP.
- Development of Conditions, Covenants, and Restrictions (CC&Rs) for the Petition Area to contain spills and prevent materials associated with light industrial uses attributable to the operations on the property, including petroleum products, chemicals, or other pollutants from leaching or draining into the ground or subsurface storm drain collection areas, to the extent practicable. These CC&Rs shall be subject to approval by the Hawai`i State Department of Health, upon consultation with the National Park Service and the County of Hawaii. The CC&Rs will mandate adherence to a Pollution Prevent Plan that will address each use permissible in the Petition Area, by specifically designating Best Management Practices (BMPs) tailored to each specific use and

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activity. Emphasis shall be given to structural BMPs to prevent industrial pollutants from being released into the environment, including reaching the groundwater.

- The CC&Rs will also help disseminate critical information about pollution prevention laws, regulations, and required practices and will establish an owners' association with power to oversee and report violations as a second line of defense against pollution violations.
- The CC&Rs will incorporate requirements to stencil messages concerning water pollution prevention next to all stormwater inlets in the Business Park.
- Lanihau will participate in a ground water monitoring program as established by the Land Use Commission.
- Lanihau is agreeable to restricting certain land uses within the proposed Petition Areas. The restricted uses will include uses which are allowed in the General Industrial (MG) zoned lands and which may be generally considered to be offensive or have some element of danger, including heliports, bulk storage of flammable products (tank farms), landfills for dumping or disposal of refuse or waste matter (except possibly for green waste/composting facilities), fertilizer manufacturing plants, junkyards, refining of petroleum products, slaughterhouses and power plants.

2. *Concern about the National Park.* Again, we share the concern about the National Park. Lanihau is continuing to work with the Park to attempt to resolve differences and arrive at joint solutions.
3. *Concern about the proliferation of industrial parks in area.* We would note that State and County plans for the area, including the Hawai'i County General Plan, the *Keahole to Kailua Development Plan*, and the Office of Planning's *West Hawai'i Regional Plan*, all identify the area for industrial/commercial purposes.
4. *Question of justification for further development prior to adequate infrastructure, such as roadway and highway systems that must be developed in conjunction with the transmission network of a municipal sewer system.* The proposed project area is within a portion of the Kona area that has long been planned for industrial and related developments and is consistent with the Office of Planning's *West Hawai'i Regional Plan* as well as the County's *General Plan* and *Keahole to Kailua Development Plan*. The State and County have for years been planning and constructing infrastructure for this region in response to these plans as well as to the on-going development activities in this region. Infrastructure includes the widening of Queen Ka'ahumanu Highway and the proposed extension of the County's Kealakehe Wastewater Treatment Plan.

We agree that adequate infrastructure, including roads and wastewater disposal systems, is necessary to support the development of the Project Area as well as other growth within this region. This infrastructure should be developed in a coordinated manner commensurate with the timing and impact of project development activity. In this regard, Lanihau is committed to participating in local and regional solutions for wastewater and road development. With respect to wastewater, Lanihau has been working and will continue to work with the County in seeking solutions to wastewater disposal, including participation in the County's proposed improvement district for the extension of the Kealakehe Wastewater Treatment Plants collection system on a fair and equitable basis. In the interim period between the start of the project and connection to the Kealakehe Wastewater Treatment Plant (WWTP), Lanihau will require the use of an individual wastewater system (IWS) with an enhanced treatment system, where the IWS and absorption field are designed to remove no less than 80 percent of the Total Nitrogen as well as offering additional phosphorus removal. It is anticipated that no more than 15 percent of the ultimate total lot count would be built on and occupied before connection to the County's WWTP. This will ensure that any interim wastewater disposal solution will not have any long

term impacts on the water quality of the region. With respect to roads, Lanihau is willing to provided roadway improvements identified in its TIAR as being necessary to mitigate the impacts of its development on existing road systems. In addition, it has developed its road circulation plan to provide alternative access roads between Kealakehe Parkway and Hina Lani Street that are consistent with the County's *Keahole to Kailua Development Plan's* Circulation Plan. These road networks will reduce the need to travel on Queen Ka`ahumanu Highway for intra-regional trips and contribute to the regional circulation network.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

GILBERT S. COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
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Kapolei, Hawaii 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS

April 16, 2001

Dr. Ron Terry
Geo Metrician
HC 2 Box 9575
Keaau, Hawaii 96749

LOG NO: 27248
DOC NO: 0104PM05

Dear Dr. Terry:

SUBJECT: **Draft Environmental Impact Statement for Kaloko-Honokohau Business Park**
Honokohau 1 and 2, North Kona, Hawaii Island
TMK: 7-4-8: 13 (por.) and 30

Thank you for your letter of March 7, 2001, and the opportunity to review and comment on the Draft Environmental Impact Statement (EIS) for the proposed Kaloko-Honokohau Business Park. The proposed park would be used for mixed light industrial and commercial uses, including the expansion of an existing quarry. The project, which must be approved by the Hawai'i State Land Use Commission, will require the reclassification of 336.984 acres of land to Urban.

An archaeological inventory survey of the proposed project area was undertaken by Cultural Surveys Hawaii as part of a larger survey of 803 acres of land that encompassed TMK 7-4-8: 5 (Por.), 13, 30 and 60. The report on this survey (Robins et al 1998), which identified a total of 246 significant historic sites, was reviewed by our office. We approved the site findings (numbers, descriptions and interpretations) and the significance evaluations, but we did not approve the proposed mitigation commitments (commitments to preservation, data recovery, etc.) (letter of February 12, 2001 to Dr. Hammatt -- Log No. 26972; Doc No.0102RC15). We agreed conceptually with the proposed forms of mitigation treatment. However, we stated that before we would finalize our evaluations of the mitigation commitments, wider consultation was needed. The extent of preservation of the Mamalahoa Trail needs to be discussed minimally with the Na Ala Hele Program of our Department and the Office of Hawaiian Affairs (OHA). Given the importance of Kaloko-Honokohau National Historic Park and the long-standing concerns of some native Hawaiian groups with the park and surrounding sites in this area, we asked for consultation with concerned local Hawaiian groups, the Office of Hawaiian Affairs (OHA), and the National Park Service (NPS) on the mitigation proposals. We indicated that the results of the consultation needed to be submitted to our office, so we could evaluate them before we would finalize our comments on mitigation commitments. We indicated that consultation could occur (1) prior to the submittal of development applications to the State or County or (2) as part of the public hearing process of any such application.

The Draft EIS for the Kaloko-Honokohau Business Park includes a new archaeological inventory survey report (Robins et al 2000) and a cultural assessment study. The survey report, which is adapted from the 1998 report on the 803 acre parcel, indicates that 73 of the 246 significant historic sites identified in the 803 acre survey area are located in the 336.984 acre petition area. The significance evaluations and recommended mitigation treatments for the 73 sites, which includes the Mamalahoa Trail, are the same as those presented in the 1998 report. Again, as this is an excerpt of the larger report, the site findings (numbers, descriptions and interpretations) and the significance evaluations have already been approved.

However, the proposed mitigation commitments have yet to be approved by our office, until consultation occurs. We have not yet received a record of the consultation process, and this Draft EIS contains no indication that it has been done yet.

It is important to clarify that in the historic preservation review process, the mitigation commitments for each significant site must be approved, before detailed mitigation planning can begin. This means that no actions on scopes of work for a detailed preservation plans or an archaeological data recovery plan for this project should begin. The mitigation commitments need first to be agreed upon. And again, we can not approve these commitments until we see the results of consultation.

Thus, pages 4-64 and 4-65 contain errors in the process. Consultation should occur simply to review the proposal of which sites should be preserved and which should be data recovered. No formal mitigation plans should be developed at this time. Ideas about those eventual plans should be obtained at a later time.

Also, we would note that buildings, roads, and infrastructure if already planned (as noted on page 4-64) cannot yet be verified "to avoid and incorporate buffer zones for all ... preservation sites", because what sites are being preserved has not yet been agreed to.

In sum, although we believe that conceptually the mitigation commitments for significant sites seem acceptable, we are not able to finalize an approval of these commitments until the results of consultation are made available to our office. Until mitigation commitments are finalized, we cannot support the formulation of any mitigation conditions for this project. Thus, we recommend no final action on this application until our office receives the results of consultation and can approve mitigation commitments – identifying which sites are to be preserved and which are to be data recovered. At that time, we can then propose wording for mitigation conditions for the State Land Use Commission (calling for preservation and data recovery of specific sites). Those conditions would call for the preparation of detailed mitigation plans prior to land alteration.

If you should have any questions about this project please contact our Hawaii Island archaeologist, Patrick McCoy (692-8029).

Aloha,

DON HIBBARD, Administrator
Historic Preservation Division

PM:jk

c: Chris Yuen, Planning Department, County of Hawaii
Superintendent, Kaloko-Honokohau National Historic Park
Office of Hawaiian Affairs
Na Ala Hele Program, State Division of Forestry and Wildlife
Office of Environmental Quality Control

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March 19, 2002

Don Hibbard, Administrator
State Historic Preservation Division
Hawai`i Department of Land and Natural Resources
601 Kamokila Blvd., Room 555
Kapolei HI 96707

Dear Dr. Hibbard:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 16, 2001, in which you clarified the details of the historic preservation review process. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we will respond to your comment.

We acknowledge that at the time the Draft EIS was written, although proposed mitigation commitments have been submitted to your office, there were still some steps to be completed before the mitigation commitments could be finalized. Furthermore, we realize that Lanihau must have approval of the mitigation commitment for each significant site before detailed preservation plans or an archaeological data recovery plan can be fully developed and finalized.

Since that time, we have received confirmation from your agency (letter dated August 28) that you are in agreement with the mitigation proposals for the significant historic sites in the project area. As requested in your letter, Lanihau will continue to coordinate with SHPD as well as the Kaloko-Honokohau National Historic Park staff concerning the data recovery plan, particularly regarding major research questions meriting study and the possibility of archiving archaeological materials at the park. Lanihau will also be coordinating with the SHPD Burials Program and the Hawai`i Island Burial Council regarding burial treatment plans.

We understand that the next steps in the historic preservation review process will be the preparation of the detailed preservation plan and the data recovery plan. We anticipate that these will be attached as conditions to any boundary amendment and other development approvals, with a requirement that SHPD will need to approve these plans and verify in writing that they have been acceptably executed prior to any land alteration. We appreciate your efforts in review of the process.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

phone: (808) 982-5831 • fax: (808) 966-7593 • HC 2 Box 9575, Keaau, Hawaii 96749 • rterry@interpac.net

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BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

GILBERT S. COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DEPUTIES
JANET E. KAWELO
LINNEL NISHIOKA

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS

REF:HP-AMK

AUG 2 8 2001

LOG NO: 28061
DOC NO: 0108RC24

Mr. Douglas Borthwick
Cultural Surveys Hawaii
733 N. Kalaheo Avenue
Kailua, Hawaii 96734

Dear Mr Borthwick:

SUBJECT: **Final Approval of Archaeological Inventory Survey for Honokohau 803 Acre Parcel (Lanihau Partners), Honokohau, North Kona, Hawaii**
TMK: 7-4-8: por. 5, 13, 30, 36

This letter responds to your letter of August 8, 2001 (received August 15th) and your fax of August 21, which submitted consultation documentation on this survey regarding the proposed mitigation measures. We also called Stan Bond, the Archaeologist at Kaloko-Honokohau park and spoke with him about National Park Service concerns, as you noted that the National Park Service had not responded to your consultation request. This consultation was requested in our letter of February 12, 2001 (Log: 26,972; Doc: 0102RC15).

Your documentation indicates a good faith effort for consultation. Only two individuals responded Mr Rodney Oshiro of DLNR's Na Ala Hele program indicated that his program had no interest in the sections of the Mamalahoa Trail. Mr David Roy (President of Na Kokua Kalako-Honokohau) expressed some concerns about possible threats to groundwater pollution, presumably that would affect the ponds and ocean within the National Park seaward of the project area. Our conversations with Mr. Stan Bond indicated that the Park Service also had these groundwater pollution concerns, but he found the mitigation proposals for historic sites within the project area acceptable, with some concerns about the Mamalahoa Trail. He saw the most important part of this trail being the intact portions from the park to Keahole Airport

Given these comments, we can now agree with the mitigation proposals for the significant historic sites within the project area.

