

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII



STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P.O. BOX 1879
HONOLULU, HAWAII 96805

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOBIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

November 8, 1995

Mr. Gary Gill, Director
Office of Environmental Quality Control
220 S. King Street, 4th Floor
Honolulu, Hawaii 96813

Dear Mr. Gill:

SUBJECT: Final Environmental Assessment for Kahikinui Kulcana Homestead Project,
Kahikinui, Maui

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OFFICE OF ENVIRONMENTAL
QUALITY CONTROL

The State Department of Hawaiian Home Lands accepts the Final Environmental Assessment (EA) for this project and has prepared a determination of Negative Declaration. Public comments received during the draft EA period have been addressed and are included in the Final EA.

Please publish notice of availability of this document in the November 23, 1995 OEQC Bulletin. We have enclosed a completed OEQC Bulletin Publication Form and four copies of the Final EA.

Warmest Aloha,

A handwritten signature in cursive script that reads "Kali Watson".

Kali Watson, Chairman
Hawaiian Homes Commission

Enclosures

cc: Brian Takeda, R.M. Towill Corporation

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1995-11-23-MA+FEA-Kahikinui Kuleana Homestead Project 23 1995

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PREPARED IN ACCORDANCE WITH CHAPTER 343, HAWAII REVISED STATUTES

Final Environmental Assessment
**KAHIKINUI KULEANA
HOMESTEAD PROJECT**
Kahikinui, Maui, Hawaii

November 1995

State of Hawaii
DEPARTMENT OF HAWAIIAN HOME LANDS
Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813

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R. M. TOWILL CORPORATION
420 Waiakamilo Road, Suite 411
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Voice: (808) 842-1133
Facsimile: (808) 842-1937

OFFICE OF ENVIRONMENTAL
QUALITY CONTROL

95 NOV -8 P3:19

RECEIVED

Final Environmental Assessment
KAHIKINUI KULEANA HOMESTEAD PROJECT
Kahikinui, Maui, Hawaii

November 1995

PREPARED FOR:
State of Hawaii
Department of Hawaiian Home Lands
Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813

PREPARED BY:
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TABLE OF CONTENTS

	PAGE
PROJECT SUMMARY	1
SECTION 1 - INTRODUCTION	
1.1 Introduction	2
1.2 Purpose	2
1.3 Project Location and Existing Use	3
SECTION 2 - PROJECT DESCRIPTION AND BACKGROUND	
2.1 Program Concept	4
2.2 Operating Principles	6
2.3 Land Use Plan	7
2.4 Land Use Principles	10
2.5 Project Schedule and Estimated Cost	12
SECTION 3 - PHYSICAL ENVIRONMENT	
3.1 Climate	13
3.2 Topography, Geology, Soils	13
3.3 Hydrogeology	14
3.4 Flora	16
3.5 Fauna	18
3.6 Scenic and Visual Resources	21
3.7 Historic/Archaeological Resources	21
3.8 Noise	24
3.9 Air Quality	24
SECTION 4 - SOCIOECONOMIC ENVIRONMENT	
4.1 Population and Employment	26
4.2 Surrounding Land Uses	27
SECTION 5 - PUBLIC FACILITIES AND SERVICES	
5.1 Transportation Facilities	29
5.2 Other Infrastructure	29
SECTION 6 - RELATIONSHIP TO LAND USE, POLICIES, AND CONTROLS OF THE AFFECTED AREA	
6.1 Hawaii State Plan	32
6.2 State Functional Plans	32
6.3 State Land Use Law	34
6.4 County of Maui General Plan and Development Plan	34
6.5 County of Maui Zoning	34

	PAGE
SECTION 7 - ALTERNATIVES TO THE PROPOSED ACTION	
7.1 No Action Alternative	35
7.2 Development of "Conventional" Project	35
7.3 Recommended Action	36
SECTION 8 - RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY	37
SECTION 9 - IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES BY THE PROPOSED ACTION	38
SECTION 10 - NECESSARY PERMITS AND APPROVALS	39
SECTION 11 - DETERMINATION	40
SECTION 12 - LIST OF ORGANIZATIONS AND AGENCIES CONSULTED IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT	
12.1 State Agencies	41
12.2 County Agencies	41
12.3 Federal Agencies	41
12.4 Citizens, Groups, and Organizations	41
SECTION 13 - COMMENTS AND RESPONSES TO THE DRAFT ENVIRONMENTAL ASSESSMENT PREPARATION	42
REFERENCES	43

APPENDICES

- APPENDIX A - PRELIMINARY ASSESSMENT OF USABLE WATER RESOURCES, KAHIKINUI, MAUI
- APPENDIX B - BOTANICAL SURVEY REPORT FOR THE PROPOSED KAHIKINUI KULEANA HOMESTEAD PROJECT SITE
- APPENDIX C - SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT STATE OF HAWAII DEPARTMENT OF HAWAIIAN HOME LANDS PROPERTY AT KAHIKINUI, MAUI
- APPENDIX D - ARCHAEOLOGICAL RECONNAISSANCE OF AN 8,300-ACRE PROJECT AREA, KAHIKINUI, MAUI

LIST OF FIGURES

- FIGURE 1 - LOCATION MAP
- FIGURE 2 - PROJECT AREA
- FIGURE 3 - PARCEL PLAN
- FIGURE 4 - SLOPE ANALYSIS
- FIGURE 5 - SOILS MAP
- FIGURE 6 - RIFT ZONES
- FIGURE 7 - WELL LOCATION MAP
- FIGURE 8 - ARCHAEOLOGICAL FEATURES

PROJECT SUMMARY

Project: Kahikinui Kuleana Homestead Project

Applicant: State of Hawaii
Department of Hawaiian Home Lands
Old Federal Building
335 Merchant Street
Honolulu, Hawaii 96813

Accepting Authority: Department of Hawaiian Home Lands

Tax Map Key: Second Division, 1-9-01: Portion 03

Location: Kahikinui, Island and County of Maui, State of Hawaii

Project Area: Approximately 1,700 acres

Owner: State of Hawaii
Department of Hawaiian Home Lands

Agent: R. M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817
Phone: (808) 842-1133
Facsimile: (808) 842-1937

Existing Land Uses: Pasture

State Land Use District: Agricultural

County of Maui
Hana Community Plan: Pasture/Ranching/Open Space

County of Maui
Zoning Designation: Not zoned

Section 1
INTRODUCTION

1.1 INTRODUCTION

The Department of Hawaiian Home Lands (DHHL) proposes to distribute land at Kahikinui, Maui, for homesteading purposes to qualified beneficiaries of Native Hawaiian ancestry. This proposed project will utilize State funds for development and is therefore subject to Chapter 200, Title 11, Hawaii Administrative Rules, and Chapter 343, Hawaii Revised Statutes. This Environmental Assessment has been prepared to address the limited environmental impacts which are anticipated for this project.

1.2 PURPOSE

The purpose of this project is to offer land to Native Hawaiian beneficiaries for homesteading purposes at Kahikinui, Maui. Approximately 1,700 acres of vacant land located on the southern slopes of Haleakala, Island of Maui, are proposed for distribution. The site will be divided into approximately 125 parcels ranging from between 10 to 20 acres. The only improvements proposed will be a bladed roadway network to provide access to individual parcels. No other improvements are proposed by DHHL. Infrastructure including water, sewage, solid waste disposal, communications and energy needs, are to be the responsibility of the beneficiaries.

The Hawaiian Homes Commission Act of 1920, as amended, provides for the settlement of Native Hawaiians on Hawaiian Home Lands. This project is consistent with the Hawaiian Homes Commission Act and is intended to expand the current programs offered by DHHL. This project addresses: 1) requests for raw land by beneficiaries for homesteading, pasturage, and self sufficiency purposes; and 2) need to provide beneficiaries with the opportunity to settle on land more quickly than other programs which would require major expenditures and long lead times for development of infrastructure. The successful

implementation of this program will lead to expansion of the concept to other lands under jurisdiction of DHHL.

1.3 PROJECT LOCATION AND EXISTING USE

The proposed project is located in Southeast Maui (Figure 1). The project site encompasses 1,700 acres and was part of a previous 9,000+ acre study area to delineate the most advantageous lands for development (Figure 2). The project site is 10.5 miles east of Makena, 12 miles east of Wailea, and 18 miles west of Hana. The site's makai boundary is approximately 1,600 feet north of Piilani Highway and its mauka boundary is approximately 13,000 feet north of the Highway. Lualailua Hills is approximately 4,000 feet west to southwest from the project site. Elevation of the site ranges from +1,500 feet to 4,200 above mean sea level. All lands proposed for this project are owned by the State of Hawaii, under jurisdiction of the Department of Hawaiian Home Lands.

The proposed project site is part of a 22,500-acre tract owned by DHHL. This larger tract is generally bounded by Piilani Highway to the south, the Kahikinui Forest to the north, Manawainui Gulch to the east, and the Auwahi ahupua'a to the west.

The area has been used for cattle grazing for the past 100 years. The most recent grazing use was by Maui Factors, Inc., which has discontinued operations since the early 1990s. The existing site contains various small shrubs and vegetation and indicates that with the cessation of pastoral uses, regeneration of some forms of vegetation are occurring. Presently, the site is vacant and uninhabited. The only evidence of prior modern human activity are the remnants of former ranch operations such as dirt roads, a surface water pipeline system constructed of galvanized steel, and stone corrals in various states of disrepair.

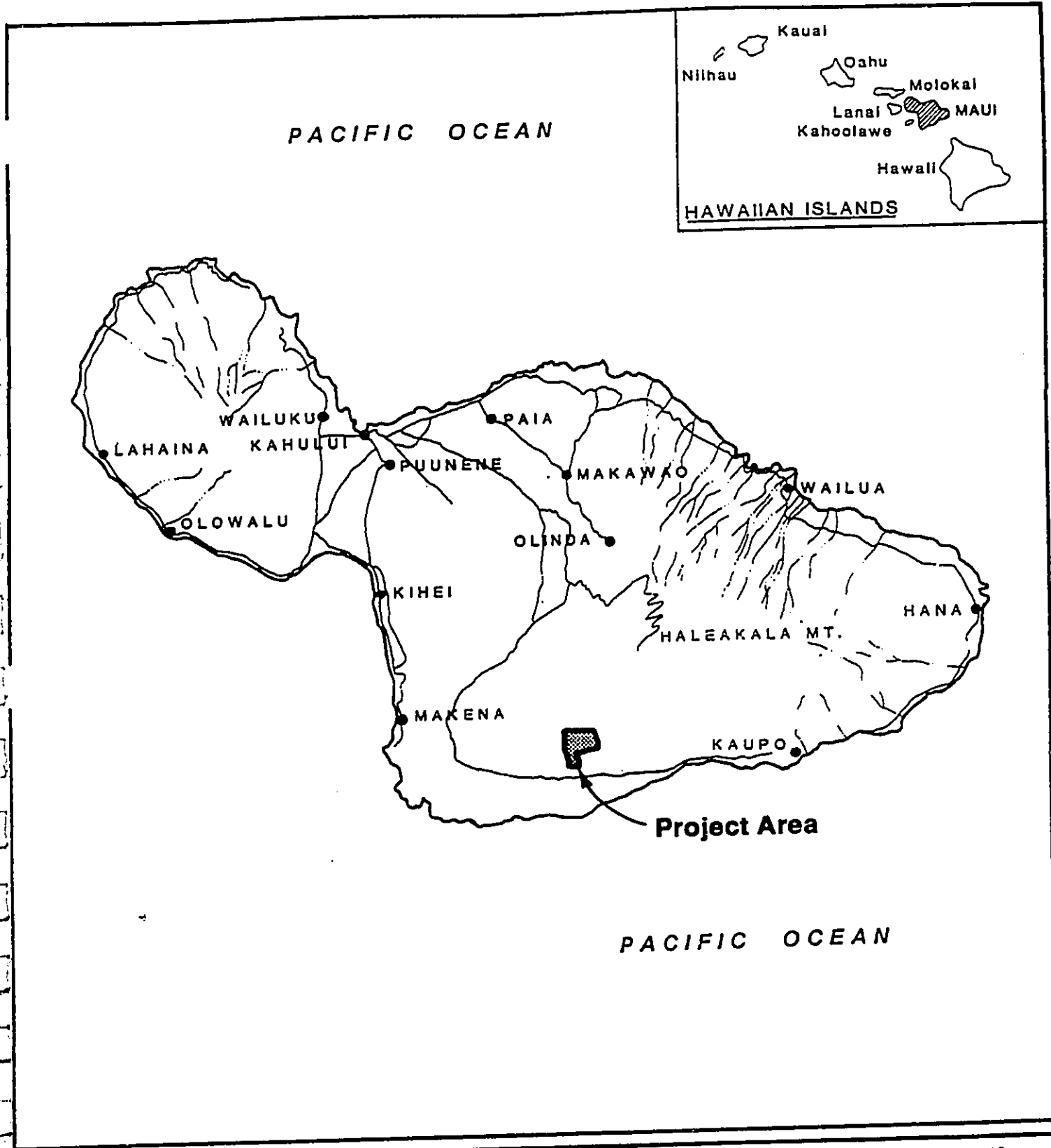
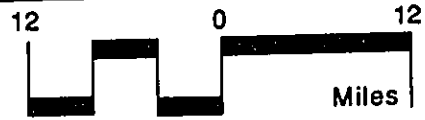