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1 98 sites needed no mitigation work and no further protection, because they were significant solely for their information content and a reasonable and adequate amount of this information was recorded/recovered during the survey

17 historic sites are to be preserved. These include all the burial sites, sections of the two inland-heading trails, the existing part of the Mamalahoa Trail, the 2 religious structures, and 2 excellent examples of permanent house sites. One multi-acre piece of land will preserve many of these sites within a small landscape as a historic preserve. Most of these sites will be preserved with the intent of public interpretation Our office's larger goals for interpretive preservation in northern Kona supports interpretation linked to the Kaloko-Honokohau ahupua'a settlement patterns – with the park lands and the sites in this and other private parcels as an interpretive package We believe that the Kaloko-Honokohau National Historic Park staff should have input on the interpretive planning and perhaps might be able to help in site management

3. 169 historic sites (as itemized in Table 22 of the report) still contain significant information on the past and merit archaeological data recovery prior to their destruction Again, when the data recovery plan is prepared, please coordinate with the Kaloko-Honokohau National Historic Park staff as well as our office on major research questions meriting study and the possibility of archiving archaeological materials (food remains, broken tools, soil samples, etc) at Kaloko-Honokohau

Note. The proposed burial treatments (preservation) will need to be submitted to the Hawaii Island Burial Council for vote (if this has not already been done) Please contact our Burials Program, Mr Ka'iana Markell (587-0008), for information that the Council will need and to be placed on their agenda

Last, clearly there is the concern that developments inland of the National Historic Park could pollute the groundwater and adversely affect the significant historic sites in the park (such as fishponds) When the development applications are submitted to the County permitting agencies, these impacts will need to be addressed and acceptable mitigation measures developed. These again are the major concerns raised by the Park Service and Mr Roy And they have recently been raised for a Land Use Commission petition for a new phase of the Kaloko Industrial Park. We agree that these are important concerns

The next steps in the historic preservation review process will be the preparation of the detailed preservation plan and the data recovery plan. These can be attached as conditions to approved development permits, with the typical clause that our office needs to approve these plans and needs to verify in writing to the County that they are acceptably executed – prior to any land alteration

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If you have any questions, please feel free to contact our office. Ross Cordy, our Branch Chief for Archaeology (692-8025), or Patrick McCoy, our Hawaii Island Archaeologist (692-8029) are our contacts for this project.

Aloha,

GILBERT COLOMA-AGARAN
State Historic Preservation Officer

RC.amk

c David Roy, Na Kokua Kalako-Honokohau [78-6822 Kuakini Highway, Kailua Kona, Hi. 96740]
Stan Bond, Kaloko-Honokohau National Historic Park
Planning Dept, County of Hawaii
James Greenwell, Lanihau Properties [fax 732-2788]
Ka'iana Markell, DLNR Burials Program

Harry Kim
Mayor

Dennis K. W. Lee
Director

Jiro A. Sumada
Deputy Director

County of Hawaii

DEPARTMENT OF PUBLIC WORKS
25 Aupuni Street, Room 202 · Hilo, Hawaii 96720-4252
(808) 961-8321 · Fax (808) 961-8630

April 27, 2001

Hawaii State Land Use Commission
P.O. Box 2359
Honolulu, HI 96804-2359

Atten: Bert Saruwatari

Subject: Kaloko-Honokohau Business Park
Draft Environmental Impact Statement
Honokohau, North Kona, HI
TMK: 7-4-8:13 (por.) and 30

We reviewed the subject document and have the following comments:

1) There is no discussion of Main Street on page 17 of appendix 11 under the Keahole to Kailua Development Plan (K to K). We understand that the K to K plan is a guide and implementation depends on topographic conditions as well as proposed land use. If feasible, the proposed interior roadway plan should provide for the additional north-south road. In addition to the existing intersection stub-out at Kealakehe Drive, the proposed upper road of TSA's Kaloko Industrial Park expansion dead end appears to invite a connection mauka of the quarry. For future reference, we would appreciate some discussion of this in the EIS.

2) We first thought the TIAR , on page 42, recommended extension of Kamanu and Kanalani Streets "through the project sites" and not just "to the North and South Access roads" as stated on p. 4-96 in the summary. On the other hand, no intersection study was done for the Phase I impact at Road G (Kamanu Street) and Kealakehe Parkway. We confirmed the accuracy of the summary directly with the traffic study consultant.

3) On pages S-9 and 4-115, reference is made to the Hawaii County DPW "Wastewater Design Standards." We presently have no published design standards. We generally defer to the City and County of Honolulu's Design Standards. The Wastewater Division is currently in the process of developing it's own standards and expect to complete this process within the next year.

4) Regarding solid waste, on pages S-10 and 4-116, the draft should estimate the impacts and suggest mitigation by waste reduction and recycling (other than green waste). Our landfill is currently operating on the first of 5 acre increments of a 150-acre total dedicated fill area.

We appreciate the opportunity to comment. If you have any questions, please feel free to contact Kiran Emler of our Kona office at 327-3530.

Galen Kuba, Division Chief
Engineering Division

KE
c: Director-Office of Environmental Control
Lanihau Properties LLC, c/o Tsukuzaki, Yeh and Moore
GeoMetrician Associates Atten.: Ron Terry
ENG/SWD/WWD
Planning Director

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Dennis Lee, Director
Hawai'i County Department of Public Works
25 Aupuni Street
Hilo, Hawai'i 96720

Dear Mr. Lee:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (DEIS) for Kaloko-Honokohau Business Park

Thank you for the comment letter of April 27, 2001, to Bert Saruwatari of the Hawai'i State Land Use Commission. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), I offer the following response to your individual comments:

1. *No discussion of "Main Street".* Section 4.3.5 of the FEIS has been revised to include a discussion of the road network of the *Keahole to Kona Development Plan*, including "Main Street", and the projects consistency with the Plan.
2. *Extension of Kamanu and Kanalani Streets* Based on discussion with the County Planning Department and the Office of the Mayor, it is our understanding that the road network as presented on Figure 4-7 is generally consistent with the roadway network plan this is currently being developed by the County. With respect to "Main Street" as shown on the *Keahole to Kailua Development Plan's* Circulation Plan, the proposed Kamanu Street Extension will allow for connection between Kealakehe Parkway and Hina Lani Street, and fulfill the basic function of "Main Street." In addition, Figure 4-7, Roadway System, has been revised to include a second collector road extending from the Honokohau Business Park area in the south to the Kaloko Industrial area in the north through the Phase III area.
3. *Wastewater design standards*. The Final EIS has been revised to note your correction.
4. *Estimate solid waste volume and potential reduction through recycling*. Using standard assumptions concerning industrial/commercial facilities of a population density of 40 persons per acre and a waste generation rate of 5 to 6 pounds/acre, the annual solid waste at buildout for 270 acres would be 7,100 to 8,500 tons. This can be substantially reduced through recycling and greenwaste programs. Recycling and composting have been the fastest growing methods of waste management in the U.S. over the last ten years, accounting for 27 percent of waste management in the late 1990s. Lanihau will encourage all lot buyers and tenants to practice recycling, and it likely that State law will soon mandate some form of recycling. As such, no substantial impact to the municipal solid waste collection and disposal system are anticipated during construction and operation of the proposed development. This information has been added to the Final EIS.

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Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

United States Department of the Interior
NATIONAL PARK SERVICE
KALOKO-HONOKOHAU NATIONAL HISTORICAL PARK
73-4786 Kanalani St., #14
Kailua-Kona, Hawaii 96740

LAND USE COMMISSION
STATE OF HAWAII
2001 APR 27 A 10:19

April 20, 2001

State of Hawaii
Department of Business, Economic Development & Tourism
Land Use Commission
P.O. Box 2359
Honolulu, HI 96804-2359

Dear Land Use Commission:

Kaloko-Honokohau National Historical Park is responding to the Draft Environmental Impact Statement for Kaloko-Honokohau Business Park. The National Park is located directly makai of this project and this development may adversely affect resources in the park. The purpose of the National Park is the perpetuation of native Hawaiian culture therefore the park is also concerned with maintaining Hawaiian plants and animals. These natural resources include two endangered water birds, threatened green sea turtles and a number of plant species of concern. Other park species may soon be added to the endangered species list.

One of the National Park's major concerns is that of changes to water quality. Our primary concerns are with proposed sewer and storm water drainage systems. Studies completed by the US Geological Survey in Kaloko-Honokohau NHP (Ground Water Resources in Kaloko-Honokohau National Historical Park, Island of Hawaii, and Numerical Simulation of the Effects of Ground-Water Withdrawals, U.S. Geological Survey Water-Resources Investigation Report 99-4070) indicate that water resources in the park are vulnerable to groundwater contamination upgradient of the park. These resources include fishponds, anchialine ponds, and marine waters. The applicant has indicated that they plan to hook into the county's system or, possibly, construct their own treatment facility. The National Park prefers the alternative of having the development become part of the county central wastewater system. Storm water runoff is the National Park's second major water concern. We do not believe that dry wells for the disposal of storm water are adequate treatment for potential contaminants. Adequate disposal will require the centralized treatment of storm water runoff to remove contaminants and nutrients. The National Park contains significant water resources with unique ecosystems. Waters in the park are home to a number of threatened or endangered species and species of concern. These include the endemic Hawaiian stilt and coot. Contamination of these ecosystems by water entering the park is a threat to these federally protected species. Sewer and storm water drainage systems need to be addressed in detail in the Environmental Impact Statement (EIS). The EIS should also address future monitoring to assure that no impacts are occurring, and measures for remediating impacts if they do occur.

Water quality affects the cultural components of many sites in the park. Appropriate cultural use of the fishponds, i.e. consumption of the fish, requires that they remain unpolluted. Ultimately the

park plans to manage the fishponds in a traditional Hawaiian style and in order to do so the fish must remain edible. A number of sacred Hawaiian sites are also can be affected by water quality. The most prominent of these is Kahinahinaula, known locally as the Queen's Bath. Park visitors use this modified anchialine pond. The pollution of marine waters would also have an effect on the perpetuation of traditional Hawaiian maritime cultural practices.

The above mentioned Kaloko-Honokohau NHP groundwater study as well as a study of the entire Kona area (Geohydrology and Numerical Simulation of the Ground-Water Flow System of Kona, Island of Hawaii; U.S. Geological Survey Water-Resources Investigations Report 99-4073) addresses the potential for decreases in ground water levels due to increased water withdrawal. Decreasing ground water levels could change salinity levels in the fishponds and anchialine ponds, adversely affecting the species that inhabit these areas. How industrial park development would alter ground water levels, and potential mitigating measures, also need to be fully addressed in the EIS.

The 82 additional units will undoubtedly increase traffic into the Kaloko Industrial Park complex and increase traffic on Queen Kaahumanu Highway. We would like to see information in the EIS on the estimated increase in traffic and measures planned to alleviate traffic congestion.

Finally, changes in the landscape can adversely affect the viewscape of a cultural park. We do recognize that development will occur mauka of Kaloko-Honokohau National Historical Park, and that visual elements of the park have been and will continue to be affected by this development. Appropriate plantings would reduce these impacts. The park has developed a Vegetation Management Plan that addresses landscaping. We have offered to act as a resource in helping the developer choose appropriate plants for this project.

Many of the questions above deal with the need for adequate infrastructure, such as central sewer hookup and adequate roads, prior to industrial development. Without such infrastructure in place, whether provided by the county or the developer, it may not be appropriate to put an industrial area near such sensitive natural and cultural resource areas. We look forward to further communications on this project that might benefit all residents of the Kona area. In that regard the park wishes to be a "consulting party" during the EIS process.

Mahalo,

Geraldine Bell
Superintendent

Cc: William L. Moore Planning
Hawaii Office of Planning
County of Hawaii Office of Planning

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

March 19, 2002

Geraldine Bell, Superintendent
Kaloko-Honokohau National Historic Park
73-4786 Kanalani St., Ste. 14
Kailua-Kona HI 96740

Dear Ms. Bell:

Subject: Comment Letter in Response to Draft Environmental Impact Statement (*DEIS*) for Kaloko-Honokohau Business Park

Thank you for your comment letter of April 20, 2001, to the Hawai'i State Land Use Commission. As the author of the EIS, and on behalf of Lanihau Properties, LLC ("Lanihau"), we offer the following response to your individual comments:

1. *Impact on water quality and mitigation.* We agree that preservation of water quality in the ponds and nearshore waters downslope of the project is of vital concern. The Draft EIS presented information on existing water quality, calculated expected impacts, and outlined the measures provided by law and regulation that would minimize adverse water quality impact and provide protection to sensitive resources.

Since publication of the Draft EIS, Lanihau has developed a number of additional mitigation measures that will increase water quality protection. These include:

- Commitment to working with the County to extend the sewer system to the Petition Area, including participating on a fair and equitable basis in an improvement district.
- In the interim period between the start of the project and connection to the Kealakehe Wastewater Treatment Plant (WWTP), Lanihau will require the use of an individual wastewater system (IWS) with an enhanced treatment system, where the IWS and absorption field are designed to remove no less than 80 percent of the Total Nitrogen as well as offering additional phosphorus removal. It is anticipated that no more than 15 percent of the ultimate total lot count would be built on and occupied before connection to the County's WWTP.
- Development of Conditions, Covenants, and Restrictions (CC&Rs) for the Petition Area to contain spills and prevent materials associated with light industrial uses attributable to the operations on the property, including petroleum products, chemicals, or other pollutants from leaching or draining into the ground or subsurface storm drain collection areas, to the extent practicable. These CC&Rs shall be subject to approval by the Hawai'i State Department of Health, upon consultation with the National Park Service and the County of Hawaii. The CC&Rs will mandate adherence to a Pollution Prevent Plan that will address each use permissible in the Petition Area, by specifically designating Best Management Practices (BMPs) tailored to each specific use and

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activity. Emphasis shall be given to structural BMPs to prevent industrial pollutants from being released into the environment, including reaching the groundwater.