Figure 1
Location Map

Department of Hawaiian Home Lands
STATE OF HAWAII



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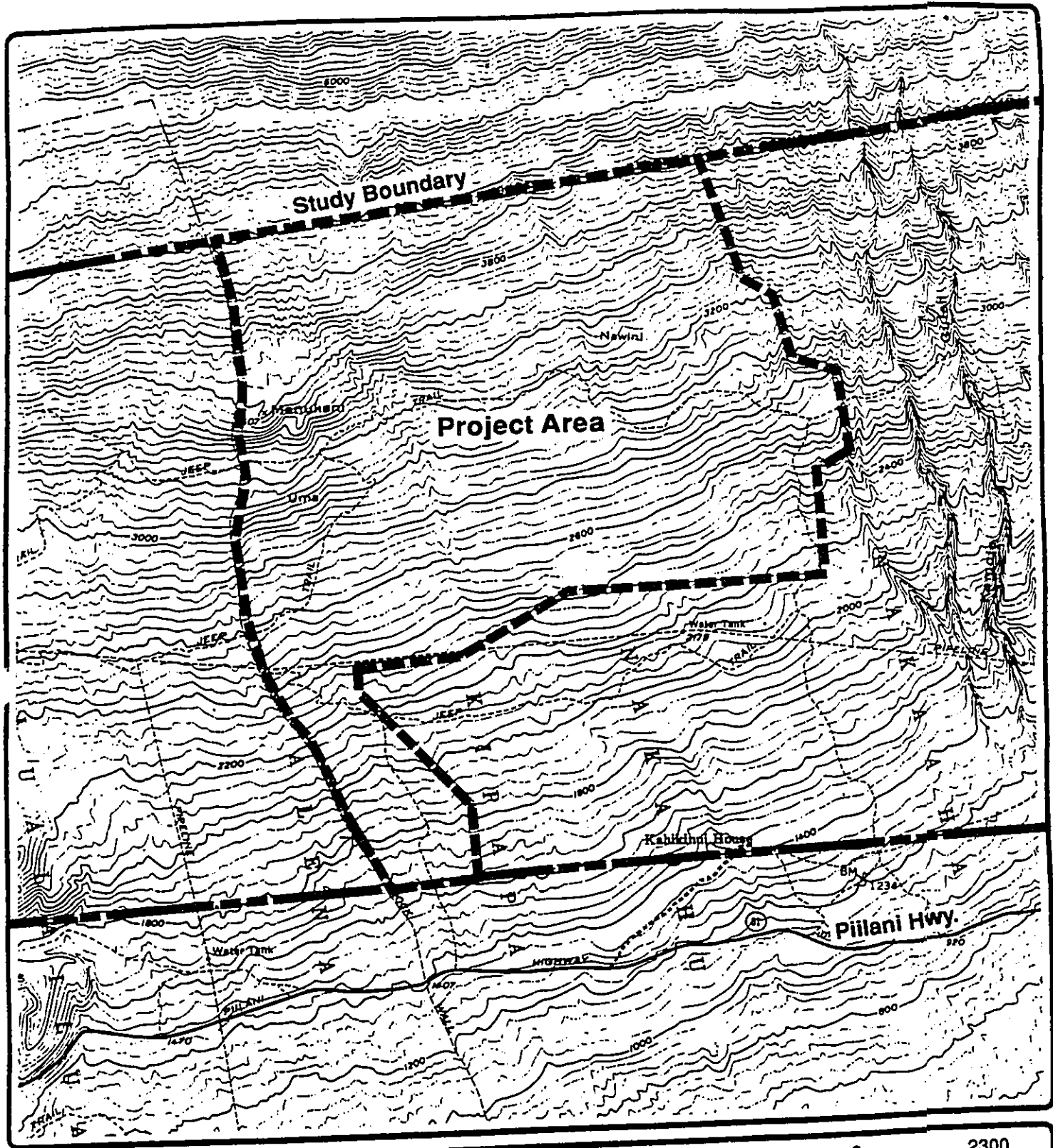


Figure 2
Project Area
 Department of Hawaiian Home Lands
 STATE OF HAWAII



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Section 2

PROJECT DESCRIPTION AND BACKGROUND

2.1 PROGRAM CONCEPT

The Kuleana Homestead Program is designed to provide another homesteading alternative to beneficiaries of the Hawaiian Home Lands trust. Giving beneficiaries immediate access to the land, allowing for the expeditious construction of safe dwellings, and the opportunity to create new communities are the major features of the program.

The term *Kuleana* refers to a small area of land awarded to a Hawaiian by the King or ruling monarch of the 1850s. This granting of land carried with it the responsibility to respect and care for the land. In return for wise stewardship, the land provided sustenance and well being to its occupants. This sense of responsibility -- both to the land, and to those who share in the use of the land, is the guiding principle for development of the Kuleana Homestead Program.

The concept is not a new one but one that revives the traditional sense of homesteading. That is, settlement of land without any modern improvements such as electricity, water lines, sewer systems, paved roads and other conventional "on-grid" utilities associated with urbanization.

The Kuleana Homestead Program is designed to be flexible, thus allowing the program to consider land conditions and beneficiary input into land planning and program requirements as it is implemented for each area designed for the program. DHHL will bring this about by initiating a community-based planning process for each area designed for the Kuleana Homestead Program.

Wherever possible, the planning process will include the concept of ahupua'a planning as another guiding principle whereby DHHL and the beneficiary community will consider

the land division running from the mountain top to the ocean in planning for the use and stewardship of the land division's natural and cultural resources.

Empowering Hawaiian Home Lands beneficiaries with the opportunity to determine as a group or as individuals, choices on how they wish to develop their Kuleana Homestead awards is another guiding principle of the program. Along with the empowerment to choose comes the responsibility to manage the awards in accordance with the Kuleana Homestead Program's principles, required health and safety standards, design and building standards, and lease agreement provisions jointly determined by the Department and each homesteader or homestead community involved in the Kuleana Homestead Program.

As such, this program may vary from region to region and range from those who wish to have immediate access to a lot to practice full time subsistence lifestyles - to those who wish to have an occasional retreat and gradually work on improvements to their homestead lot. The community-based planning processes established for each area may eventually lead to the creation of contemporary, alternative, "off-grid" Hawaiian communities or to the creation of fully developed parcels with a range of "on-grid" amenities typically associated with developed properties.

To expedite access and settlement of the land, the Department will construct unpaved roads to the awardees' surveyed and staked lots. Awardees will then have immediate access to their lots. DHHL will not plan for the installation of any other improvements.

The Kuleana Homestead Program is not for everyone. Beneficiaries who want typical subdivision infrastructure should not select a Kuleana Homestead lease award and wait for the Department to provide improved lots. The program is designed for the beneficiary who can handle the rigors of an "off-grid", subsistence living life style.

Finally, the Kuleana Homestead Program's target beneficiaries also includes those who are unable to qualify for residential awards due to their inability to qualify for home financing

under the Department's housing development program. The Kuleana Homestead Program demonstrates that the Department's spectrum of programs addresses the diversity of its beneficiaries' socio-political-economic status and accompanying value systems.

2.2 OPERATING PRINCIPLES

Kuleana Homesteads will be offered to qualified native Hawaiians in the same manner in which other dispositions are offered. As with other dispositions, the lots will be offered by the date of applications, by area, and by island. The only difference is that the awards will be made regardless of whether the applicant is on the pastoral or agricultural list. Anyone choosing to select a Kuleana Homestead award will be removed from other lists. Anyone currently with a homestead lease will not be allowed to select a Kuleana Homestead lease unless they assign or return their current lease. As such, another waiting list will not be created for the Kuleana Homestead Program. The pastoral and agricultural lists will be consolidated by date of application, by area and by island into one master list for the purpose of offering Kuleana Homestead awards as lands are dedicated to the program.

The awards at Kahikinui will be made using the Maui pastoral list. This was done as a pilot project to expedite the awards process in order to demonstrate the effectiveness of the program.

Basic needs will be provided using the following measures:

- Homesteaders will be responsible for constructing their own dwelling units. Construction standards, building permits, and inspection protocols will be developed and enforced by DHHL or by participating homestead community associations.
- Homesteaders will need to carry potable water to individual Kuleana Homestead lots. Catchment basins may supplement the need for additional water.

- Homesteaders shall be responsible for providing their own energy needs. Electricity could be provided via generators or alternative energy sources.
- Homesteaders shall be responsible for providing their own solid waste and waste water disposal. Sewage could be handled via portable septic systems or dry composting toilets.
- Homesteaders shall be responsible for providing their own communication systems. Communications could be handled via cellular telephones or radios.

Development of permanent, long term infrastructure solutions may eventually be desired by the homestead community. Cooperatives, improvement associations, community development corporations and self-help programs are recommended to equitably share costs and to maximize economies of scale. The lessees may also find it productive to work with counties in the provision and maintenance of those services. It is understood that DHHL's only commitment is to provide the land, an unpaved road, and to survey, stake, and award lots in accordance with the Kuleana Homestead Program rules to be promulgated.

2.3 LAND USE PLAN

Kahikinui is the first area selected for DHHL's new Kuleana Homestead Program. DHHL is refining the program as it is being implemented. Final rules for the program will be developed once homestead lots are successfully awarded at Kahikinui.

In August 1994, the Department initiated Maui HHL beneficiary community-based planning for the pilot Kuleana Homestead Program at Kahikinui. Land awards at Kahikinui will be offered to those applicants on the Maui pastoral waiting list.

Kahikinui is a special place with 22,805 acres of land spanning from the summit of Haleakala to the ocean. It is the only intact ahupua'a on DHHL's land inventory. As such,

the Maui beneficiary community advised that the **ahupua'a concept** of land planning and management be initiated for the ahupua'a.

The now arid ahupua'a was once home to hundreds of Native Hawaiians and provided habitat to scores of native plants and animals. Today, due to overgrazing and the loss of its watershed, virtually no one inhabits the land. Much of its cultural sites, native plants, animals and their habitat have been neglected or nearly destroyed.

The beneficiary community on Maui desires that the settlement of Kahikinui be viewed as a long term Native Hawaiian community effort to resettle and restore the ahupua'a of Kahikinui.