- The CC&Rs will also help disseminate critical information about pollution prevention laws, regulations, and required practices and will establish an owners' association with power to oversee and report violations as a second line of defense against pollution violations.
- The CC&Rs will incorporate requirements to stencil messages concerning water pollution prevention next to all stormwater inlets in the Business Park.
- Lanihau will participate in a ground water monitoring program as established by the Land Use Commission.
- Lanihau is agreeable to restricting certain land uses within the proposed Petition Areas. The restricted uses will include uses which are allowed in the General Industrial (MG) zoned lands and which may be generally considered to be offensive or have some element of danger, including heliports, bulk storage of flammable products (tank farms), landfills for dumping or disposal of refuse or waste matter (except possibly for green waste/composting facilities), fertilizer manufacturing plants, junkyards, refining of petroleum products, slaughterhouses and power plants.

With regard to treatment of stormwater prior to injection, an important purpose of the BMPs for urban land uses is to *prevent* contamination of stormwater at the source, reducing or eliminating the need for treatment.

2. *Importance of water quality for cultural practices.* We agree with your assessment that maintenance of water quality is important for the perpetuation of cultural practices.
3. *Changes in salinity.* The DEIS addressed salinity changes in Section 4.2.2.2. The proposed project is not expected to have any substantial impact on the salinity of the ponds or nearshore ocean environment, and no mitigation for salinity impacts is thus necessary.
4. *Traffic impacts.* Section 4.3.5 of the DEIS contains an extensive discussion of traffic impacts, including those to the South Access Road/National Park entrance. As part of the project, current planned traffic improvements include extensive upgrades to this intersection.
5. *Landscaping.* Lanihau welcomes working with the National Park to jointly develop landscaping that meets both areas' needs and provides an attractive and appropriate entryway and boundary to both projects.
6. *Need for infrastructure in place prior to development.* The proposed project area is within a portion of the Kailua-Kona area that has long been planned for industrial and related developments and is consistent with the Office of Planning's *West Hawai`i Regional Plan* as well as the County's *General Plan* and *Keahole to Kailua Development Plan.* The State and County have for years been planning and constructing infrastructure for this region in response to these plans as well as to the on-going development activities in this region. Infrastructure includes the widening of Queen Ka`ahumanu Highway and the proposed extension of the County's Kealakehe Wastewater Treatment Plan.

We agree that adequate infrastructure, including roads and wastewater disposal systems, is necessary to support the development of the Project Area as well as other growth within this region. This infrastructure should be developed in a coordinated manner commensurate with the timing and impact of project development activity. In this regard, Lanihau is committed to participating in local and regional solutions for wastewater and road development. With respect to wastewater, Lanihau has been working and will continue to work with the County in seeking solutions to wastewater disposal, including participation in the County's proposed improvement district for the extension of the Kealakehe Wastewater Treatment Plants collection system on a fair and equitable basis. Lanihau is also considering interim wastewater treatment systems that

meet or exceed the water quality levels of the County's existing plant. This will ensure that any interim wastewater disposal solution will not have any long term impacts on the water quality of the region. With respect to roads, Lanihau is willing to provide roadway improvements identified in its TIAR as being necessary to mitigate the impacts of its development on existing road systems. In addition, Lanihau has developed its road circulation plan to provide alternative access roads between Kealakehe Parkway and Hina Lani Street that are consistent with the County's *Keahole to Kailua Development Plan's* Circulation Plan. These road networks will reduce the need to travel on Queen Ka'ahumanu Highway for intra-regional trips and contribute to the regional circulation network. Please note that in February of 2002 the State Department of Transportation (HDOT) announced that in June 2003 work would commence on widening Queen Ka'ahumanu Highway to a four-lane divided highway between Henry Street and Kona International Airport. The first phase of the project will extend between Henry Street and Kealakehe Parkway (entirely to the south of Petition Area) and will take about two years to complete. The timetable for the balance of the project has not been set.

7. *"Consulting party"*. Lanihau welcomes continuing consultation with the National Park.

Sincerely,

Ron Terry

cc: Lanihau Properties, LLC, c/o Tsukazaki Yeh and Moore
Anthony J.H. Ching, State Land Use Commission
Genevieve Salmonson, Office of Environmental Quality Control

Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 14

Noise Impacts

D. L. ADAMS ASSOCIATES, LTD.

ACOUSTICAL CONSULTANTS

Project No. 00-33

ENVIRONMENTAL NOISE ASSESSMENT STUDY
KALOKO HONOKOHAU BUSINESS PARK
HONOHOHAU 1st & 2nd, NORTH KONA, HAWAII

December 21, 2000

Prepared for:
Lanihau Partners, LP
Honolulu, Hawaii

PALI PALMS PLAZA • 970 NO. KALAHEO AVENUE • SUITE A-311
KAILUA, HAWAII 96734 • (808) 254-3318 • FAX (808) 254-5295
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Figure

1 Vicinity Map and Traffic Noise Prediction Locations

2 Site Map

3 Predicted Noise Levels Rock Crusher, Hammer, Tractor occurring at the south end of Quarry Site (Existing Location)

4 Rock Crusher, Hammer, Tractor, and Drilling occurring at the west end of Quarry Site (Existing Location)

5 Rock Crusher, Hammer, Tractor and Drilling occurring at the east end of Quarry Site (Future Location)

6 Typical Sound Pressure Levels from Construction Equipment

1.0 SUMMARY

1. The proposed Kaloko Honokohau project involves the reclassification of land within the State Land Use Conservation District that is currently being used primarily for quarrying. The proposed new use of the property includes continuing quarry activity for a portion of the project and mixed light industrial and commercial uses for the majority of the project area.

2. The project area is currently exposed to average daytime ambient noise levels, excluding quarry related noise, of approximately 56 dBA with the dominant noise sources being traffic and wind.

3. Near-field quarry-related activities range from sound levels of 72 to 95 dBA at distances between 30 and 100 feet from the noise-generating equipment. Currently, noise from these activities, except drilling and blasting, are not audible at the property boundary due to noise shielding from the topography of the site.

4. The dominant noise sources during project construction will most likely be earth moving equipment, such as bulldozers and diesel powered trucks. Noise from construction activities should be short term and must comply with State Department of Health noise regulations.

5. The main noise source following the completion of the project will be due to quarry-related activities as the quarry operation progresses eastward. Other noise related to the proposed light industrial and commercial mixed used would involve increased vehicular traffic entering and exiting the site.

6. The majority of the project site will experience daytime noise levels below 60 dBA except during blasting. Commercial activities are acceptable in areas with noise levels below 60 dBA. If, in the future, it is decided that commercial activities will be built in areas with predicted noise levels in excess of 60 dBA, then a new noise study should be conducted at the site of the commercial building to determine if additional shielding due to new buildings has occurred. If predicted or actual noise levels are still in excess of 60 dBA, then noise mitigation measures must be considered.

2.0 PROJECT DESCRIPTION

The proposed Kaloko Honokohau Business Park project site is located in North Kona, Hawaii on the east (mauka) side of Queen Kaahumanu Highway, about midway between Keahole-Kona International Airport and Kailua-Kona. The site is located immediately across the highway from the Kaloko-Honokohau National Historic Park. Adjacent developments include the Kaloko Industrial Park to the north and the McClean Honokohau Project to the south. There are several residential developments located east of the site. A vicinity map is shown in Figure 1.

The topography in the vicinity of the site slopes steeply upward from the west to the east. There is very little vegetation in the vicinity of the site.

The proposed new uses of the property includes expanding the existing quarry activity to the south. The quarry activities will only operate during daytime hours 7 AM to 10 PM. South, east, and west of the quarry activity is proposed to be mixed light industrial and commercial uses. The site plan is shown in Figure 2. We have labeled the various sections of property identified for Light Industrial and Commercial Mixed Use as Areas A, B and C for reference purpose.

3.0 NOISE STANDARDS

Various local and federal agencies have established guidelines and standards for assessing environmental noise impacts and set noise limits as a function of land use. The applicable noise regulations are described below and a brief description of common acoustic terminology used in the regulations is presented in Appendix A.

3.1 State Department of Health (DOH)

The State DOH defines three receptor classes of zoning and specifies corresponding maximum permissible sound levels due to stationary noise sources, equipment related to agricultural, construction, and industrial activities [Reference 1]. These levels are enforced for any location at or beyond the property line and shall not be exceeded for more than 10% of the time during any 20-minute period. The specified noise limits which apply are a function of the zoning and time of day as shown in Table 1. With respect to mixed zoning districts, DOH specifies that the primary land use designation shall be used to determine the applicable zoning district class and the maximum permissible sound level.

Table 1
Maximum Permissible Sound Levels in dBA

Zoning District	Daytime Noise Limit (7 AM to 10 PM)	Nighttime Noise Limit (10 PM to 7 AM)
Class A - residential, conservation, preservation, public spaces, open space	55	45
Class B - multi-family dwelling, apartment, business, commercial, hotel, resort	60	50
Class C - agriculture, country, industrial	70	70

The State Department of Health defines a heavy vehicle as a vehicle which has a manufacturer's gross vehicular weight rating of ten thousand pounds or greater. Such vehicles shall not be operated on any trafficway in such a manner that it emits noise in excess of the limits specified in Reference 2. If these limits will be exceeded a permit from the DOH director is required.

3.2 U.S. Federal Highway Administration (FHWA)

The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, L_{eq}, for traffic noise exposure [Reference 5]. For example, Category B, defined as picnic and recreation areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals, has a corresponding maximum exterior L_{eq} of 67 dBA and a maximum interior L_{eq} of 52 dBA. These limits are viewed as design goals, and all projects meeting these limits are deemed in conformance with FHWA noise standards.

The State HDOT has adopted FHWA's design goals for traffic noise exposure in its noise analysis and abatement policy [Reference 6]. According to the policy, a traffic noise impact occurs when the predicted traffic noise levels "approach" or exceed FHWA's design goals or when the predicted traffic noise levels "substantially exceed the existing noise levels." The policy also states that "approach" means at least 1 dB less than FHWA's design goals and "substantially exceed the existing noise levels" means an increase of at least 15 dB.

3.3 U.S. Environmental Protection Agency (EPA)

The U.S. EPA has identified a range of yearly day-night equivalent sound levels, L_{dn}, sufficient to protect public health and welfare from the effects of environmental noise [Reference 4]. The EPA has established a goal to reduce exterior environmental noise to an L_{dn} not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to an L_{dn} not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels, but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

4.0 EXISTING ACOUSTICAL ENVIRONMENT

Noise level measurements were taken on June 19, 2000 at the property line 100 yards mauka of Costco (north of the quarry), at various locations on the quarry property, and at locations 1, 2, and 3 shown in Figure 1. The average noise level taken during a 10-minute interval at the property line 100 yards mauka of Costco was 56.5 dBA. The measurement was taken during quarry activity, however, the dominant noise source was due to traffic. An occasional back-up alarm from trucks in the quarry area was audible. Traffic volumes and vehicle mix were also recorded during measurements at this location.

5.0 POTENTIAL NOISE IMPACT DUE TO THE PROJECT AND NOISE MITIGATION

5.1 Quarry Operations

Sample measurements were taken at the site in the vicinity of various quarry activities. The data was used to predict the future impact of the quarry as it progresses (southward). The measured data is as follows:

Equipment/Activity	Approx. Distance (ft.)	Sound Pressure Level (dBA)
Rock Crusher	100	80.5 - 82.0
Rock Hammer & Tractor with Hoe	125	77.5 - 79.5
Hydraulic Drill	50	95
Heavy Truck	30	75

The activities that occur at the bottom of the quarry wall include the rock crusher, hammer and tractor. Due to the topography, the quarry wall will shield direct noise from these operations from those properties uphill. The drilling process which occurs at the top of the quarry wall will be the dominant noise source in the vicinity of the quarry. This is due to the high sound levels generated by the drill which is not shielded by the walls of the quarry.

Given the sound measurements of the existing operations and topography of the site, we developed a noise model of the site by establishing a grid and calculating the contribution of each operation. From this data, we were able to locate noise contours that consider both direct and shielded noise sources. The noise contours, shown in Figure 3, are the result of the noise model and only includes those operations occurring at the bottom of the quarry, in its existing condition, such as the rock crusher, hammer, tractor, and truck noise. As can be seen from Figure 3, the greatest impact is south in Area B where sound levels reach approximately 66 dBA. The sound levels at Area A are in the mid to upper 50s. The model indicates that the sound levels in the vicinity of the Costco property from the quarry are approximately 49 to 50 dBA, 7 to 8 dB less than what was measured in the vicinity of the Costco site on June 19, 2000. The dominant noise source measured at the Costco was radiating from traffic on Queen Kaahumana Highway. The only noise sources perceived to radiate from the quarry were back-up alarms on the trucks. We predict the noise impacts will remain the same in the vicinity of the Costco location since we predict that the sound levels of the Quarry operations at 7 to 8 decibels lower than the ambient noise level due to traffic noise.

Figure 4 shows the estimated noise levels from the site with all measured quarry activities operating simultaneously, including drilling. The results of this model indicate that the greatest impact is on Area A with sound levels predicted of between 80 and 81 dBA. The model indicates that the impact of the quarry noise on the western property line reaches 70 dBA.

Since the quarry operations will progress southward, we developed a model of the quarry activity near the end of its course as shown in Figure 5. This model assumes that all of the quarry activity will be operating simultaneously, including drilling. As can be seen from Figure 5, the impact is equal for both Areas A and C where sound levels are approximately 75 dBA.

The table below summarizes the predicted noise impact from quarry operations.

Quarry Noise Source	Area Impacted	Approximate SPL (dBA)
Rock Crusher, Hammer, Tractor	A	57
occurring at the south end of Quarry	B	67
Site (Existing Location)	C	52

Rock Crusher, Hammer, Tractor,	A	81
and Drilling occurring at the west	B	67
end of Quarry Site (Existing Location)	C	63
Rock Crusher, Hammer, Tractor,	A	81
and Drilling occurring at the east	B	60
end of Quarry Site (Future Location)	C	75

Please note that this model does not include the sound contribution of the blasting. Blasting will generally occur infrequently. Since the noise from blasting will occur for such a brief duration, far less that 10% of any 20 minute period, it is excluded from the state DOH noise limits.

5.2 Mitigation of Quarry Noise

The most significant noise source in the quarry is the drilling process which takes place at the top of the quarry wall. As can be seen from the table above, the drilling activity can increase the sound level by more than 20 dBA for locations in Area A, adjacent to the drilling operations. Since the dominant noise from drilling occurs at grade, an effective way to mitigate the noise is to provide shielding. To provide this shielding, low-sensitive structures such as warehouses or manufacturing facilities can be placed closest to the quarry to act as a noise buffer for other uses that are more noise sensitive, such as offices and retail, located furthest from the quarry. In addition, placing structures away from the quarry will attenuate noise through distance. If industrial structures are built within the 70 dBA contour, noise attenuation measures in the building construction should be considered. If commercial activities will be located within 500 feet of the east boundary of Area B or within 100 feet of the west boundary of Area A and no shielding is provided by industrial buildings, noise attenuation measures in the building construction will be required.

The noise radiating to the Kaloko-Honokohau National Historic Park, on the west side of the Queen Kaahumanu Highway, is expected to be below 55 dBA. This is in compliance with the daytime noise limits for a Class A zoning (conservation or preservation space) which is 55 dBA.

5.3 Construction Noise

Development of Kaloko Honokohau Business Park will involve excavation, grading, and construction of new buildings and infrastructure. The various construction phases of the project may generate significant amounts of noise, which may impact nearby areas. The actual noise levels produced will be a function of the methods employed during each stage of the construction process. Typical ranges of construction equipment noise are shown in Figure 6. Earthmoving equipment, e.g., bulldozers and diesel-powered trucks, will probably be the loudest equipment used during construction, assuming that pile driving will not be required.

In cases where construction noise exceeds, or is expected to exceed the DOH's "maximum permissible" property line noise levels [Reference 1], a permit must be obtained from the DOH to allow the operation of vehicles, construction equipment, power tools, etc., which emit noise levels

in excess of "maximum permissible" levels. Specific permit restrictions for construction activities are:

> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels...before 7:00 a.m. and after 6:00 p.m. of the same day, Monday through Friday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels...before 9:00 a.m. and after 6:00 p.m. on Saturday."
>
> "No permit shall allow any construction activities which emit noise in excess of the maximum permissible sound levels on Sundays and on holidays."

In addition, construction equipment and on-site vehicles or devices whose operations involve the exhausting of gas or air, excluding pile hammers and pneumatic hand tools weighing less than 15 pounds, must be equipped with mufflers, and construction vehicles using trafficways must satisfy the DOH's vehicular noise requirements [Reference 2].

Blasting, if required, could also produce noise impacts. However, blasting at construction sites near populated areas is usually accomplished by using numerous small charges detonated with small time delays. Blast mats can also be used to assist in directing the explosive energy into the rock, controlling flying debris, and muffling the noise. Thus, with the appropriate blast design techniques, the noise from blasting can be controlled to minimize noise impacts.

5.4 Project Generated Traffic Noise

A computer version of the Federal Highway Administration Traffic Noise Prediction Model [Reference 7] was used to predict future noise levels due to traffic in the vicinity of the proposed site. This model calculates the sound pressure level at a receiver due to traffic flowing by a receiver at a constant speed. No barriers were included in the analysis. Vehicles were assumed to be traveling at 45 miles per hour. The existing predicted future peak traffic hour volumes were provided by Parsons Brinkerhoff Quade & Douglas, Inc. [Reference 8]. Measured traffic noise levels along with the traffic volume and vehicle mix counts obtained during the measurements were used to calibrate the FHWA's Traffic Noise Prediction Model [Reference 7]. The future traffic levels were assumed to be comprised of 90% automobiles, 5% medium trucks, and 5% heavy trucks as was observed during traffic noise measurements on June 18, 2000. Traffic generated noise levels were predicted at four locations 50 feet from the edge of the road, shown in Figure 1. The results are presented in Table 2.

Table 2
Existing and Projected Future Peak Hour Traffic Noise Levels (L_{eq} in dBA)

With or Without Proposed Project	Year	Location 1 - Queen Kaahumanu Highway		Location 2 - Hina Lani Street West		Location 3 - Hina Lani Street East		Location 4 - Mamalahoa Highway	
		AM	PM	AM	PM	AM	PM	AM	PM
Without Proposed Project	existing	69.6	70.7	64.8	64.8	65.5	65.3	70.0	69.7
	year 2010	72.1	72.6	69.5	69.5	69.9	69.9	71.7	71.7
	year 2020	72.5	73.4	69.6	69.6	70.1	70.1	72.5	72.4
With Proposed Project	year 2010	72.3	72.8	70.4	70.5	71.4	71.7	72.2	72.1
	year 2020	73.2	73.5	70.7	70.7	72.0	72.1	72.7	72.5

As can be seen in Table 2, the noise levels 50 from the assessed roadways are expected to exceed the FHWA guideline with and without the proposed project. From the results of Table 2, traffic noise level increases, with and without the project, were calculated and are presented in Table 3.

Table 3
Change in Traffic Noise Levels With and Without the Proposed Project (L_{eq} in dBA)

	Location 1 - Queen Kaahumanu Highway		Location 2 - Hina Lani Street West		Location 3 - Hina Lani Street East		Location 4 - Mamalahoa Highway	
	AM	PM	AM	PM	AM	PM	AM	PM
Increase Due to Project - Year 2010	0.2	0.2	0.9	1.0	0.5	1.8	0.5	0.4
Increase Due to Project - Year 2020	0.7	0.1	1.1	1.1	1.9	2.0	0.2	0.1

As shown in Table 3, the increased traffic noise from the proposed operation is expected to be between 0.1 and 2 dBA. The following table shows an approximation of human sensitivity to changes in sound level. Notice that a change of less than 1 dBA is considered imperceptible by most people and a change of 3 dBA is required before the change is just barely perceptible. Thus, no significant traffic noise increases due to the project are expected.

Table 4
Human Sensitivity to Changes in Sound Level

Changes in Sound Levels (dBA)	Change in Apparent Loudness
1	Imperceptible
3	Just barely perceptible
6	Clearly noticeable
10	About twice (or half) as loud
20	About four times (or quarter) as loud

5.5 General Considerations

When there is no drilling, the sound level in Areas A, B, and C are predicted to be no more than 67 decibels, with most adjacent properties at 60 dBA or less. This level is within state noise limits for industrial use.

The sound levels represented by the noise contours in Figures 3 through 5 are based on near-field measurements of individual quarry activities. It represents a worst-case scenario in that it considers all operations occurring simultaneously. If the drilling operations are acoustically shielded as described above, the noise impact on Areas A, B and C should be below 70 dBA. Other considerations in further mitigating quarry-related noise would include placement of the structures with regard to quarry-related noise. Placing the structures away from the quarry will attenuate noise through distance. In addition, low-sensitive structures such as warehouses or manufacturing facilities can be placed closest to the quarry to act as a noise buffer for other uses that are more noise sensitive, such as offices and retail, located furthest from the quarry.

REFERENCES:

1. Chapter 46, *Community Noise Control*, Department of Health, State of Hawaii, Administrative Rules, Title 11, September 23, 1996.

2. Chapter 42, *Vehicular Noise Control for Oahu,* Department of Health, State of Hawaii, Administrative Rules, Title 11, November 6, 1981.

3. *Section 3.11 Noise Regulations*, Land Use Ordinance, City and County of Honolulu, Oahu, October 22, 1986.

4. *Toward a National Strategy for Noise Control*, U.S. Environmental Protection Agency, April 1977.

5. *Department of Transportation, Federal highway Administration Procedures for Abatement of Highway traffic Noise,* Title 23, CFR, Chapter 1, Subchapter J, Part 772, 38 FR 15953, June 19, 1973; Revised at 47 FR 29654, July 8, 1982.

6. *Noise Analysis and Abatement Policy,* Department of Transportation, Highways Division, State of Hawaii, June 1977.

7. *FHWA Highway Traffic Noise Prediction Model,* FHWA-RD-77-108; U.S. Department of Transportation, December 1978.

8. Traffic Data Received from Parsons Brinckerhoff Quade & Douglas, Inc., August 11, 14 and 27, 1998.

RECEIVED AS FOLLOWS

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FIGURE 1 - Vicinity Map and Traffic Noise Prediction Locations