As such, all who accept a land award at Kahikinui are required to reside on the land and are invited to be a part of a new community and its effort to restore the ahupua'a.

Via the beneficiary-community based planning process on Maui, a community plan to protect and restore the native forest and watershed on the mauka slopes has been completed.

The proposed land use plan involves two major elements: 1) construction of the access roadway system, and 2) parcel plan.

ACCESS ROADWAY SYSTEM

The major accessway to the project site is via Piilani Highway, a minimally improved roadway system. Access within the project site will be provided via a rough graded unimproved roadway system with sufficient right-of-way to allow for future improvement and dedication per standards of the County of Maui. The roadway system will consist of the following (Figure 3):

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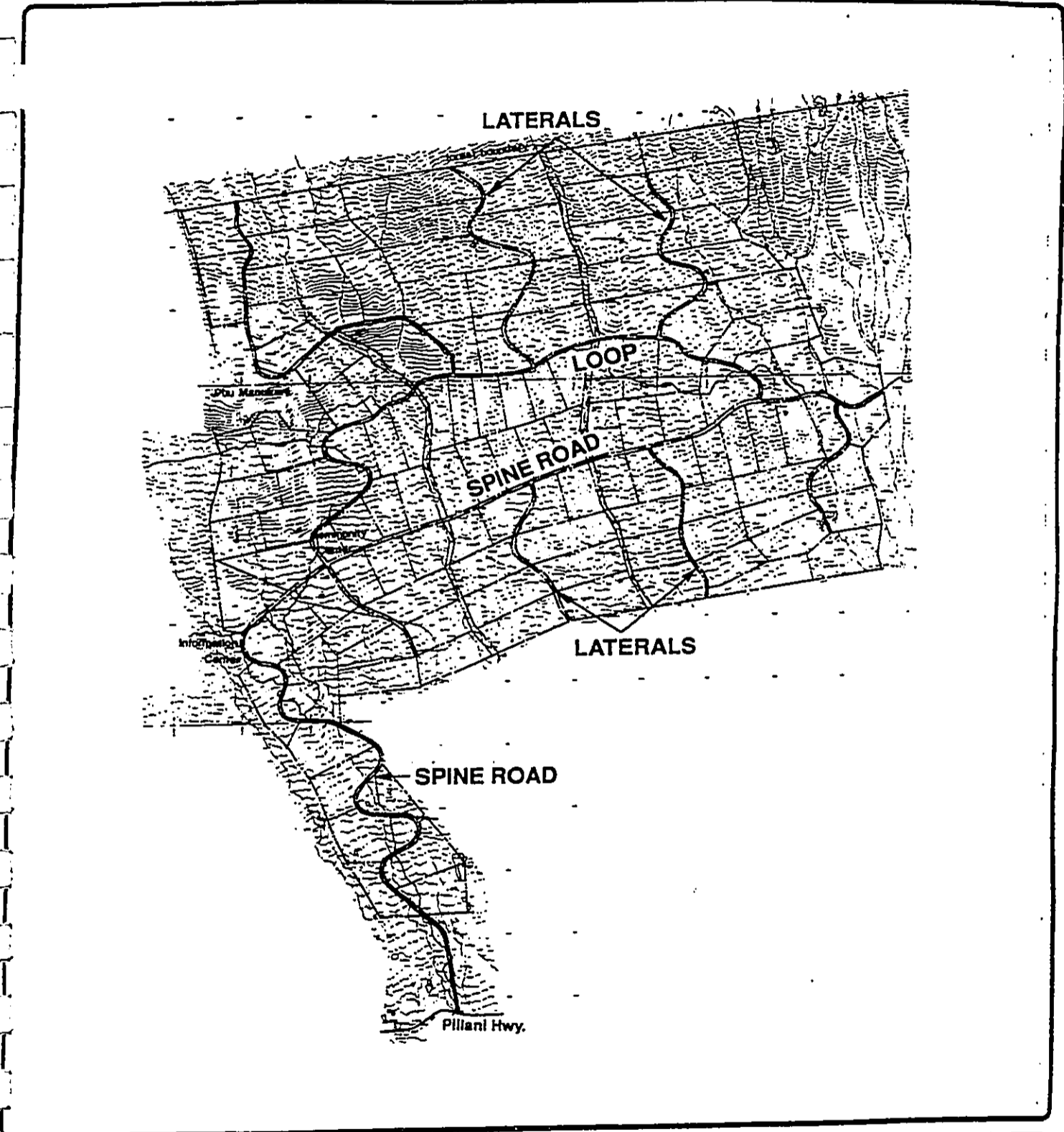


Figure 3
Site Plan

Department of Hawaiian Home Lands
STATE OF HAWAII



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July 1995

- Spine Road - A two lane spine road with 48 foot right-of-way is proposed to connect with Piilani Highway (T-intersection) to serve as the point of entry and main thoroughfare within the Kahikinui Kuleana Homestead Project site.
- Loop Road - A single lane loop road with 48 foot right-of-way will provide access to connecting lateral roads. The loop road will be an extension of the two lane spine road.
- Laterals - A system of single lane laterals with 40 foot right-of-ways will provide connection to the forest lands and for possible future access and expansion of the project. The single lane laterals will extend from the spine road and loop road.

PARCEL PLAN

Approximately 125 parcels are proposed with sizes from 10 to 20 acres (Figure 3). The parcels are oriented, wherever possible, to run "horizontal" with the terrain which will reduce the elevation difference across lots. Conversely, a "vertical" orientation would increase elevation changes across individual lots which would increase the effort for earthwork, construction, and farming. Smaller lots are therefore oriented in the central portion of the project site where there is increased opportunity for land uses, while larger lots are located in the steeper mauka portions to compensate for the greater effort needed to "work" the land.

Features of the parcel plan include the following:

- Lots - Normal County of Maui setbacks should be observed for all improvements. Along each property line a 20 foot easement should also be observed for access and utility uses.
- Community Center - Approximately 4 acres has been set aside for a future Community Center in the Uma area.

- Info Center - Sufficient space for an information center has been set aside in the area of the stone corral. The Info Center is intended to provide information and access to the dry land forest located along the western boundary of the project site.
- Puu Manukani - Community open space has been set aside in this area visually dominated by an ancient cinder cone. Anticipated uses would include outdoor recreation, community events, and related functions.
- Drainageways - Several existing major drainageways (50 to 150 feet wide) have been set aside as open space. The purpose is to allow for natural drainage and for possible future use as community catchment and transmission systems.

2.4 LAND USE PRINCIPLES

Land use principles associated with the Kahikinui Kuleana Homestead lands include:

- Kuleana Homestead lands are meant to be lands that DHHL would not be developing in the immediate future, if ever. This is due to the land's remoteness, lack of basic infrastructure, and cost of development.
- Lot sizes are proposed at 2 to 20 acres depending on the character and location of the land. Lot sizes will be sufficient for intended uses. No more than one dwelling unit will be allowed per parcel, with the opportunity for one additional ohana housing unit. Kauhale dwelling patterns may also be allowed provided that it is consistent with the intent of this section.
- Lessees shall be given the opportunity to be involved in community-based settlement planning processes including the formulation of community

design standards, building standards, and other aspects of community design and settlement planning as appropriate.

- Homesteaders, as individual lessees or as a community, are responsible for developing water, sewerage, solid waste disposal, energy and telephone/communication on their lots as their resources and abilities allow. Wherever possible, future infrastructure should be developed to meet County dedication requirements.
- Only basic unpaved roads will be provided by the Department. Sufficient rights-of-way will be set aside along roadways for utilities. Installation of future utilities will be the responsibility of Kuleana homesteaders.
- Significant historical and archaeological sites as well as significant native flora, fauna, and natural communities are to be preserved and set aside, or incorporated into the development plan.
- Land use development must be consistent with the existing topography and character of the land:
 - + Industrial uses will not be permitted. This reduces conflicts with residential uses.
 - + Vehicular access for future installation of utility services, e.g., water, sewer, electricity, etc., must be provided.
 - + Development of parcels must be consistent with area topography.
- Wherever possible land use development should be consistent with DHHL, County, and State land use controls:

- + Development should be consistent with DHHL approved homestead community planned design standards and building codes or with county building codes and plan review processes.
- + The Department and kuleana community association may enter into memoranda of understanding with the counties to delineate the counties', DHHL's, and the kuleana community associations' roles in land development, and in the provision of county services such as water connections, waste disposal, police protection, fire, emergency, and other services.
- + County land use restrictions should be considered, including the prohibition of uses which would constitute a nuisance to neighbors, e.g., noise, visual/aesthetic blight.
- + State and Federal requirements governing development of utilities including sewage, water, energy and other necessary services should be complied with to the extent practicable.

2.5 PROJECT SCHEDULE AND ESTIMATED COST

It is anticipated that due to minimal requirements for construction, this project can be completed in approximately two months. The anticipated cost will be \pm \$1 million which will need to be verified with an engineering construction cost estimate. Work would primarily involve construction of the roadway system, and surveying and staking of parcels.

Section 3
PHYSICAL ENVIRONMENT

3.1 CLIMATE

The climate in Kahikinui is characterized as warm and dry. Annual mean temperatures range from a low of 74° F to a high of 88° F. Annual rainfall is approximately 20 to 30 inches. Wind speeds in the area are generally calm in the mornings and increases in mid-day due to trade winds. Daily on- and off-shore wind patterns also influence wind conditions at the site.

3.2 TOPOGRAPHY, GEOLOGY, SOILS

Topography. The site generally slopes north to south. It is characterized as moderate to steep slopes ranging between 10% and 30% (Figure 4). A series of disjointed terraces occur along a jeep trail near the 3,000-foot elevation indicating the possible occurrence of small areas with slopes of less than 10%. Although there are many small and unnamed gulches in the area, no major gulches occur on the proposed project site. Significant streams that occur to the east of the site are intermittent below the 4,000-foot elevation. Flows from these streams do not reach the ocean due to percolation into the substrate.

Geology. Mount Haleakala is one of two shield volcanoes that formed the Island of Maui via successive lava flows. This type of volcanic activity is the fundamental process that created the Hawaiian Islands.

The site's surface soils primarily consist of permeable rocks of the Hana Series of volcanic lava flows. In areas where the Hana Series lavas crop out, rainfall absorption is so high and overland runoff so low that stream patterns have not been significantly developed. However, east of the subject property (where more DHHL land is located) and beyond, soils of the Kula Series of lava flows are less permeable. In this area, significant gullies have been carved out.