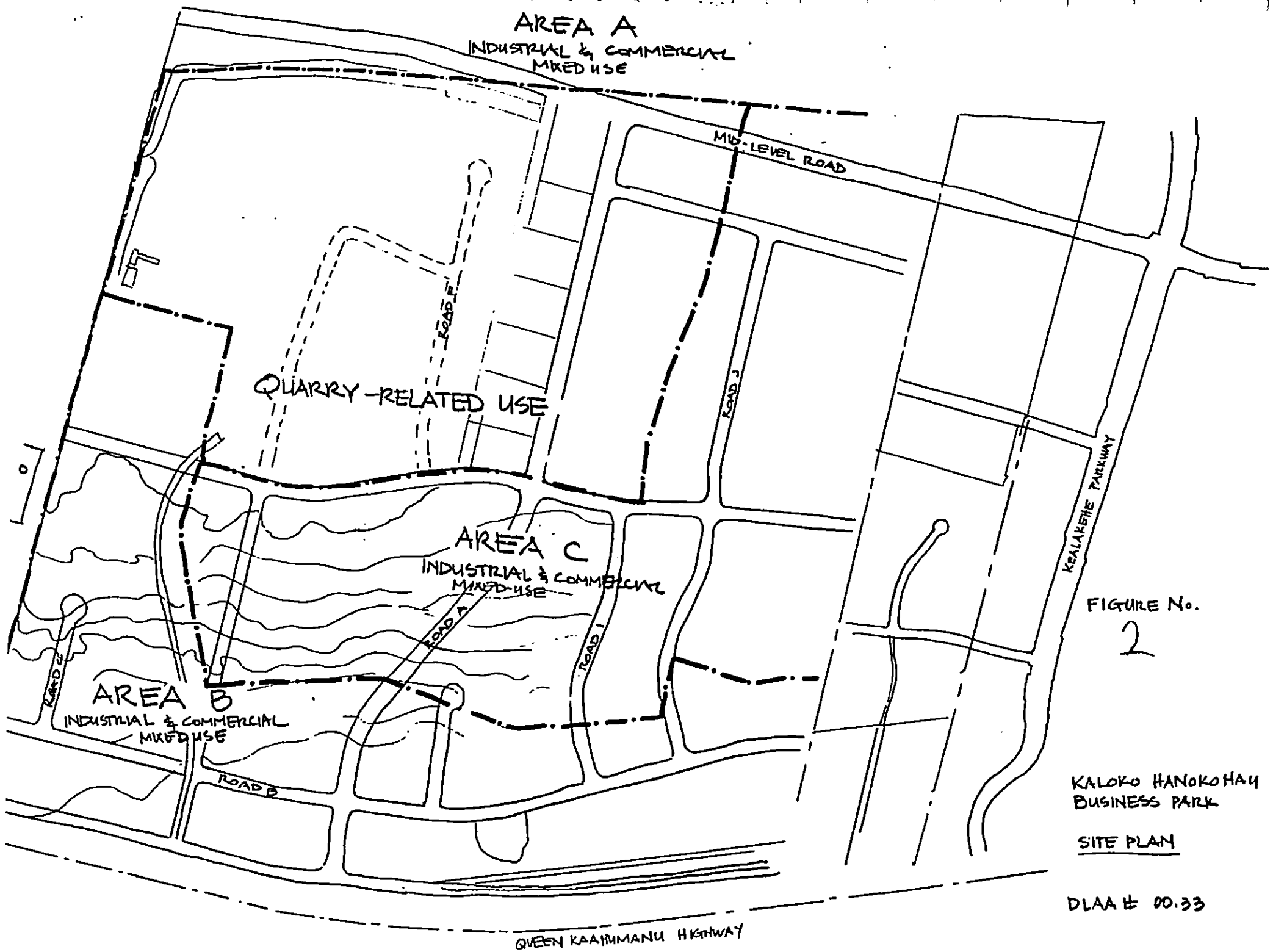


FIGURE No.
2

KALOKO HANOKOHAU
BUSINESS PARK

SITE PLAN

DLAA # 00.33

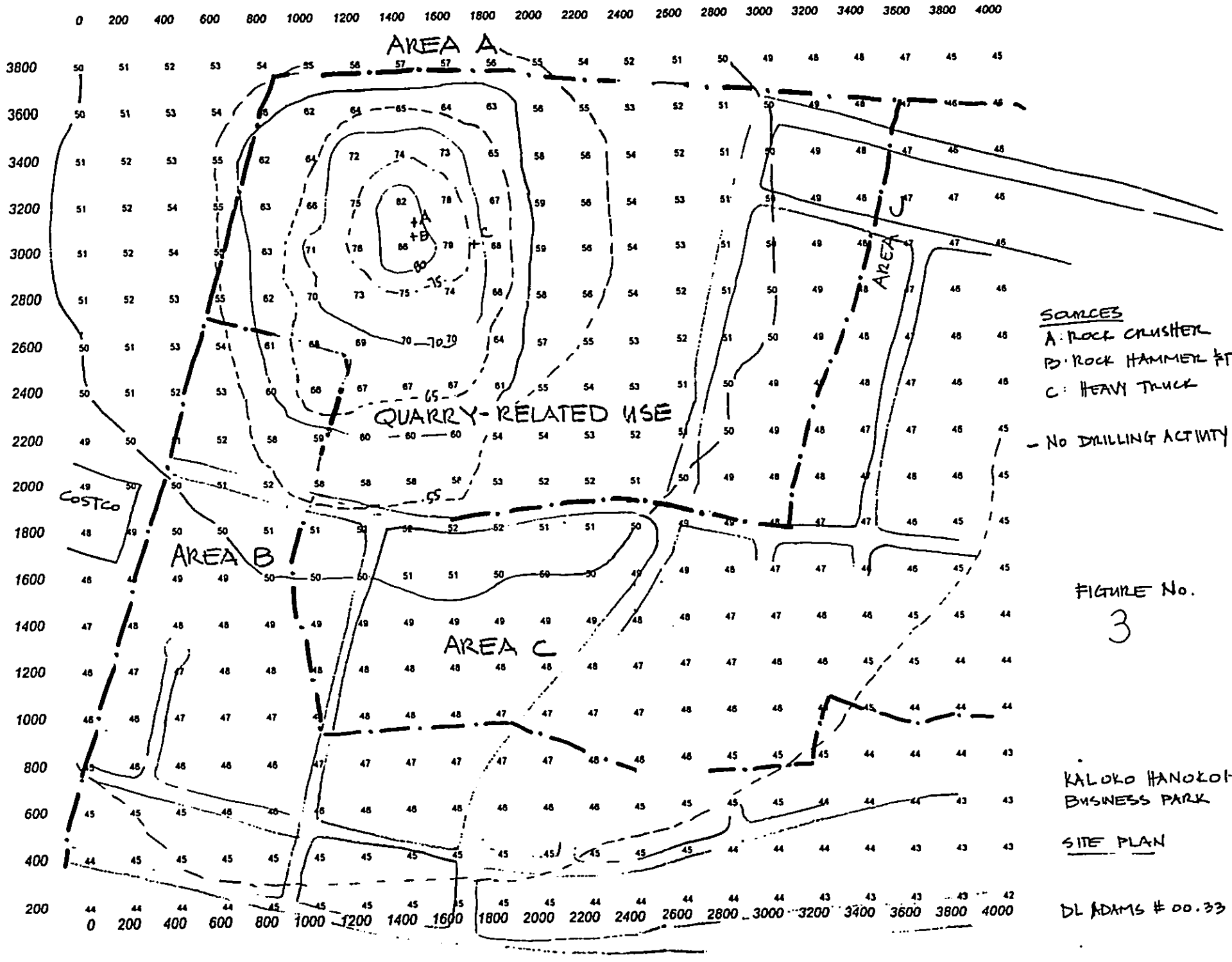
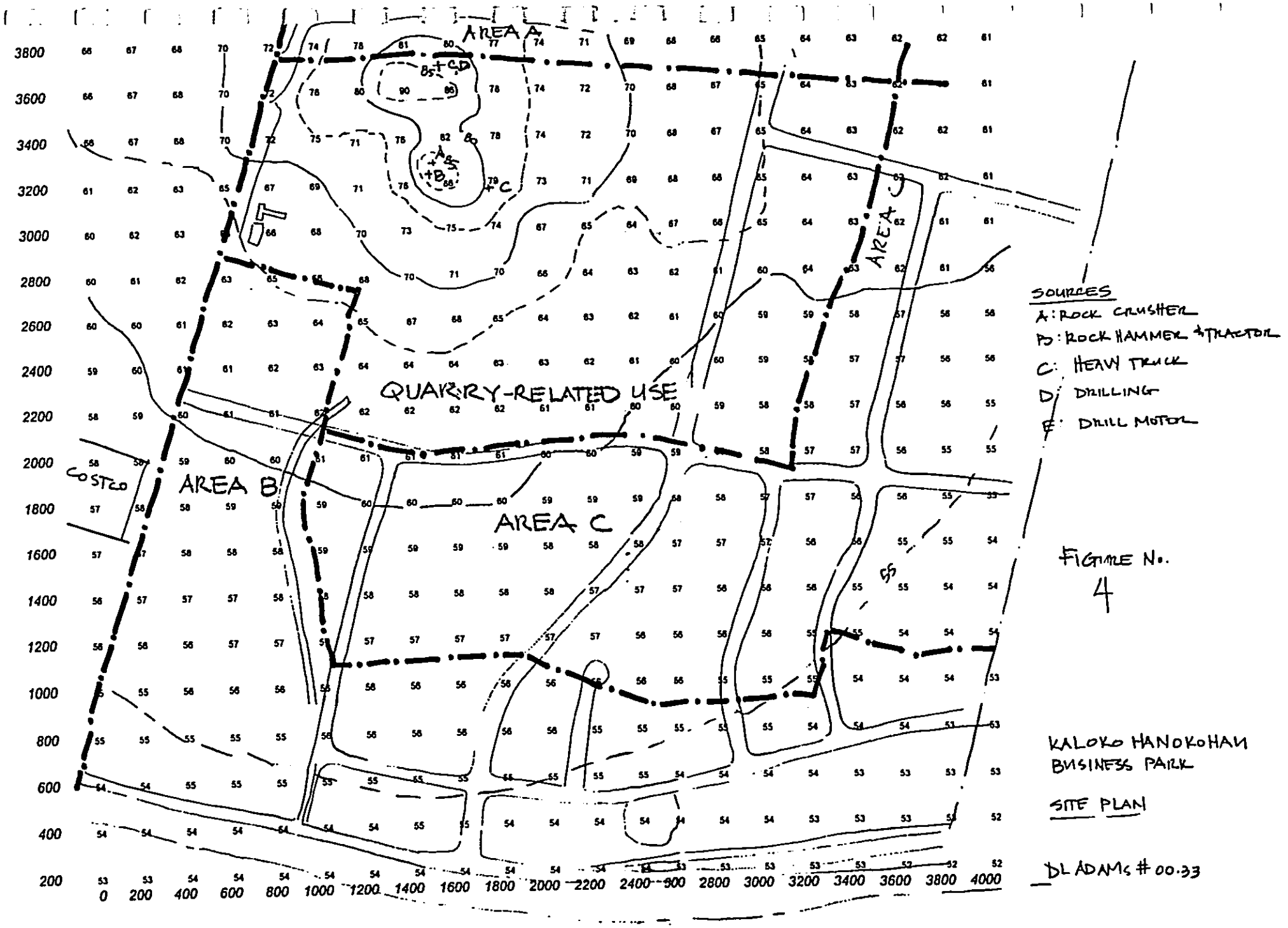


FIGURE No.
3

KALOKO HANOKOHAU
BUSINESS PARK

SITE PLAN

DL ADAMS # 00.33



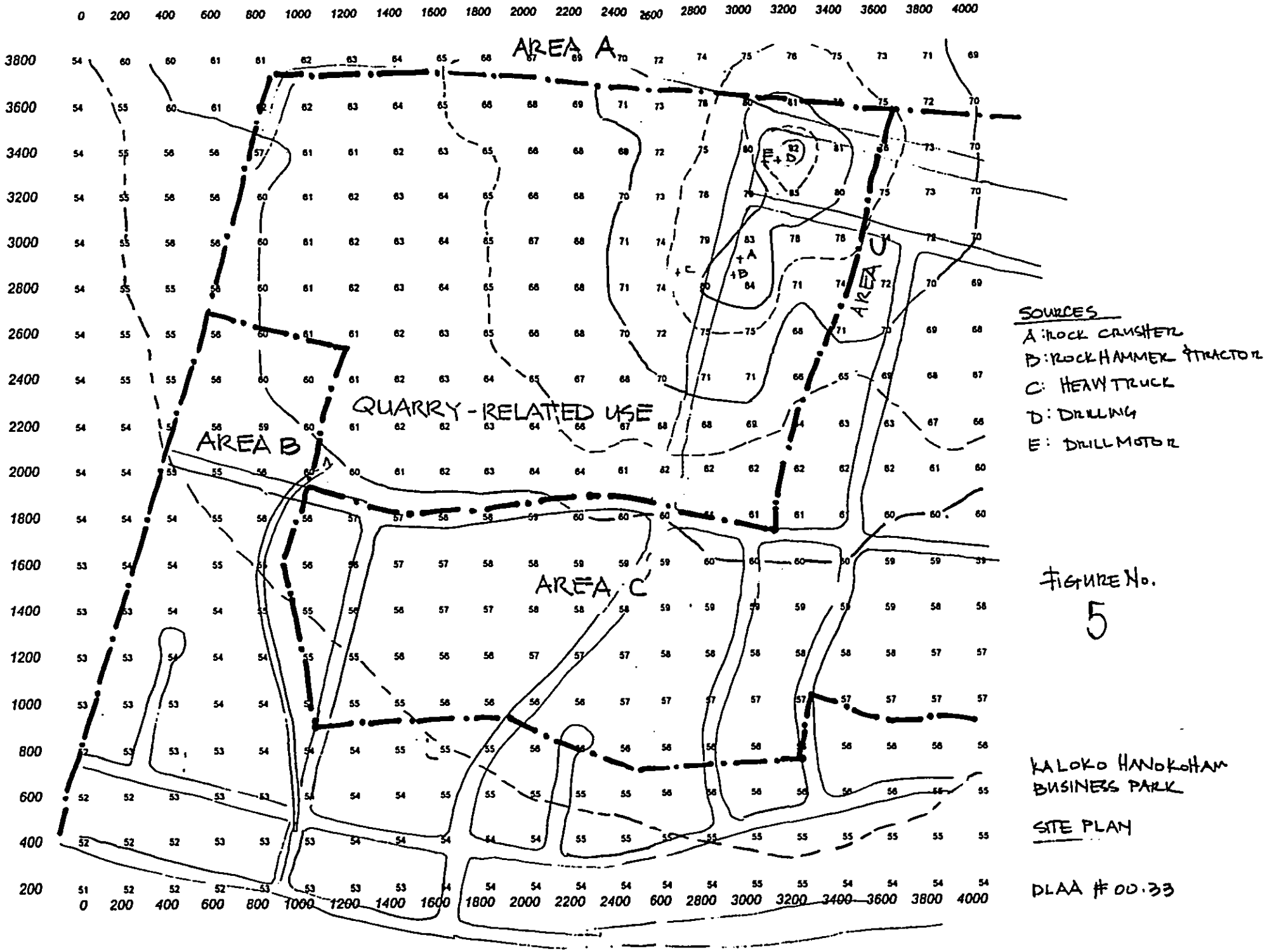
SOURCES
A: ROCK CRUSHER
B: ROCK HAMMER & TRACTOR
C: HEAVY TRUCK
D: DRILLING
E: DRILL MOTOR

FIGURE No.
4

KALOKO HANOKOHAU
BUSINESS PARK

SITE PLAN

DL ADAMS # 00.33



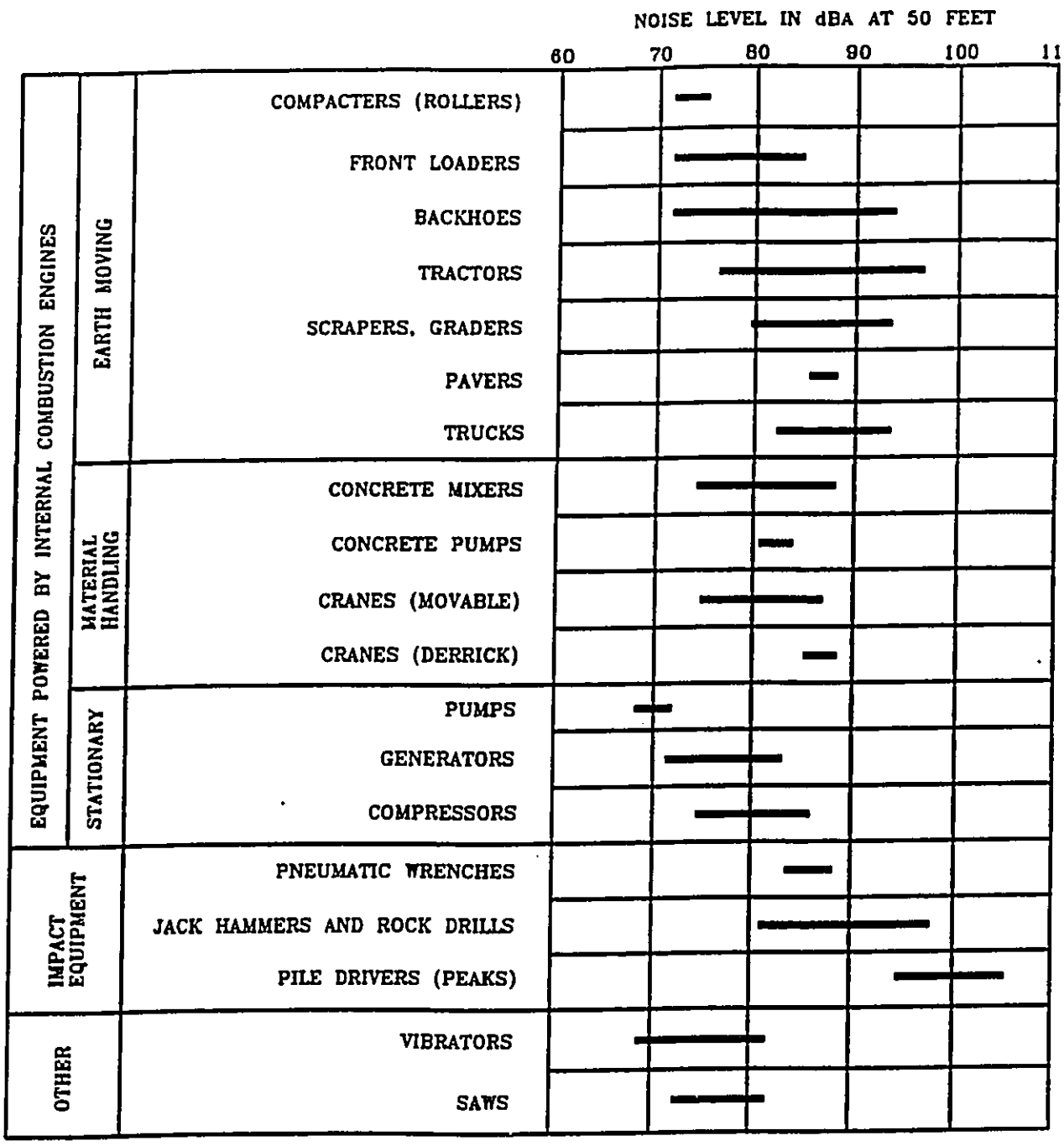
SOURCES
A: ROCK CRUSHER
B: ROCK HAMMER & TRACTOR
C: HEAVY TRUCK
D: DRILLING
E: DRILL MOTOR

FIGURE No.
5

KALOKO HANOKOHAM
BUSINESS PARK

SITE PLAN

DLAA # 00.33



NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

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FIGURE 6 - Sound Pressure Levels for Construction Machinery

APPENDIX A

ACOUSTICAL TERMINOLOGY

Sound Pressure Level

Sound or noise consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. It is measured in terms of decibels (dB) using precision instruments known as sound level meters. Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/Pref) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and Pref is the reference pressure, 20 micropascals, which is approximately the lowest sound pressure that can be detected by the human ear. For example, if P is 20 micropascals, then SPL = 0 dB, or if P is 200 micropascals, then SPL = 20 dB. The relation between sound pressure in micropascals and sound pressure level in decibels (dB) is shown in Figure A-1.

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound levels, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined level of 53 dB, not 100 dB; two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of a sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 5 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

The human ear is more sensitive to sound in the frequency range of 250 Hertz (Hz) and higher, than in frequencies below 250 Hz. Due to this type of frequency response, a frequency weighting system, was developed to emulate the frequency response of the human ear. This system expresses sound levels in units of A-weighted decibels (dBA). A-weighted sound levels de-emphasizes the low frequency portion of the spectrum of a signal. The A-weighted level of a sound is a good measure of the loudness of that sound. Different sounds having the same A-weighted sound level are perceived as being about equally loud. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

Appendix A
Acoustical Terminology (Continued)

Statistical Sound Levels

The sound levels of long-term noise producing activities, such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels developed. It is known as the Exceedence Level, L_n. The Exceedence Level, L_n, represents the sound level which is exceeded for n% of the measurement time period. For example, $L_{10} = 60$ dBA indicates that for the duration at the measurement period, the sound level exceeded 60 dBA 10% of the time. Commonly used Exceedence Levels include L_1, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. Figure A-2 illustrates the relationship between selected statistical noise levels.

Equivalent Sound Level

The Equivalent Sound Level, L_{eq}, represents a constant level of sound having the same total acoustic energy as that contained in the actual time-varying sound being measured over a specific time period. L_{eq} is commonly used to describe community noise, traffic noise, and hearing damage potential. It has units of dBA and is illustrated in Figure A-2.

Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 pm and 7 am to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations. Qualitative descriptions, as well as local examples of L_{dn}, are shown in Figure A-3.

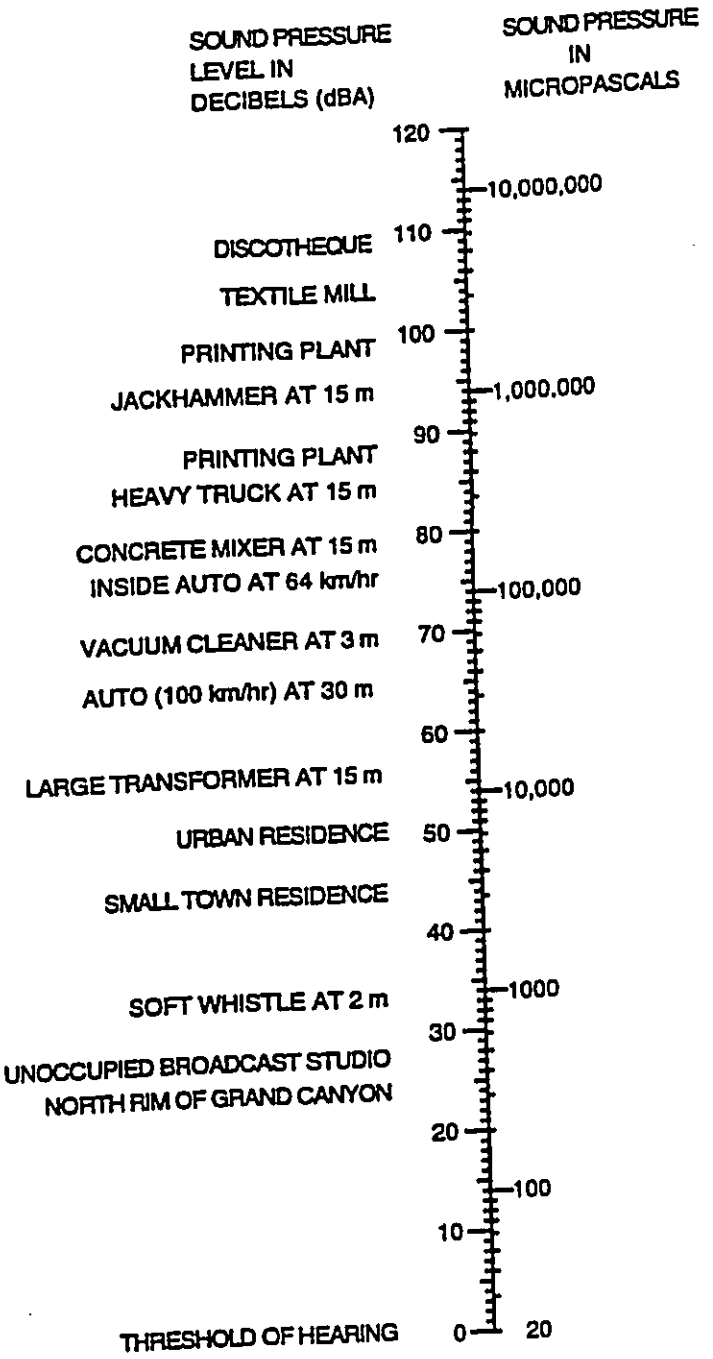

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FIGURE A-1 - THE RELATION BETWEEN SOUND PRESSURE, P, AND SOUND PRESSURE LEVEL, SPL. ALSO SHOWN ARE TYPICAL VALUES OF A-WEIGHTED SOUND LEVELS OF VARIOUS NOISE SOURCES.

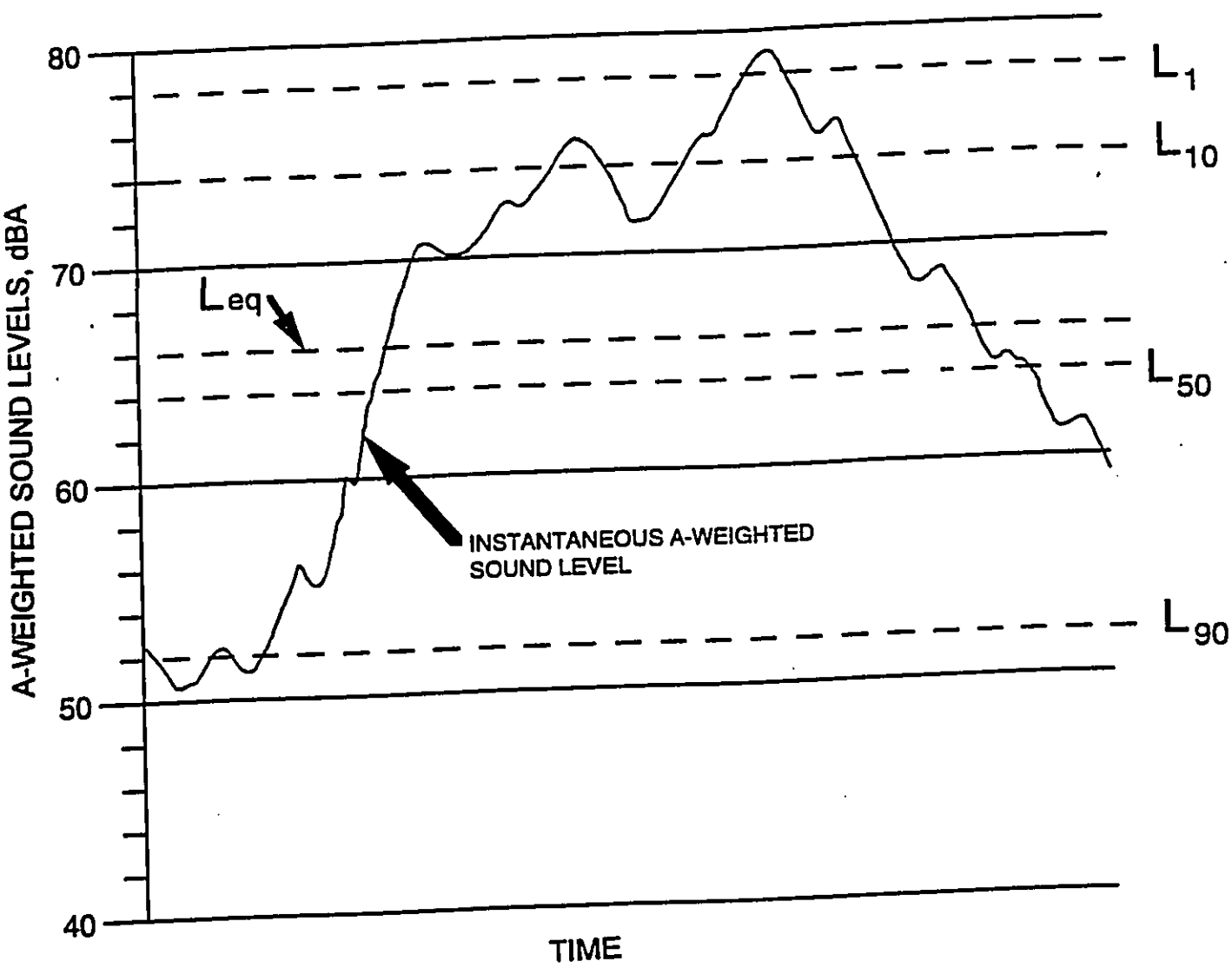

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FIGURE A-2 - COMPARISON OF AN INSTANTANEOUS SOUND LEVEL AND THE CORRESPONDING STATISTICAL SOUND LEVELS