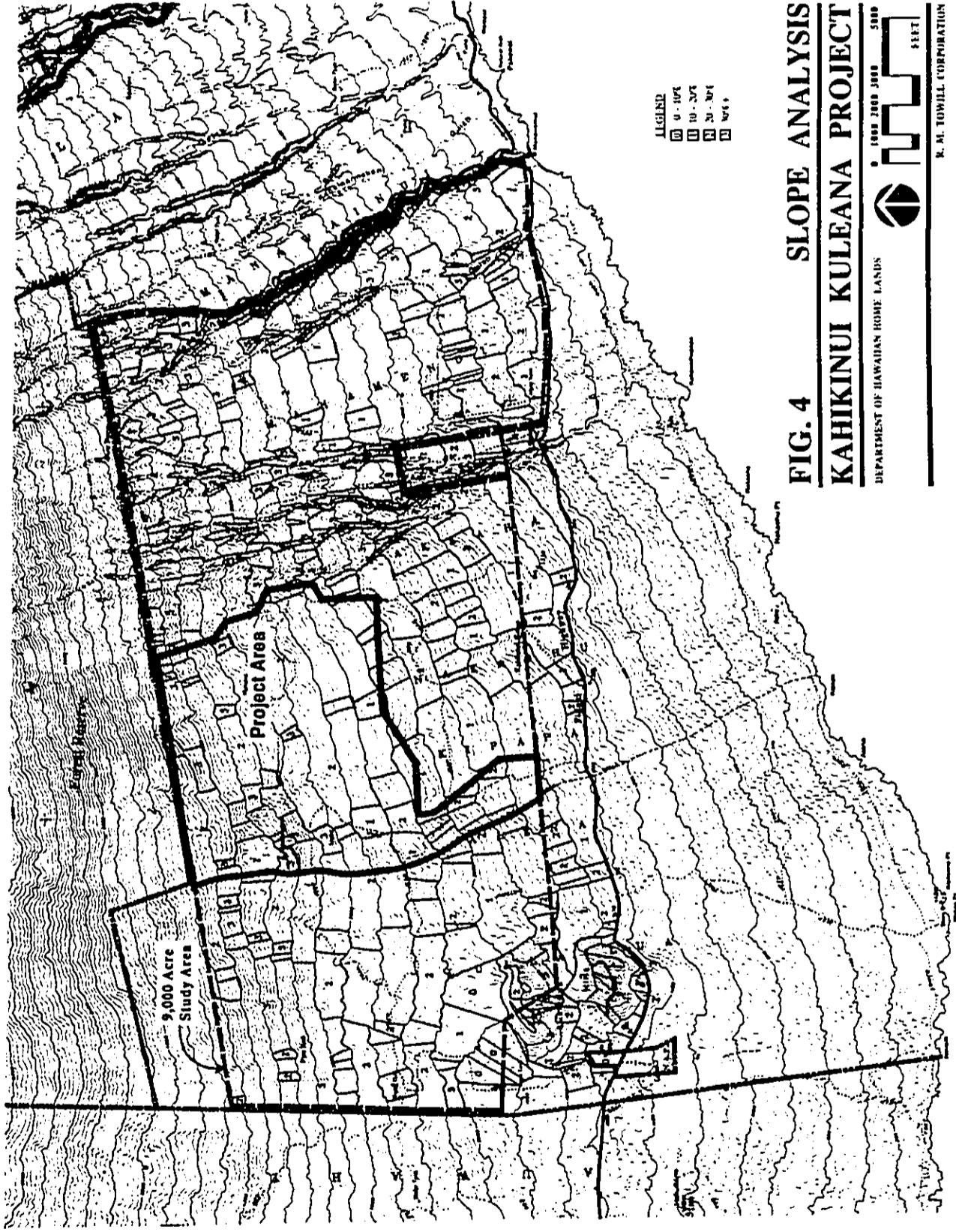


FIG. 4 SLOPE ANALYSIS
KAHIKINUI KULEANA PROJECT

DEPARTMENT OF HAWAIIAN HOME LANDS

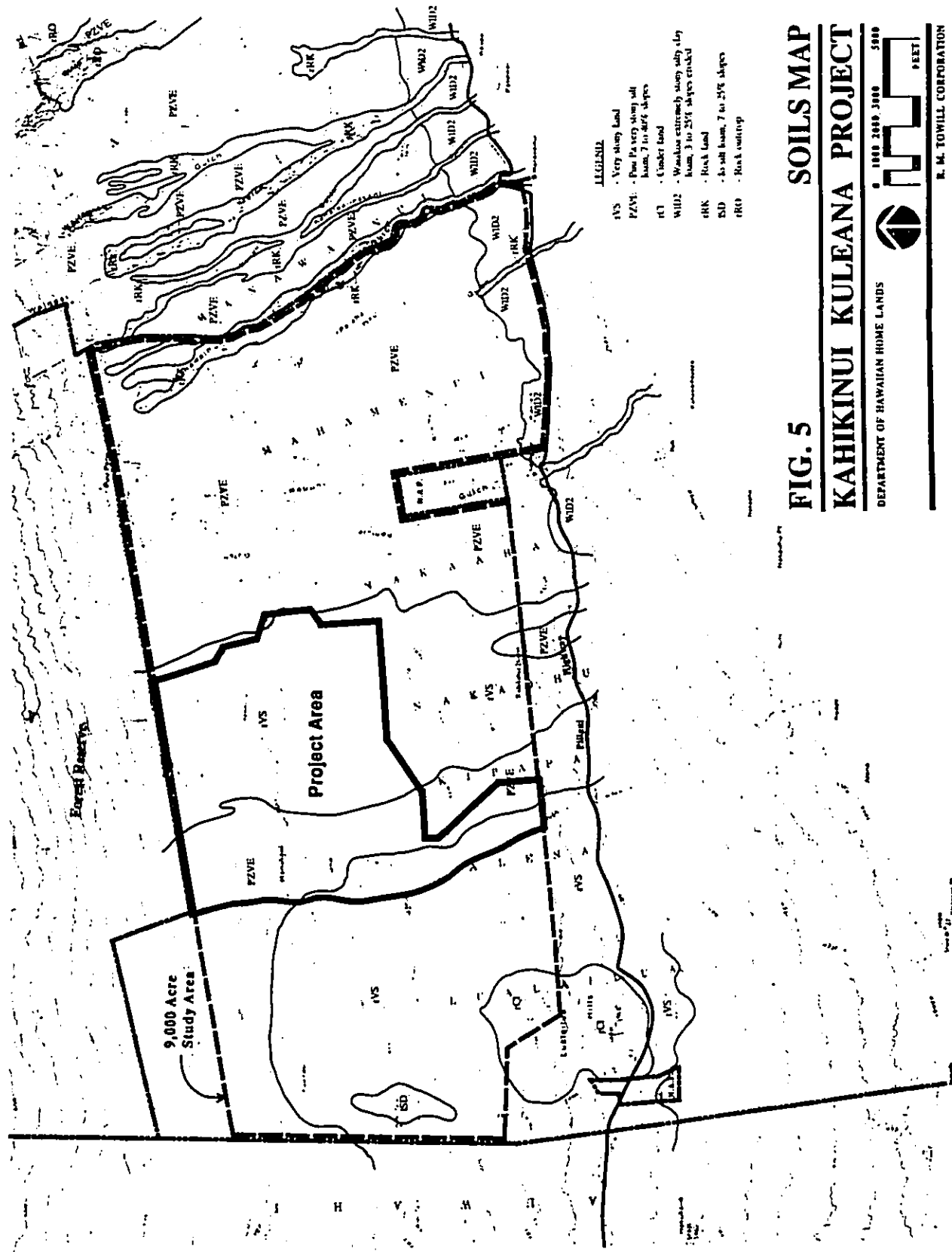
The last known eruption of Haleakala occurred 200 years ago. The lava flow hazard for the property is Zone 5, which is the lowest lava flow hazard category.

Soils. Soils at Kahikinui are primarily composed of poor quality soils (Figure 5). Predominant soils on the site consist of very stony land and is categorized by the U. S. Department of Agriculture, Soils Conservation Service (SCS), as "rVS". This soil type is found on the Islands of Maui, Molokai, and Lanai. The rVS land type is applied to lands where 50% to 90% of the surface is covered with boulders and stones. On the Island of Maui, this soil type is mainly found on the upper slopes of Haleakala between the 4,000-foot to the 9,000-foot elevation. These areas have very shallow soils. The soil type is mainly used for wildlife habitat and water supply. The SCS does not classify this soil type in any Pasture Group.

The remaining portion of the site along the eastern flank contains Puu Pa very stony silt loam (PZVE), 7% to 40% slopes. This soil type is found along the southern and intermediate slopes of Haleakala. The soil is up to 10 inches thick, and is a very dark brown silt loam with subangular blocky structure. The soil is medium acid to slightly acid in the surface layer and neutral below the surface layer. This soil is used for pasture and wildlife habitat. The SCS classifies this soil type as Pasture Group 2 which indicates limited suitability for pasture use.

3.3 HYDROGEOLOGY

Ground water resources will not be developed at this time by DHHL. However, it is anticipated that water development will be actively sought by Kuleana lessees at a future date. In order to assess future impacts to water resources a hydrogeological assessment of the project site was undertaken by Mink and Yuen, Inc., in December 1994. The primary purpose of the report, which is contained in the appendix, was to determine potential for development of future water resources for domestic and agricultural/pastoral uses.



The report indicates there is a relative lack of available surface water for development. Potential for exploitation of groundwater resources however, would be available via a thin basal lens underlying the region containing the project site. According to the report,

"The arid climate [at Kahikinui] precludes the formation of appreciable water resources, either as streamflow or as ground water. Nevertheless, groundwater resources do occur, though their developability is highly constrained by difficulty of access, especially in the vertical dimension, and by sensitivity to salinization. Surface water collection is not a feasible means of creating a reliable water supply."

The report notes that potential locations for groundwater are constrained but probably exist 1) at high elevation, at approximately 5,000 - 6,000 feet, south of Haleakala Crater, and 2) within the Southwest Rift Zone, where the project site is located. The steep slopes of Haleakala Crater would place enormous technical and economic constraints on feasible exploitation via drilling. The depth to groundwater in this location would be near sea level, but would require drilling in excess of 5,000 vertical feet. Although it may be technically possible to access groundwater in this location, the cost to exploit this resource would be prohibitive and cannot be considered feasible.

Greater potential for groundwater development may be found at the south portion of the project site which lies within the Southwest Rift Zone (Figure 6). Elevation in this area is approximately 1,700 feet which would require drilling on the order of about 1,700+ feet (Figure 7). This is significantly less than the 5,000 - 6,000 vertical feet required south of Haleakala Crater.

The volume of potable water available would be limited by the sustainable yield and sustainable pumpage of developed wells which would need to be drilled. The estimated draw per well would be approximately 350 gallons per minute (gpm). This is equivalent to approximately 504,000 gallons or .5 million gallons per day (mgd) per developed well.

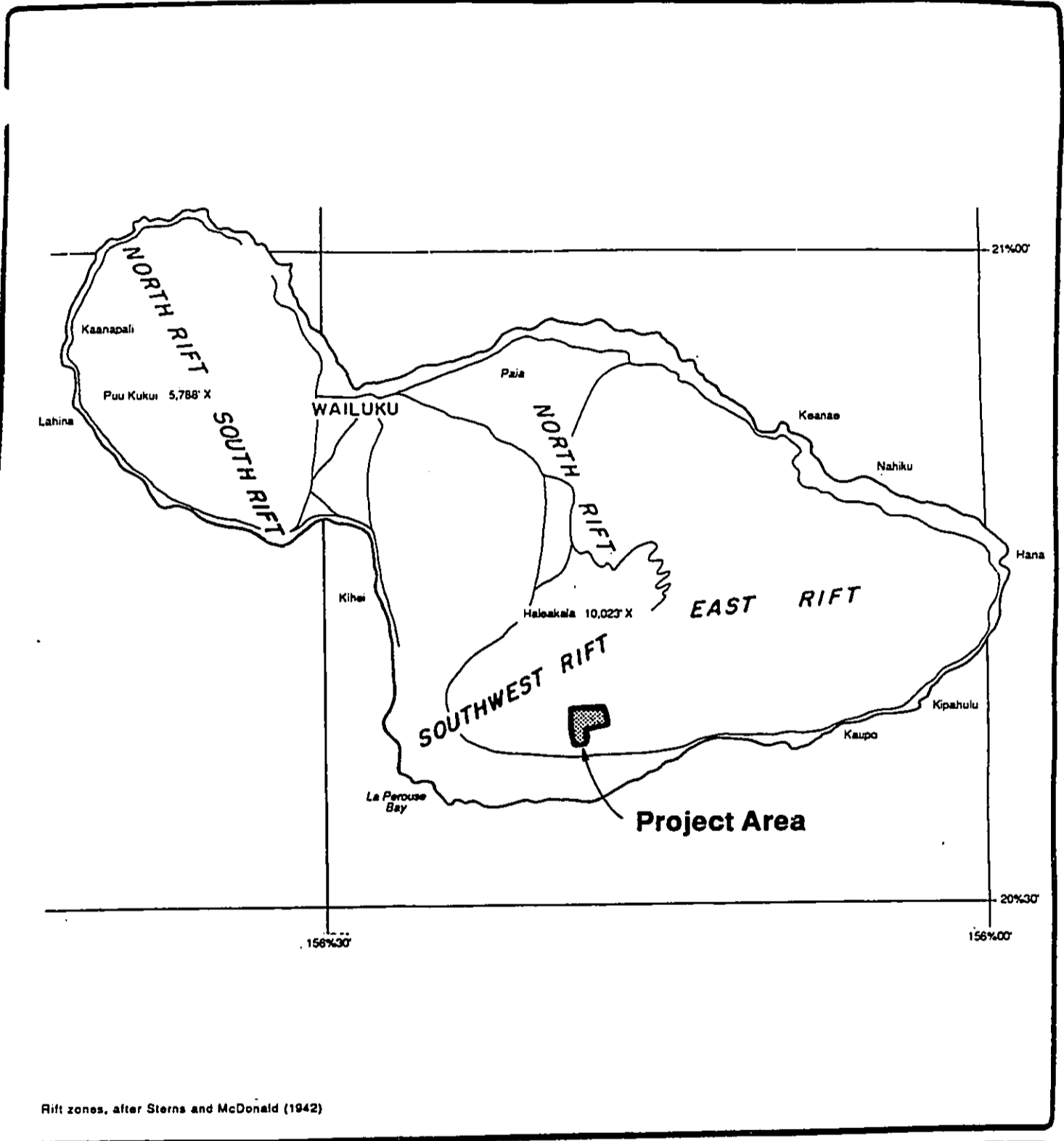

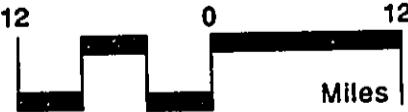


Figure 6
Rift Zones
 Island of Maui
 Department of Hawaiian Home Lands
 STATE OF HAWAII

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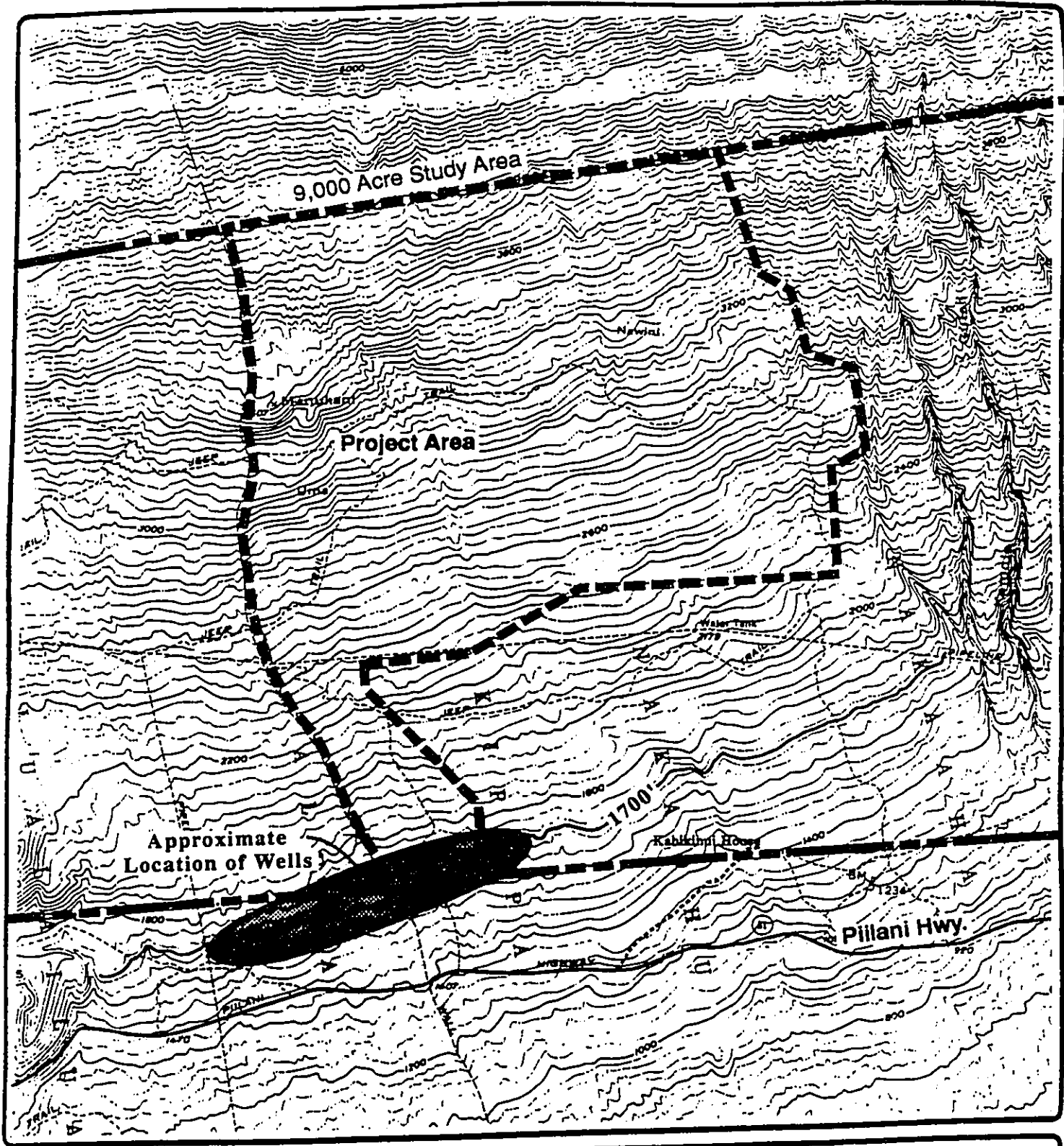
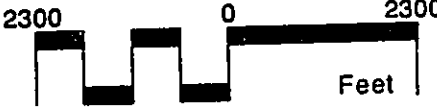


Figure 7
Well Location Map
Department of Hawaiian Home Lands
STATE OF HAWAII

  Feet

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July 1995

IMPACTS AND MITIGATION

The proposed project will not impact the existing groundwater resources of Kahikinui. The results of the hydrogeological study suggest, however, that groundwater resources do exist and can be developed at a future date by Kuleana beneficiaries. The approximate sustainable pumpage per well would be .5 mgd. Depending on the water requirements of Kuleana homesteaders wells may be developed at the 1,700 foot elevation. The cost of development would be approximately \$1.2 million per well in 1995 dollars. Specific details including well pump hardware, transmission and storage costs, and overall resource management would need to be the subject of further study in anticipation of water resource development.

3.4 FLORA

In August and September 1994, a botanical survey report was undertaken by Evangeline Funk, Ph.D., Botanical Consultants. Since completion of the study the project site was shifted to its current location, along the northern boundary of the forest reserve line. Because the existing project site overlaps and is roughly contiguous with the study area, it is expected that this survey accurately represents the flora resources of Kahikinui. A copy of the botanical report is provided in the attached appendix.

The project site is characterized as containing two basic vegetation types: Lantana Scrub and Open Kikuyu Grassland. The boundary between these vegetation types was found to be extremely irregular. Lantana Scrub covers the dryer, rocky southern portion of the project site, while Open Kikuyu Grassland was found at higher elevations in the northern part of the site. Lantana Scrub, *Lantana camara* L., is a spreading thicket forming wood shrub with multicolored flowers and is considered to be one of the world's worst weeds (Holm et al. 1977). On the study site, Lantana are usually less than three feet in height. In some shallow swales plants four feet or more are not uncommon. Kikuyu Grass, *Pennisetum clandestinum* Hochst, is an aggressive, creeping, sod-forming, perennial grass that spreads by stolons and rhizomes (Holm et al. 1977). Although important as a pasture

grass, it is also considered to be one of the world's worst weeds. Other flora species were also noted and are discussed in detail in the appendix.

No Candidate, proposed, or listed threatened or endangered species as set forth in the Endangered Species Act of 1973, as amended, were found. One individual of a potential candidate for listing, 'Ahakea (*Bohea sandwicensis*), was reported from approximately 2,600 foot elevation, north of Lualailua Hills. In 1986, a single half dead tree was also reported to be within one third mile from Lualailua Hills. An extensive search of the area, however, did not locate the 'Ahakea tree and it is presumed to have died.

Medeiros et al. (1986) report that *Bonamia menziesii* A. Grey, *Acacia koaia*, *Portulaca villosa* Cham., and *Bidens micrantha* Gaud. subspecies, *kalealaha*, can be found within five miles of a site located at 3,000 feet elevation in the western portion of the study site. This information was obtained from the 1920 field notes of C. N. Forbs, who had visited the area and Medeiros et al. (1986). Of these taxa, *Bidens micrantha* subspecies, *kalealaha* is a listed endangered species. Two other species, *Acacia koaia* and *Portulaca villosa* are potential candidates for listing. *Portulaca villosa* has been collected by several botanists along the coast near the study site and along the beach from Kanaio to Kaupo in East Maui. However, there is still some question as to the endangered status of *Acacia koaia*.

Bonamia menziesii is a proposed endangered species which has been reported from between 1,100 to 2,400 feet elevation in the Lualailua ahupua'a. The major portion of this ahupua'a, however, is not contained within the project site. No discovery of this species was obtained during the study.

At 3,000 feet elevation the vegetation of the site is largely composed of dense Kikuyu Grassland with scattered rock outcrops containing Lantana shrubs. Scattered trees within this area include Christmas berry, guava, 'Akia, and an occasional Halapepe, Ulei or sandalwood tree. The western portion of the area at this elevation contains a cattle ranching operation which maintains an even purer pasture of Kikuyu grass. A search of

the western end of this area similarly, did not turn up any candidate, proposed, or listed threatened or endangered species.

IMPACTS AND MITIGATION

None of the species found on the project site are considered threatened or endangered. The majority of the project site is overrun by the introduced weeds Lantana and Kikuyu grass.

It is expected that the existing Lantana shrubs and Kikuyu grass will be cleared after distribution of parcels and settlement of the project site. This work however, will likely take place over time due to the prevalence and abundance of the vegetation. This clearing will eventually be followed by limited construction of residential units, with some anticipated farming uses. Because the majority of the site is already dominated by the introduced Lantana shrubs and Kikuyu grass, adverse environmental impacts are not anticipated.

3.5 FAUNA

A avifaunal and feral mammal survey of the site was undertaken in November 1994, by Phillip L. Bruner, Ph.D., Environmental Consultant Faunal Surveys. As with the flora study, the project site was shifted after completion of the avifaunal and mammal survey. Because the existing project site overlaps and remains roughly contiguous with the previous project area, it is expected that this study also represents accurately the faunal resources of Kahikinui. A copy of the avifaunal and mammal survey is contained in the attached appendix.

The objectives of the survey were to document bird and mammal species occurrence on the project site, provide limited baseline data on relative abundance, identify presence of endangered or threatened species, and determine if the project site contains any special or unique resources that if lost or altered by development, would result in significant impact of the native bird and mammal resources of Kahikinui.

Resident Endemic Birds. No endemic native landbirds were recorded during the survey. The Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) forages in agricultural fields and pastures as well as in upland forested habitats (Hawaii Audubon Society 1993). None were recorded during this survey, although some individuals are seen on Haleakala. This species is listed by the State as endangered on Oahu, but not on Maui. No other native resident landbirds would be expected on this site.