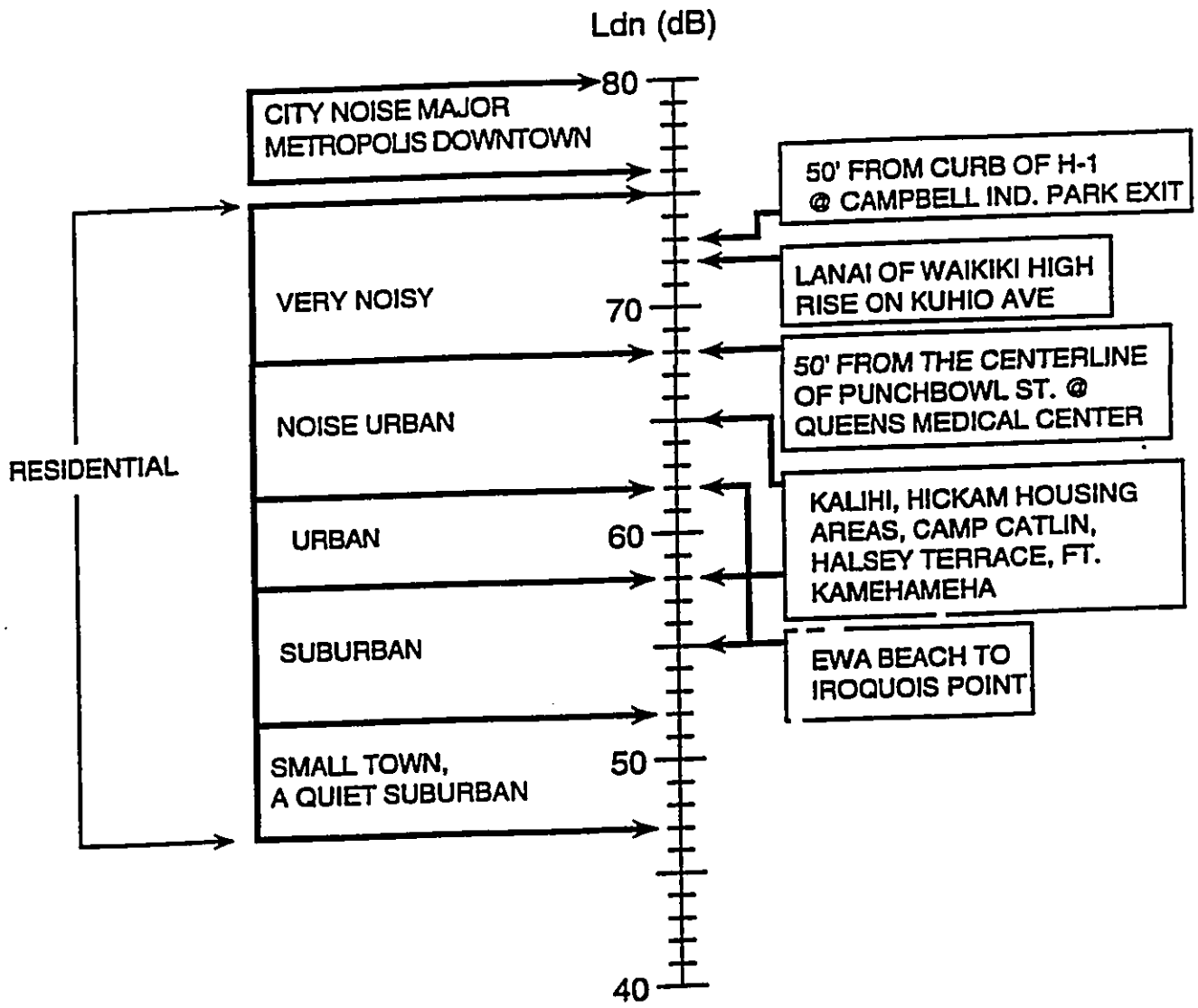

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FIGURE A-3 - QUALITATIVE DESCRIPTION OF THE DAY-NIGHT EQUIVALENT SOUND LEVELS (Ldn) AND EXAMPLE Ldn's AT SELECTED LOCATIONS ON OAHU

Final Environmental Impact Statement

Kaloko-Honokohau Business Park

APPENDIX 15

Excerpt of TSA Corporation Findings of Fact, Conclusions of Law, and Decision and Order for a State Land Use District Boundary Amendment

BEFORE THE LAND USE COMMISSION

OF THE STATE OF HAWAI`I

In the matter of the Petition	)	DOCKET NO. A00-732
	)	
of	)	FINDINGS OF FACT,
	)	CONCLUSIONS OF LAW, AND
TSA CORPORATION	)	DECISION AND ORDER FOR A
	)	STATE LAND USE DISTRICT
To Amend the Land Use District	)	BOUNDARY AMENDMENT;
Boundary of Certain Lands situated at	)	
Kaloko, North Kona, Island of Hawaii,	)	EXHIBIT A
State of Hawai`i, consisting of	)	
approximately 102.016 acres, Tax Map	)	
Key: 7-3-051: portion of 060, from the	)	
Conservation District to the Urban	)	
District	)	

This is to certify that this is a true and correct copy of the Decision and Order on file in the office of the State Land Use Commission, Honolulu, Hawaii.

2-14-02 by Anthony J. H. Ching
Date Executive Officer

FINDINGS OF FACT, CONCLUSIONS OF LAW, AND DECISION AND ORDER FOR A STATE LAND USE DISTRICT BOUNDARY AMENDMENT

LAND USE COMMISSION
STATE OF HAWAII
2002 FEB 14 A 6:31

DECISION AND ORDER

IT IS HEREBY ORDERED that the Property being the subject of Docket No. A00-732, filed by Petitioner, TSA Corporation, consisting of approximately 102.016 acres of land in the State Land Use Conservation District at Kaloko, North Kona, Island of Hawaii, County of Hawaii, State of Hawaii, identified as Tax Map Key No. 7-3-051: portion of 060, is hereby reclassified into the State Land Use Urban District, and the State land use district boundaries are amended accordingly, subject to the conditions of approval set forth herein.

This Commission is acutely aware that continuous development is planned for this coastline. Although each developer might claim that only a "small amount" of pollution will result from their development and that the area's ecosystem will show "little" effects, these developments and their impacts are cumulative and, absent strong mitigation measures, have the potential to devastate the fragile resources of the coastal and marine aquatic environments of the entire Kona coastal region.

Absent adequate, effective and enforceable conditions of approval, including removal of wastewater nutrients and surface runoff contaminants, Petitioner's proposed industrial development has the potential to cause unacceptable adverse impacts to coastal resources, particularly the natural and cultural resources of the adjacent National Park and the traditional and customary native Hawaiian practices

that depend on the pristine nature of such resources.

Based upon the findings of fact and conclusions of law stated herein, it is hereby determined that the customary and traditional native Hawaiian practices, the cultural resources, and the important natural systems and habitats of the National Park that have been identified herein shall be adequately protected by the conditions of this decision and order.

To protect the exercise of customary and traditional native Hawaiian practices; to protect the historical and cultural resources of the coastal area including the Kaloko-Honokohau National Historical Park; to ensure the health and preservation of the natural systems and habitats of the National Park, including the endangered, threatened, and endemic species and their habitat, the reclassification of the Property shall be subject to the following conditions.

Wastewater

1a. The Petition Area shall be developed with dry sewer lines for eventual connection to the Kealakehe Wastewater Treatment Plant (WWTP).

1b. The Petition Area shall be required to connect to the WWTP, when such connection is available. The Petitioner, its successors, and assigns, shall collaborate with the County of Hawaii to include the Petition Area within an improvement district, if one is developed to fund the connection to the WWTP. The Petitioner or individual

lot owners within the Petition Area shall pay for their fair share of the cost to fund such connection to the WWTP, whether or not an improvement district is established.

1c. The Petitioner and/or any future owner(s) of the Petition Area shall refrain from constructing upon or occupying any portion of the Petition Area until such time as the portion (e.g., lot) to be constructed upon or occupied is connected to the WWTP, unless in the interim, the portion to be constructed upon or occupied has installed a septic tank system [i.e., Individual Wastewater System (IWS)] designed to remove no less than 60% Total Nitrogen from the treatment system (e.g., septic tank with FAST, Biofilter, Recirculation Filters, Sequential Batch Reactor, or comparable technology) and an absorption field of import material which is designed to achieve no less than 80% reduction of nitrogen; featuring adequate percolation rate; and offering additional phosphorus removal. Installation is subject to conditions of approval dictated by the Director of the Hawaii State Department of Health and Hawaii Administrative Rules (HAR) Title 11 Chapter 62. When connection to the WWTP becomes available, all portions of the Petition Area, including all individual lots therein, shall connect to the WWTP, whether or not an interim wastewater treatment system has been installed.

1d. Utilization of the IWS described above (i.e., septic tank with FAST, Biofilter, Recirculation Filters, Sequential Batch Reactor, or comparable technology and an absorption field of import material which is designed to achieve no less than 80%

reduction of nitrogen; featuring adequate percolation rate; and offering additional phosphorus removal) shall be limited to no more than 45% of the individual lots to be developed in the Petition Area.

1e. The owner of the IWS shall certify with the Hawaii State Department of Health that the IWS shall be operated and maintained in accordance with all of the provisions of the operation and maintenance manual developed pursuant to HAR 11-62. The certification shall include that upon the sale or transfer of ownership of the IWS, the sale or transfer will include the appropriate transfer documents and provisions binding the new owner to the operation and maintenance manual.

1f. Petitioner and/or each individual lot owner(s), shall develop and participate in a Wastewater Treatment System Maintenance Agreement, before constructing upon or occupying any portion of the Petition Area, that shall provide for safe and effective operation and maintenance of the treatment unit(s), whether shared or individual, and/or the temporary sewage line. This requirement shall be included in the conditions of sale of any lot and/or parcel in the Petition Area.

1g. Should the National Park Service elect to pursue installation of a temporary sewage line to the WWTP for the Kaloko-Honokohau National Historic Park Visitor Center construction project, the Petitioner may elect, subject to prior authorization by the National Park Service, to dispose of wastewater from not more

than 20 one-acre lots in the Petition Area, via such temporary line to the WWTP. In no event shall the temporary sewage connection be in place and utilized for longer than five (5) years from the date of completion of construction of such temporary line except at the sole discretion of the National Park Service. The Petitioner shall pay its fair share cost to fund such temporary connection to the WWTP, as determined by the National Park Service, the Petitioner and the County of Hawaii. When connection to the WWTP becomes available through permanent sewer lines, all portions of the Petition Area, including all individual lots that may have been connected to the above described temporary sewage line, shall connect to the WWTP through permanent lines, whether or not one or more lots were connected via the temporary sewage line. Connection of not more than twenty (20) one-acre lots to the WWTP via such temporary sewage line does not release any other individual lots within the Petition Area from compliance with any other condition(s) of this decision and order.

Storm and Surface Water Runoff

2a. To the extent possible, all storm and surface water runoff shall be captured on the premises. To the extent possible, all runoff entering the ground shall be first treated to remove all industrial waste so that no industrial pollutants will reach the Kaloko-Honokohau National Park or enter the water table. Petitioner shall be subject to and prepare covenants, conditions, and restrictions for the Petition Area to contain

spills and prevent materials associated with light industrial uses attributable to the operations of property, including petroleum products, chemicals, or other pollutants from leaching or draining into the ground or subsurface storm drain collection areas. Said covenants shall be subject to the approval of the Hawaii State Department of Health, upon consultation with the National Park Service, and the County of Hawaii. The Petitioner and/or tenant shall obtain all required permits and construct required improvements for storm water discharge on and from the property. These conditions shall include the following:

2b. Prior to the occupancy of any part of the Petition Area, the Petitioner shall engineer, construct (or require to be constructed) and maintain surface water/storm water containment systems that ensure no State water quality standards will be violated.

2c. No injection well shall be constructed as an element of a surface water/storm water containment system in the Petition Area unless, prior to the start of any construction, appropriate requirements of HAR Chapter 11-23 are satisfied and the Hawaii State Department of Health issues an UIC (Underground Injection Control) permit. Contaminants shall be monitored and removed with best efforts prior to entering injection wells.

2d. If a large void, such as a lava tube or solution cavity, is encountered

during drilling, where the drill rod drops more than three feet, measures shall be taken to prevent migration of the injected fluids to the Kaloko-Honokohau National Park to the satisfaction of the Hawaii State Department of Health as described in HAR §11-23-09(f).

2e. All injection wells established in the Petition Area shall be operated in such a manner that they do not violate any of the Hawaii State Department of Health's administrative rules under title 11 HAR, regulating various aspects of water quality and pollution, and chapters 342-B, 342-D, 342-F, 342-H, 342-J, 342-L, and 342-N, Hawaii Revised Statutes (HRS). Relevant HAR include but, are not limited to:

i. Chapter 11-20, "Rules Relating to Potable Water Systems";

ii. Chapter 11-62, "Wastewater Systems"; and

iii. Chapter 11-55, "Water Pollution Control".

2f. The operator of any injection well or wells in the Petition Area shall keep detailed records of the operation of the well or wells, including, but not limited to, the type and quantity of injected fluids, and the method and rate of injection for each well. Such records will be available for inspection or review by the Hawaii State Department of Health as specified under appropriate sections of HAR Chapter 11-28.

2g. Any person who violates any of these conditions shall be subject to penalties as prescribed in appropriate chapters of HRS and HAR as they relate to (but

are not limited to): Potable Water Systems; Wastewater Systems; Water Pollution Control; Safe Drinking Water; and Underground Injection Control.

2h. The Petitioner, successors and/or individual lot owners in the Petition Area shall ensure that all drainage injection wells or subsurface drainage structures be designed with a debris catch basin to allow the detention and periodic removal of rubbish and sediments deposited by runoff. Storm water runoff shall first enter the debris catch basin before flowing into the drainage well. The debris catch basin's volume should be at least two (2) cubic yards (or approximately 4'x4'x4'). The debris catch basin shall be periodically inspected and cleaned accordingly. Oil/water separators shall be utilized where petroleum products are used.