Migratory Endemic Birds. The only migratory shorebird observed on the project site was the Pacific Golden Plover (*Pluvialis fulva*), which is the most abundant shorebird species in Hawaii. Plover forage in open areas such as mud flats, lawns, pastures, plowed agricultural fields and along roadsides. Ninety four plover were recorded on this survey in the upper pastureland and open habitat areas of the project site. The only other migrant shorebird which might appear in this area is the Ruddy Turnstone (*Arenaria interpres*). Neither the plover or turnstone are listed as endangered or threatened.

Resident Endemic Seabirds. No seabirds were recorded, nor were expected, at the project site. Predators such as dogs, cats, pigs, and the Small Indian Mongoose (*Herpestes auropunctatus*), along with human presence restricts seabird nesting to isolated and protected locations on the main Hawaiian islands.

Resident Waterbirds. No wetland habitat suitable for waterbirds occurs on the site. Accordingly, no waterbirds were observed.

Exotic Introduced Birds. Only ten species of exotic birds were recorded during the field survey:

Ring-necked Pheasant (*Phasianus colchicus*)
Black Francolin (*Francolinus francolinus*)
Gray Francolin (*Francolinus pondicerianus*)
Spotted Dove (*Streptopelia chinensis*)
Zebra Dove (*Geopelia striata*)

Eurasian Skylark (*Alauda arvensis*)
Common Mynah (*Acridotheres tristis*)
Japanese White-eye (*Zosterops japonicus*)
Nutmeg Mannikin (*Lonchura punctulata*)
House Finch (*Carpodacus mexicanus*)

Other species which could potentially occur are further described in the survey report which is contained in the appendix. None of the observed or potentially occurring exotic species are threatened or endangered.

Feral Mammals. Small Indian Mongoose and feral cats were observed on the project site. Evidence of pig (*Sus scrofa*) rooting was abundant, particularly at higher elevations. Feral Goats (*Capra hircus*) also occur in abundance at this site. No Axis Deer (*Axis axis*) were sighted although they do occur nearby at Ua Palakua (Bruner 1988). The endemic and threatened Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) was not sighted on this survey although two nights were spent searching for individuals.

The long term ranching use of the area has already significantly altered the habitat of the project site. No threatened or endangered faunal species were observed. This may be due in part to presence of introduced predatory species such as feral cats and the Indian Mongoose.

IMPACTS AND MITIGATION

The proposed project is not expected to adversely impact faunal resources. The area has already been subjected to long term ranching uses and most, if not all of the native fauna, have already been displaced by loss of habitat due to grazing. The remaining fauna are introduced species which would continue to thrive on or near the site, regardless of any change in land use.

3.6 SCENIC AND VISUAL RESOURCES

The project site is located on the slopes of southern Haleakala and affords unobstructed views towards the Pacific Ocean to the south, the top of Haleakala to the north on cloud-free periods, and the flanks of Haleakala to the east and west. The most prominent feature of the landscape in the area is Lualailua Hills, a cinder cone that gently rises approximately 300 feet above the surrounding land.

The property and the surrounding area appears barren and rocky due to rough a'a and pahoehoe lava flows. The lack of rainfall results in low lying shrubs and barren soils and is typical of the site's general appearance. Mauka of the site and beyond the 4,000-foot elevation, rainfall increases and accordingly, vegetation is more evident.

IMPACTS AND MITIGATION

The proposed low intensity of development and uses such as pasture, self-sufficiency homesteads, horticulture, revegetation and cultural sites preservation, will not significantly affect the area's visual resources. Subsistence shelters would be few due to the lack of support infrastructure. It is anticipated that these shelters would be low-rise one-story structures, constructed of materials such as wood or stone and would not appear out of character with the surrounding landscape. The anticipated passive uses of the site, therefore, would not adversely affect the areas visual resources.

3.7 HISTORIC/ARCHAEOLOGICAL RESOURCES

Historic. The Kahikinui region has been used for cattle grazing for the past 100 years. Recently, cattle grazing at the project site was discontinued and various small shrubs and vegetation were observed. Presently, the site is uninhabited and the only evidence of modern human activity are the remnants of former ranch operations such as dirt roads, a surface water pipeline system constructed of galvanized steel, stone corrals in various states of disrepair, and the Kahikinui House. This shelter is associated with the early history of Kahikinui Ranch and is not located on the project site.

Archaeological Resources. Cultural Surveys Hawaii (CSH) conducted an archaeological reconnaissance of an 8,300-acre portion of DHHL's 22,500-acre tract in Kahikinui, which included the 1,700-acre subject property. The reconnaissance area is bounded to the north by the Kahikinui Forest, to the east by Manawainui Gulch, to the west by Lualailua Hills, and to the south by Piilani Highway and along an exclusion area whose mauka boundary is about 2,000 feet north of Piilani Highway. The survey was prepared in September 1994, and involved aerial and ground reconnaissance of the property and the larger tract. The purpose of this reconnaissance was to identify and define the boundaries of major site complexes.

Kahikinui was found to be one of the major archaeological resources of the Island of Maui and the State of Hawaii. While many surface features have been destroyed over the years, overall archaeological resources at Kahikinui have been preserved relatively intact due to its long and stable history as ranch lands.

CSH identified a total of 41 site and site-complexes, many of which were never before recorded. Site locations were mapped and the survey area was divided into 15 sections labeled "A" through "O" (Figure 8). Most of the sites identified occurred in the eastern and southwestern portions of the survey area and corresponds with Sections A through F, and L through M, respectively. Portions of the reconnaissance area containing the highest density of archaeological sites included Sections A, C, D, E, F, L, and M. Selection of the subject 1,700-acre project site was based on need to avoid those sections which showed high densities of archaeological sites. Accordingly, the project's site location and configuration includes those lands which avoid or would have the least impact on archaeological sites.

Although the project site avoids major archaeological areas, some locations contain cultural resources. CSH identifies 4, and possibly 5 sites within the subject 1,700-acre project site. These sites are identified in Table 1 - Archaeological Sites.

100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400 4500 4600 4700 4800 4900 5000 5100 5200 5300 5400 5500 5600 5700 5800 5900 6000 6100 6200 6300 6400 6500 6600 6700 6800 6900 7000 7100 7200 7300 7400 7500 7600 7700 7800 7900 8000 8100 8200 8300 8400 8500 8600 8700 8800 8900 9000 9100 9200 9300 9400 9500 9600 9700 9800 9900 10000

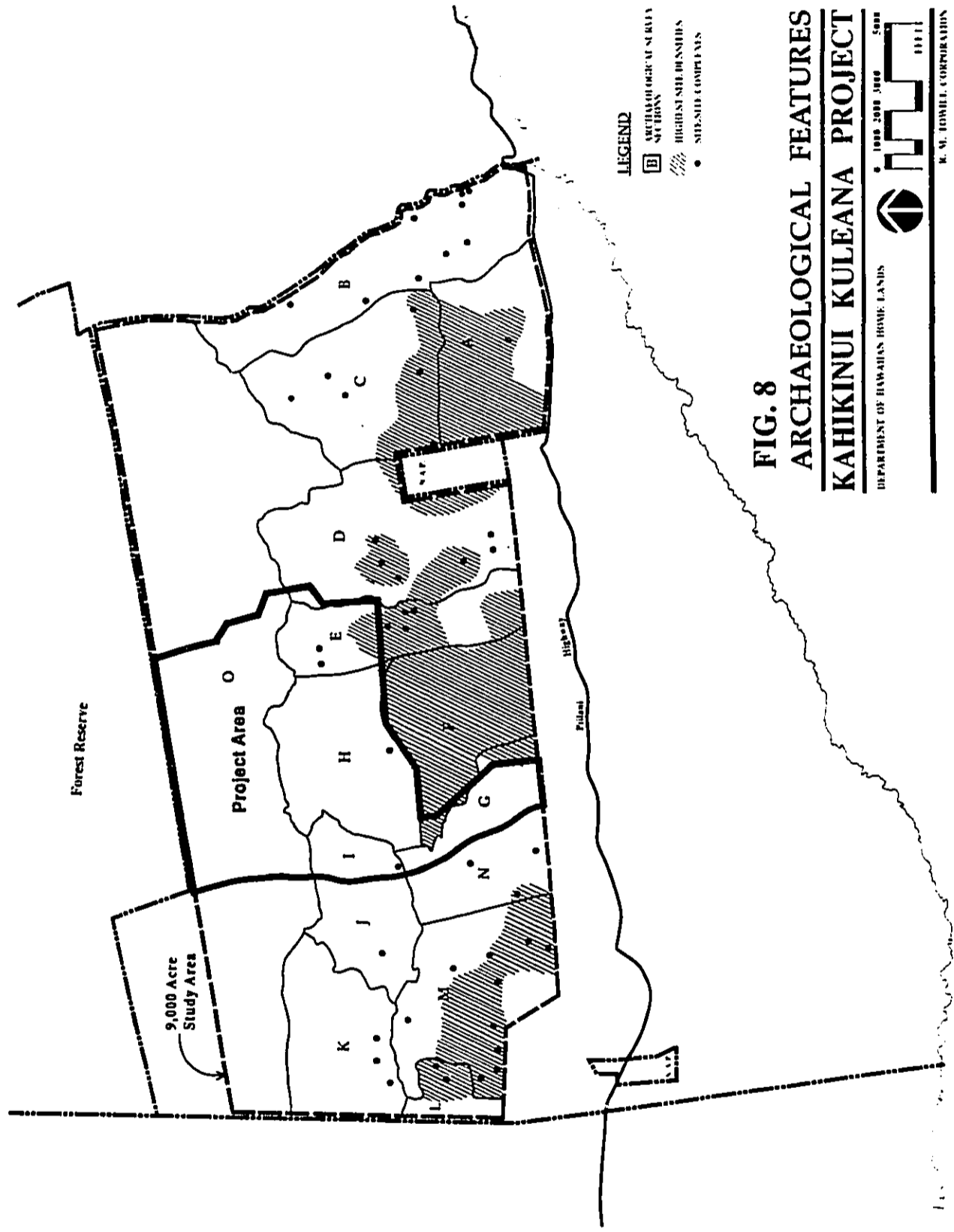


FIG. 8
ARCHAEOLOGICAL FEATURES
KAHIKINUI KULEANA PROJECT

DEPARTMENT OF HAWAIIAN HOME LANDS

1000 2000 3000 4000

K. M. JONHEIL CORPORATION

Table 1
Archaeological Sites at Kahikinui, Maui

CSH SITE/ AREA NO.	SITE TYPE	DIMENSIONS	BRIEF DESCRIPTION
1010	Notched Heiau	125' X 100'	Notched Heiau, walled on all four sides. Adjacent areas contain gardening enclosures. West side of walls have smooth straight finish.
1015	Massive L-shaped Wall	50m X 20m	Located immediately mauka of site 1010, Notched Heiau. No clues in vicinity as to function of wall. Possibly of a religious use but with appearance of an unfinished structure.
1016*	Habitation Enclosure	5m X 5m	Site is 800 to 1,000' east of Site 1015. Site is isolated with no immediate clues as to function beyond habitation enclosure.
1030	Shelter	18m X 5m	Only archaeological site observed during helicopter survey of Section I.

Note: Site No. 1016 is located immediately makai of the southern boundary of the proposed project site. This site has been included because of its approximate location within the potential project area.

The archaeological reconnaissance recommends that a more intensive survey be performed prior to the development of homestead uses. DHHL proposes to carry out a "walk through" by an archaeologist to identify actual sites. As required, an Archaeological Inventory Survey of critical areas will be undertaken. It is the intention of DHHL to encourage avoidance of significant sites by creating fenced buffers around each archaeological site of importance. These buffers would involve marked setbacks using fencing and/or appropriate signage. Each buffer will also be mapped in future parceling of the project area for retention under DHHL approved control. These measures and controls would be developed in coordination with the Historic Preservation Division, Department of Land and Natural Resources.

IMPACTS AND MITIGATION

Potential for archaeological sites to be impacted will be addressed by further coordination with the Historic Preservation Division, DLNR, to undertake a walk

through of sensitive areas to verify individual site locations. An Archaeological Inventory Survey will be prepared, as required, to determine the significance of individual sites. As needed, an Archaeological Preservation Plan and Data Recovery Plan will be prepared based on results of the Archaeological Inventory Survey. The overall strategy will be to undertake data recovery of minor sites which are not considered significant, and preservation of significant sites by use of fencing and/or signage. All phases of this effort will be undertaken in accordance with requirements of the Historic Preservation Division, DLNR.

3.8 NOISE

The subject site has low noise levels because there are no permanent human activities or development at the site. The nearest urbanization and associated noises occur over 12 miles to the northwest at Makena.

IMPACTS AND MITIGATION

Other than construction noise generated by building roadways, subsistence shelters and limited land preparation for subsistence living uses, adverse noise impacts from the development of Kahikinui for homestead uses are not expected.

Short-term construction noise from road building would be in accordance with noise regulations of the Department of Health.

No significant short- or long-term noise impacts are anticipated from the project.

3.9 AIR QUALITY

Existing air quality at the site is generally free of urban generated pollutants due to the site's distance from air emission sources.

IMPACTS AND MITIGATION

Other than localized short-term impacts from road building activities, development of the site for homestead use is not anticipated to have a significant adverse impact on the area's air quality.

With respect to impacts from short-term road building activities, the site is uninhabited and there would be no impacts to area residents. Due to the need for a roadway system prior to distribution and settlement by beneficiaries, any impacts on the area's air quality would have dispersed long before settlement occurs. Thus, no significant impacts on the area's air quality are anticipated.

Section 4
SOCIOECONOMIC ENVIRONMENT

4.1 POPULATION AND EMPLOYMENT

Population. The site and the surrounding area is not populated. The nearest population centers are 12 miles distant at Makena and Wailea. Kula is located to the northeast.

DHHL's preliminary plans for development indicates dividing usable portions of the project site into approximately 125, 10 to 20 acre parcels. Beneficiaries would be allowed to have at least one dwelling per parcel with allowance for an ohana dwelling unit. Kauhale-style dwelling patterns are permissible if consistent with DHHL approved health and safety requirements. Land uses on these parcels would be encouraged to be consistent with County and State land use controls.

DHHL estimates that based on the average beneficiary's household size, that the site could be populated by a range of up to 650 persons distributed over the 1,700-acre site. Under this scenario, the population density would be well below typical suburban levels and some agricultural communities in the County of Maui. Thus, the impact of the establishment of an agricultural community would be negligible in terms of population distribution for the County of Maui.

Employment. The nearest employment centers are located in Makena and Wailea. The Island's main job centers are located in Kahului and the West Maui area. Significant growth in job opportunities have occurred along the Kihei to Makena area and is due primarily to expansion in the tourism industry.

The proposed project is intended to meet Native Hawaiian beneficiary requirements for developable land for farming, pasturage, and self-sufficiency. The site, therefore, will probably offer only limited employment opportunities. For some beneficiaries, agricultural

and pasturage uses may increase as infrastructure (agricultural water source) is developed and income from farming developed. A DHHL, Beneficiary Community Management Plan for the Kahikinui Forest, adjacent and north of the project area, recommends that employment opportunities in forest management be targeted to residents of Kahikinui. It is anticipated, however, that the majority of beneficiaries would derive income from jobs located elsewhere, around the Island. In due time, other on-site, and culturally sensitive economic opportunities may be developed by the homestead community.

4.2 SURROUNDING LAND USES

Land uses within Kahikinui below the 5,000-foot elevation and above Piilani Highway was formerly used by Maui Factors for cattle grazing under a lease agreement which expired in 1992. These lands are presently used for hunting, soil conservation and wildlife management. Lands above the 5,000-foot elevation will be managed as a forest reserve by a private non-profit Kahikinui community-based corporation. Lands makai of the Highway and along the coastline are barren and vacant and sometimes used for access by recreational fishermen. The Hoapili Trail, a historic horse trail constructed in the years prior to 1940, runs along the coastal portion of Kahikinui.

The County of Maui mines sand from the nearby Lualailua Hills.

Beyond Kahikinui towards the west are lands used for cattle ranching by the Ulupalakua Ranch. Lands towards the east towards Kipahulu are also used by cattle ranches. The surrounding area from La Perouse Bay to Kipahulu is not developed.

The proposed development of homesteads with agricultural uses such as pasture and potential crop production will not have a significant adverse impact on surrounding land uses and property. However, DHHL lands mauka and makai within the larger Kahikinui area will require appropriate management to protect the natural resources of the area:

- Fencing will be utilized to delineate nearby resource areas that would be off limits to development or subsistence hunting and gathering. These areas would include

archaeological sites and locations with known endangered or indigenous flora and fauna;

- Transportable individual septic systems will be required to be installed and maintained by beneficiaries in order to mitigate sanitary impacts on the project site and the surrounding natural resources of the area; and
- Provision for limited collection of solid waste will need to be coordinated within the homestead community and with appropriate collection/disposal services to ensure compliance with sanitary and health codes.

Section 5
PUBLIC FACILITIES AND SERVICES

5.1 TRANSPORTATION FACILITIES

Piilani Highway, a County owned two-lane minimally improved roadway, provides access to the District of Kahikinui. Existing jeep trails off Piilani Highway provides access to the project site. Existing traffic on Piilani Highway is minimal due to the lack of development within the region.

DHHL proposes to provide an access road from Piilani Highway to serve as a "spine", with a loop and lateral roads leading to individual parcels. local connector roads leading to individual parcels. The roadway system would be designed with sufficient right of way in order to meet future County standards and to accommodate paving and dedication. The initial roadway surface will be mostly graded and unpaved, with gravel surfaces in some areas.

The proposed development of the site for homesteads and limited agricultural activities will not adversely impact the existing highway. It is anticipated that the existing highway will accommodate the anticipated low levels of traffic that would be generated by this project.

5.2 OTHER INFRASTRUCTURE

Water. Other than catchment water systems, there are no facilities to provide water to the site. The County's water system, which is substandard, ends two miles west of Kahikinui. An abandoned water pipeline runs through the site at the 2,400-foot elevation and terminates at the Ulupalakua parcel east of the property. A branch line which runs down through the site into lands makai of Piilani Highway has also been abandoned. This pipeline was formerly used by Ulupalakua Ranch to transport water for cattle operations. Pumping of brackish water occurred near the shoreline and the water was used for

watering cattle. Intermittent streams occur at Manawainui and Palaha Streams, east of the project site.

Historical documentation show the existence of springs and wells in the area. However, it appears that many of these sources of water have been overused and has since been covered with sedimentation and litter. The County of Maui does not have plans to develop water for the area.

Preliminary projections for developing a potable water source indicates that well development would cost approximately \$1.2 million per developed well. Because of costs associated with development, financial assistance involving use of bonds, grants, or other creative financing will be required if future water development is to be realized. Until such time that a potable water system is developed, beneficiaries will need to transport water to the site.

Wastewater. There are no wastewater infrastructure on the property or the surrounding area. Septic tanks or cesspools are used when necessary. The Department of Health prohibits the use of injection wells and cesspools on lands above the Underground Injection Control Line which is located along Piilani Highway.

Beneficiaries would be required to dispose of wastewater via portable wastewater systems in accordance with the regulations of the Department of Health. Thus, no impacts are anticipated to the areas' natural resources.

Drainage. There are no drainage structures on the site. Since there are no flood hazards at the site, no drainage improvements are anticipated at this time.

Energy. Electrical lines end two miles west of the site and there are no plans to extend service into the area. Electricity would be provided by other means such as generators and solar energy collectors.

Communications. There is no telephone service to the area. Telecommunications would be provided by radio or cellular telephone.

Fire and Police Protection. Fire protection is provided by the County fire station located at Makawao. However, for most emergencies, response time would be greater than in most urban areas due to the distance and the lack of an on-site water system. Police protection is provided by the County police station located in Wailuku.

Medical Facilities. The nearest hospital is located 12 miles to the west in Keokea. Most emergencies would need to be handled by beneficiaries on-site.

Section 6
**RELATIONSHIP TO LAND USE,
POLICIES, AND CONTROLS OF THE AFFECTED AREA**

6.1 HAWAII STATE PLAN

The Hawaii State Plan, Chapter 226, Hawaii Revised Statutes, serves as a written guide for the future long range development of the State. The Plan identifies goal, objectives, policies, and priorities for the State.

The proposed project would be in conformance to the State Plan's objectives and policies for socio-cultural advancement of the Hawaiian people. By allowing the beneficiaries who are Hawaiian in ethnicity the opportunity to use the property as subsistence homesteads without major supporting infrastructure, beneficiaries would use modern technology and revive past techniques used in living off the land. Hunting, planting, fishing and gathering, which would be expected of beneficiaries, would foster increased knowledge and understanding of the Hawaiian culture and lifestyle.

The project would also conform to the State Plan's policy to promote housing for the Hawaiian lifestyle. It is the long term goal of the project to foster such a lifestyle with subsistence homesteads traditional to Hawaiians of the recent past. The neighborhood that would result from this project would reflect Native Hawaiian culture and values in a contemporary, off-grid community.

6.2 STATE FUNCTIONAL PLANS

The Hawaii State Functional Plans (Chapter 226, Hawaii Revised Statutes) provide a management program that allows use of State resources to improve current conditions and attend to various social issues and trends. The proposed project is consistent with the State Functional Plans for Historic Preservation and Agriculture through the following Implementing Actions:

HISTORIC PRESERVATION

Objective B: Protection of Historic Properties

Policy B(2): Establish and make available a variety of mechanisms to better protect historic properties

Implementing Action B(2)(c): Respond to the discovery of prehistoric/historic burials in a timely and sensitive manner, which takes into consideration cultural concerns.

DHHL proposes to avoid disturbance of significant archaeological and cultural sites. All phases of work which may potentially disturb prehistoric/historic sites will be coordinated with the State Historic Preservation Division, DLNR. As required, appropriate mitigation measures will be developed to ensure no significant adverse impacts.

AGRICULTURE

Objective D: Achievement of Optimal Contribution by Agriculture to the State's Economy.

Policy D(1): Encourage the conduct of basic and applied research on agricultural systems, technologies, practices, organisms, crops, and products, and encourage the transfer of research information to agricultural users.

Implementing Action D(1)(d): Support research and development of non-traditional agricultural uses and cultural practices, including natural and organic methods.

The proposed project will initially promote use of land for subsistence agriculture. It is anticipated that over time beneficiaries will seek to develop a water source which will encourage expansion of agricultural activities. This expansion could initially involve sale of surplus crops at a "farmer's" or open market, with future potential for development of commercial sales.

6.3 STATE LAND USE LAW

The property is designated within the State Agricultural District. Uses proposed under the development would be consistent with objectives and policies of the State Land Use Law, Chapter 205, Hawaii Revised Statutes.

The State Agricultural District permits lots as small as one acre. The project's minimum lot size is well above the Agricultural District minimum lot size. In addition, pastoral and homestead uses, including subsistence farming, gathering, hunting and fishing, would be consistent with rules governing uses in the State Agricultural District.

6.4 COUNTY OF MAUI GENERAL PLAN AND COMMUNITY PLANS

The County of Maui's General Plan and Community Plan for the area covers desired population, land uses, public infrastructure, environmental concerns, and cultural resources. Under the Hana Community Plan, the area is planned for continued use as open space and agricultural uses. Thus, the project will be consistent with the area's Community Plan.

6.5 COUNTY OF MAUI ZONING

The County of Maui has not zoned the property. Uses and future standards for development are based on regulations governing the State Agricultural District, and dedication requirements of the County.