Pollution Prevention

3a. Any public or private industrial development within the Petition Area which could be considered a new source of pollution or an increased source of pollution shall, in its initial project design and subsequent construction, provide the highest and best degree of waste treatment practicable under existing technology.

3b. Before constructing upon or occupying any portion of the Petition Area, a Pollution Prevent Plan (PPP), after consultation with the National Park Service, shall be developed that addresses each of the types of uses permissible in the light industrial park, by specifically designating Best Management Practices (BMPs) tailored to each

specific use. Emphasis shall be given to structural BMPs to prevent any and all pollutants that may be associated with such industries from being released into the environment, including reaching the groundwater. Structural BMPs shall include, but shall not be limited to, oil/water separators, detention ponds, lined containment pits, and stormwater filtration units designed to contain and remove industrial contamination. The PPP shall include but not be limited to:

i. All cleaning, repairs and maintenance of equipment involving the use of industrial liquids, such as gasoline, diesel, solvent, motor oil, hydraulic oil, gear oil, brake fluid acidic or caustic liquids, antifreeze, detergents, degreasers, etc. shall be conducted on a concrete floor, whether roofed or unroofed. The concrete floor shall be constructed to contain any drip or spills and to provide for the recovery of any spilled liquid. Water drainage from these concrete floors if necessary, shall pass through a separator sump before being discharged.

ii. Any containers used for storage of used oil or other industrial liquids shall be kept on a concrete surface. The surface shall be bermed to prevent the loss of liquid in the event of spills or leaks. The containers shall be sealed and kept under shelter from the rain.

(The Department of Labor and Industrial Relations' Occupational Safety and Health regulations, sections titled, "Housekeeping Standards" and "Storage of Flammable or Combustible Liquids," shall be followed along with the local fire code.)

iii. All employees shall be informed to immediately collect and contain any industrial liquid spills on the concrete floor and should be informed against discharging or spilling any industrial liquids. Employees shall be aware to prevent any industrial spill onto the bare ground.

In the event that a specific use is proposed for the Petition Area that is not specifically addressed in the PPP, the Petitioner and/or the individual lot owner(s) proposing such use shall consult with the National Park Service to establish a set of BMPs appropriate for such proposed use and consistent with the goal of preventing any and all pollutants from being released into the environment. In the event that the Petitioner and the National Park Service cannot agree upon a mutually acceptable PPP within 12 months of the date of issuance of the boundary reclassification, the Commission shall review the draft PPP, along with written comments from Petitioner, the National Park Service and the other parties, and shall issue a final PPP. In no event shall the Petitioner and/or individual lot owner(s) construct upon or occupy any portion

of the Petition Area until such time as the final PPP is complete. The final PPP shall be recorded and shall run with the land within the Petition Area in the same manner as all conditions of approval imposed by the Commission.

3c. The Petitioner, its successors or individual lot owners shall provide signage for all drainage/injection wells in the Petition Area with warnings such as the following: DUMP NO WASTES. GOES TO GROUNDWATER AND OCEAN. HELP PROTECT HAWAI'I'S ENVIRONMENT. Signage shall be either stand-up (legible from at least 30 feet, permanently posted at an effective and safe height) or painted on the ground next to the drainage well's inlet.

3d. For parking areas, BMPs will be established as covenants running with the land, which emphasize pollution prevention rather than treatment. All large vehicles such as buses, trucks, or construction equipment shall utilize drip pans to avoid release of petroleum onto paved surfaces. Areas used primarily for automobile parking shall be periodically checked and cleaned to avoid buildup of oil or other automotive fluids. Maintenance work other than emergency work on vehicles will be banned in parking areas.

3e. Where site geometry permits, the Petitioner, its successors or individual lot owners shall design and construct (or require to be constructed) landscaped areas,

including grassed or vegetative swales to capture storm water drainage from all perimeter lots, facilities, and parking areas of the Petition Area.

3f. Owner or operator covenants developed for the Petition Area shall expressly disclose to all future individual lot owner(s) the existence of the National Park System Resource Protection Act, 16 U.S.C. Sections 19jj-19jj-4, and the consequences of violation of such act. In particular, future land owners shall be made aware that any person who destroys, causes the loss of, or injures any park system resource is liable to the United States for response costs and damages resulting from such destruction, loss or injury.

3g. The Petitioner shall participate and collaborate in a regional (Kaloko-Honokohau) pollution prevention forum to be convened by the Commission within one year from the issuance of this decision and order. Intervenor shall be invited as well. Topics to be discussed include: pollution prevention planning; best available control technologies (BACT); structural and operation BMPs addressed to the type of uses permissible in the light industrial park, and formulas for determining fair and reasonable pro-rata share costs relating to any ground water monitoring program. Participants in this forum should include but not necessarily be limited to individuals

or entities with property or development interests impacting the Queen Kaahumanu Highway corridor extending from the Kona International Airport to the Palani Road intersection.

Groundwater Quality Monitoring

4. The Petitioner shall contribute its fair and reasonable pro-rata share of costs relating to a ground water monitoring program of USGS Wells 4161-01, 4161-02 and 4061-01, Aimakapa Pond, Kaloko Pond and two (2) other anchialine ponds of the Kaloko-Honokohau Historic National Park as identified by the National Park Service. Monitoring would continue once every six months for 10 years from initial occupancy, or until such time as sewer lines and hookup to the WWTP is implemented.

Constituents to be monitored shall be of a full suite of nutrients (including nitrogen and phosphate), contaminants (including metals, phenolic compounds, pesticides and pesticide breakdown products, chlorinated solvents, BTEX compounds, selected pharmaceutical endocrine disruptive compounds, such as ethinyl estradiol, and nonylphenol), and standard water quality parameters (including pH, temperature, dissolved oxygenates, and salinity). The fair and reasonable pro-rata share of costs will be determined by the Commission and in conjunction with the findings generated at the regional pollution prevention forum discussed above.

Regional/Local Transportation

5a. The Petitioner shall participate and collaborate in a regional (Kaloko-Honokohau) transportation planning forum to be convened by the Commission within one year from the issuance of this order. Participants in this forum to be convened include but, are not limited to individuals or entities with a property or development interest impacting the Queen Ka'ahumanu Highway corridor extending from the Kona International Airport to the Palani Road intersection. Topics to be discussed include: regional transportation planning issues; the timing and cost of necessary improvements to the Queen Ka'ahumanu Highway as described in the Hawaii Long Range Transportation Plan; determination of individual fair share contributions; and process for resolving any conflicts which may arise.

5b. The Petitioner shall contribute their fair and reasonable pro-rata funding and construction of regional transportation improvements and programs to the satisfaction of the State Department of Transportation for the Petition Area.

5c. The Petitioner shall participate and collaborate with the County of Hawaii Department of Public Works and other affected agencies in the development of County feeder streets within the Petition Area.

5d. Petitioner shall participate in the fair and reasonable pro-rata funding and construction of any such roadways from its northern boundary to the southern

boundary in accordance with the roadway requirements of the County of Hawaii.

5e. Petitioner shall provide an appropriate easement as determined by the County of Hawaii on the south end of Kamanu Street in order to provide a North-South connection with the adjoining property.

Financial Contribution Plan

6. The Petitioner shall coordinate with affected State or County agencies the development of a financial plan for satisfying any financial contributions or requirements associated with this petition. All such plans may provide for an annual fair share incremental payment to the affected agency by the Petitioner out of the development revenues or otherwise. The affected State or County agency may establish a dedicated escrow account for the deposit and utilization of the financial contribution from Petitioner to facilitate this plan.

Affordable Housing

7. The Petitioner shall submit a housing needs assessment and implementation plan to the Commission and appropriate County housing agency for their review and approval within six months of the issuance of this decision and order and comply with the County of Hawaii affordable housing policy. The housing needs assessment shall be based on an analysis of the jobs generated by the development, the projected number of qualified households which may be entitled to housing assistance

as specified by the County of Hawaii, the number and availability of affordable housing units and rentals in the West Hawaii area (both planned and built), the projected number of employees from the development who might be expected to commute from East Hawaii, the number of owner occupants (within the Petition Area) who reside in the West Hawaii area and the number of employees who might already reside in the West Hawaii area.

Archaeological/Historical Sites

8a. Eight sites (21999, 22010, 22014, 22016, 22017, 22018, 22023, and 22032) retain the potential to yield information important for understanding prehistoric and historic land use. If Petitioner believes that one or more of these sites cannot be preserved, it shall provide to the Land Use Commission no later than six (6) months after this decision and order is issued a mitigation plan for its review and approval.

8b. Should any previously unidentified burial, archaeological or historical sites such as artifacts, marine shell concentrations, charcoal deposits, stone platforms, pavings or walls be found, the Petitioner, developer(s) and/or landowners of the affected properties shall stop work in the immediate vicinity and the State Historic Preservation Division of the Department of Land and Natural Resources (SHPD) shall be notified immediately. The significance of these finds shall then be determined and approved by the SHPD. Subsequent work shall proceed upon an archaeological

clearance from the SHPD when it finds that mitigative measures have been implemented to their satisfaction.

Landscaping

9a. Petitioner shall develop a landscaping plan for the Petition area that can be followed by each subsequent lot owner/tenant. Fishermen knowledgeable of traditional reference points used in locating fishing grounds, and the National Park Service shall be consulted on the development of building and landscape design guidelines prior to construction to maintain these reference points.

9b. Petitioner, where feasible, shall use indigenous and water conserving plants such as the papyrus (native paper plant) and incorporate the same into common area landscape planting.

9c. The Amy B.H. Greenwell Botanical Garden, Kaloko-Honokohau National Historical Park and other interested parties and educational institutions shall be afforded the opportunity to gather seeds and cuttings of native plants on the property that cannot be rescued or incorporated into the project's landscaping plan.

9d. The Petitioner shall provide buffer fences/buffer strips to protect the Bidens Micrantha, a candidate endangered species by establishing a buffer zone with a minimum width of 30 feet, in the immediate vicinity of Bidens Micrantha #1 plant identified in the EIS. The Petitioner shall ensure that genetic material (seeds and

cuttings) are propagated from the other three Bidens Micrantha plants located within the makai portion of the Petition area.

Soil Erosion and Dust Control

10. Petitioner shall implement efficient soil erosion and dust control measures during and after the development process to the satisfaction of the Hawaii State Department of Health.

Civil Defense

11. Petitioner, developers and/or landowners of the affected properties shall add a solar powered siren with 115 Dbc omni directional speaker array, and insure that the siren be installed in a central location funded and constructed according to adequate civil defense measures as determined by the County of Hawaii and State Civil Defense agencies.

12. Petitioner shall develop the Petition area in full compliance with all material representations made by the Petitioner to the Commission. Failure to do so for any reason including but not limited to economic feasibility, may result in the imposition of fines as provided by law for each and every separate violation, reversion of the Petition area to its former condition by Petitioner at Petitioner's own expense, reversion of the Petition Area to its former classification or a change to a more appropriate classification and/or any other legal remedies, including but not limited to

suit for actual and punitive damages under Federal or State law or suit for injunctive relief that requires the developer to restore the project area to its former condition.

13. Petitioner shall give notice to the Commission of any intent to sell, lease, assign, place in trust, or otherwise voluntarily alter the ownership interests in the Petition Area, prior to development of the Petition Area.

14. Petitioner shall timely provide without any prior notice, annual reports to the Commission, the Office of Planning, and the County of Hawaii Planning Department in connection with the status of the subject project and Petitioner's progress in complying with the conditions imposed herein. The annual report shall be submitted in a form prescribed by the Executive Officer of the Commission.

15. The Commission may fully or partially release the conditions provided herein as to all or any portion of the Petition Area upon timely motion and upon the provision of adequate assurance of satisfaction of these conditions by Petitioner.

16. Within 7 days of the issuance of the Commission's Decision and Order for the subject reclassification, Petitioner shall (a) record with the Bureau of Conveyances a statement that the Petition Area is subject to conditions imposed by the Land Use Commission in the reclassification of the Petition Area, and (b) shall file such copy of such recorded statement with the Commission.

Petitioner shall record the conditions imposed by the Commission with the

Bureau of Conveyances pursuant to Section 15-15-92 Hawaii Administrative Rules. All such conditions shall run with the land.

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ADOPTION OF ORDER

The undersigned Commissioners, being familiar with the record and proceedings, hereby adopt and approve the foregoing ORDER this 7th day of February, 2002. This ORDER and its ADOPTION shall take effect upon the date this ORDER is certified and filed by this Commission.

LAND USE COMMISSION
STATE OF HAWAI'I

By _____
MERLE A. K. KELAI
Chairperson and Commissioner

By (absent)
LAWRENCE N.C. ING
Vice Chairperson and Commissioner

By _____
P. ROY CATALANI
Commissioner

By _____
BRUCE A. COPPA
Commissioner

By _____
PRAVIN DESAI
Commissioner

By _____
ISAAC FIESTA, JR.
Commissioner

By _____
M. CASEY JARMAN
Commissioner

By _____
STANLEY ROEHRIG
Commissioner

By _____
PETER YUKIMURA
Commissioner

APPROVED AS TO FORM:

_____
Deputy Attorney General

Filed and effective on
February 14, 2002

Certified by:

_____
Executive Officer