Section 7

ALTERNATIVES TO THE PROPOSED ACTION

7.1 NO ACTION ALTERNATIVE

The Department of Hawaiian Home Lands has a major mission to fulfill the mandate of the Hawaiian Homes Commission Act of 1920. The proposed project would address the intent of the Act and provide for the settlement of Native Hawaiians on Hawaiian Home Lands. The no action alternative would prevent DHHL from fulfilling this mandate. The no action alternative:

- does not address the mandate of the Hawaiian Homes Commission Act of 1920, nor the needs of Native Hawaiian Beneficiaries; and
- would result in a lost opportunity to provide for the settlement of Native Hawaiians. There will be extreme difficulty for the continued distribution of conventional house and lot packages given the austere fiscal situation facing the State. The proposed project is a cost effective means of maximizing the ability of the State and DHHL to distribute lands to Native Hawaiian Beneficiaries;

7.2 DEVELOPMENT OF "CONVENTIONAL" PROJECT

Development of a conventional project consisting of a finished house and lot subdivision was considered, but was determined unacceptable. The proposed project is intended to maximize the use of limited state resources in order to provide for the settlement of Native Hawaiians on Hawaiian Home Lands. Development of a conventional housing project would require major financing for infrastructure in addition to costs for housing construction. Programs for conventional housing have already been utilized by DHHL for the provision of numerous housing units. The proposed project is intended to supplement

and expand the range of programs by offering an alternative that is not now available. The proposed project would:

- Provide an alternative that is more cost sensitive to the fiscal condition of the State; and
- Provide an alternative that meets the demand for raw land for development. In return for land, Kuleana Homestead lessees are expected to care for and take part in development of the land.

7.3 RECOMMENDED ACTION

The recommended action is to proceed with development of the proposed project at Kahikinui, Maui.

Section 8

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

Development of the proposed project will commit the necessary construction and human effort, and fiscal resources. Use of these resources will benefit Native Hawaiian beneficiaries who do not now have access to raw land for homesteading purposes. Existing vegetation, which primarily consists of Lantana Scrub and Open Kikuyu Grassland will be removed by Kahikinui Homesteaders in order to construct residential dwellings and to use the land for subsistence agriculture and pastoral purposes. These uses will enhance the present use of the land which is now vacant and fallow.

Long-term gains resulting from development of the proposed project include use of the land for homesteading and settlement. The proposed project will enhance economic productivity by providing DHHL with a program option that will enable the more efficient distribution of Hawaiian Home Lands to Native Hawaiian beneficiaries.

Section 9

**IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES BY
THE PROPOSED ACTION**

Development of the proposed project will involve the irretrievable loss of certain environmental and fiscal resources. However, the costs associated with the use of these resources should be evaluated in light of recurring benefits to the recipients of Hawaiian Home Lands.

It is anticipated that the construction of the proposed project will commit the necessary construction materials and human resources (in the form of planning, engineering, construction and labor). Reuse for much of these resources is not practicable. Although labor is compensated during the various stages of development, labor expended for project development is non-retrievable.

Section 10
NECESSARY PERMITS AND APPROVALS

Government regulatory permits are not anticipated to be required for the proposed activity.

Section 11
DETERMINATION

In accordance with the provisions set forth in Chapter 343, Hawaii Revised Statutes, and the significance criteria in Section 11-200-12 of Title 11, Chapter 200, this assessment has determined that the project will have no significant adverse impact to water quality, air quality, existing utilities, noise, archaeological sites, or wildlife habitat. All anticipated impacts will be temporary and will not adversely impact the environmental quality of the area.

It is recommended that an Environmental Impact Statement (EIS) not be required, and that a negative declaration be issued for this project.

Section 12

ORGANIZATIONS AND AGENCIES CONSULTED IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

12.1 FEDERAL AGENCIES

U.S. Army Corps of Engineers

12.2 STATE AGENCIES

Department of Hawaiian Home Lands

Office of State Planning

Department of Land and Natural Resources

Department of Health

12.3 COUNTY OF MAUI

Department of Planning

Department of Public Works

Maui County Council

12.4 CITIZENS, GROUPS, AND ORGANIZATIONS

Kahikinui Kuleana Ad Hoc Committee

- Ka 'Ohana O Kahikinui

- Keokea Hawaiian Homestead Farmer's Association

- Waiohuli Hawaiian Homesteaders, Inc.

- Hui Kakoohoopulapula

L.I.F.E. (Living Indigenous Forest Ecosystems), Inc.

Professor Gerald D. Carr, Department of Botany, University of Hawaii at Manoa

Rene Sylva

Art Mederios, National Biological Survey

Fern Duvall, State Department of Land and Natural Resources

Section 13
**COMMENTS AND RESPONSES TO THE DRAFT
ENVIRONMENTAL ASSESSMENT PREPARATION**

This section contains the Draft EA comments received and the responses to the comments:



University of Hawai'i at Mānoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

Oct. 23, 1995
EA:00135

Mr. Mike Crozier
Department of Hawaiian Homelands
335 Merchant Street
Honolulu, Hawaii 96813

Dear Mr. Crozier:

Draft Environmental Assessment (EA) Kahikinui Kuleana Kahikinui, Maui

The Department of Hawaiian Homelands (DHHL) proposes to distribute 1,700 acres of vacant land on the southern slopes of Haleakala. The site will be divided into approximately 125 parcels ranging from 10 to 20 acres. The only proposed improvement will be a graded road network for access. All other improvements will be the responsibility of the beneficiaries.

We reviewed the draft Environmental Assessment (EA) with the assistance of Paul Berkowitz of the Environmental Center.

Possible Segmentations

According to Section 11-200-7, Hawaii Administrative Rules (HAR), "a group of actions proposed by an agency or an applicant shall be treated as a single action when:

- (1) The component actions are phases or increments of a larger total undertaking.
- (2) An individual project is a necessary precedent for a larger project."
- (3) An individual project represents a commitment to a larger project."

Based on information provided in the draft EA, it is unclear whether the proposed action is part of a larger project. However, given the information provided in Section 5,

Mr. Mike Crozier
October 23, 1995
Page 2

it appears that the proposed action may be connected to a larger plan to expand some of the area's infrastructure. In particular, the possibility of developing a potable water system is discussed as a potential future action. If the DHHL plans to develop wells, then the impacts of this future development should be considered in the present document.

Furthermore, the project appears to have the potential to be segmented in terms of geography. The Environmental Notice simultaneously lists another DHHL project, the Kula Residential Lot, Unit 1. Thus, as stipulated in Section 11-200-12 (HAR), the agency should consider the two proposed actions simultaneously, evaluating "the overall and cumulative effects" of both projects together. In other words, the Kahikinui EA should discuss of how the proposed road network relates to nearby and future DHHL actions.

Alternatives

According to content requirements stipulated in Section 11-200-17, environmental assessments "shall contain any known alternatives for the action." The draft EA lists two options: (1) no action, and (2) development of a "conventional" project (finished homes). An additional option would be to carry out the same action, but at a different site. In light of the difficulties at the chosen site, this option seems to warrant further consideration.

The Kahikinui site seems problematic for a few reasons: (1) it receives only 20.30 inches of annual rainfall, (2) it has marginal groundwater resources which are expensive to develop, (3) the surface is 50 to 90% stones and boulders, and (4) it contains slopes of up to 30%. For the above reasons, it seems questionable whether the land can be used for the stated intention of subsistence agriculture. Has the DHHL contacted potential beneficiaries to see if they are interested in the land? Are the beneficiaries ready to practice subsistence agriculture on the site? How does the Kahikinui development fit into other DHHL development plans? Is this the best site for the proposed action?

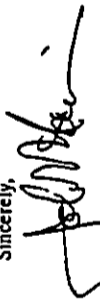
Conclusion

In short, the proposed action by itself appears relatively benign. However, we

Mr. Mike Crozier
October 23, 1995
Page 3

have two concerns regarding the proposed action. First, we are concerned that the current action may be connected to other actions which have more extensive environmental impacts. In addition to violating the Administrative Rules, segmentation circumvents the public review process by not disclosing the full extent of the project to the public. Second, we are concerned that the known alternatives have not been fully investigated. Were alternate sites considered and what was the rationale for choosing Kahikinui as a site for subsistence agriculture? Before continuing further with the proposed project, these issues need to be addressed in more detail.

Thank you for the opportunity to review the draft EA.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
Brian Takeda ✓
Roger Fujjoka
Paul Berkowitz

BENJAMIN J. CAYetano
GOVERNOR
STATE OF HAWAII



STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS

FU KULEANA
HOMESTEAD PROGRAM

October 27, 1995

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

Dear Mr. Harrison:

SUBJECT: Draft Environmental Assessment (EA) for Kuleana Homestead Program at Kahikinui, Maui

This is to inform you that provisions contained Section 11-200-7 HAR regarding segmentation of the Department of Hawaiian Home Lands (HHL) development project at Kahikinui, Maui is not applicable as follows:

- 1) The Kula project is not related to the Kahikinui project. Both were planned independently and at different times. With respect to proximity, the ahupua'a of Kahikinui is approximately 15 miles from Kula.
 - 2) The project at Kula is not a necessary precedent for the Kahikinui project and vice versa. The Kula project came about as a result of a department initiated "accelerated" land distribution program which occurred in the mid-1980's. HHL beneficiaries were awarded lots under the condition that they would not access the land until the department had the resources to complete the infrastructure.
- The Kahikinui project came about as a result of a beneficiary initiated effort to settle lands without costly infrastructure. Under the newly established Kuleana Homestead Program, the department will provide access to surveyed and staked "raw" lands. Lessees agree to handle their infrastructural development and maintenance needs on their own and as a community. Without the desire on the part of Maui beneficiaries to settle Kahikinui coupled with the initiation of the Kuleana Homestead Program, the department would not have planned to open up homestead lots at Kahikinui for perhaps another 50 years.

KALI WATSON
CHIEF OF BUREAU
HAWAIIAN HOME LANDS

JOHN M. M. VASALATHI
DEPUTY CHIEF OF BUREAU

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Handwritten initials: *Opp*, *AK*, *PL*

J. T. Harrison
EA Kahikinui
page 2

Kahikinui is the first HHL attempt in recent history to allow such a settlement. As such, Kahikinui is a pilot program aimed at demonstrating that native Hawaiians, in partnership with the department, can successfully settle "raw" lands utilizing alternative modern "off grid" technologies blended with traditional native Hawaiian technologies, values and lifestyles.

- 3) There is no HHL "commitment to a larger project" covering the east side of Maui. All projects are independent of each other. Both Kula and Kahikinui are separate ahupua'a divided by large parcels of privately owned lands. Clearly, the projects are not linked in any manner pertaining to development on the ground. As such, linking the two from geographic and infrastructural standpoints is impossible and unfeasible. Programatically, the developments targets different segments of the beneficiary population.

Addressing the possible linkage of development projects at the Kula site which were covered in separate environmental assessments will be handled under a separate response to OEQC.

Department sponsored and funded linkage of water source and distribution systems between both sites have not been considered given the costs associated with such a linkage as well as the Kuleana Homestead Program parameters.

Given present hydrological knowledge of Kahikinui and Kula, well development at both sites are cost prohibitive. Water studies at Kahikinui are currently being implemented and it is premature to indicate that subsurface water sources, which are developable from a cost standpoint, are present on site. As such, there are no plans for HHL to develop wells in the area. However, well development may be a possible future action to be initiated by the future community at Kahikinui which is outside of the scope of this project. At Kahikinui it is understood that lessees are presently required to haul water to their homestead lots. Kula lots will be tied into the Maui County water system.

Roadways planned for both Kahikinui and Kula are intended for ingress and egress and to access lots within the sites. For Kahikinui, additional roadways will be planned for land management, for access to cultural sites, and for access to economic development sites -- all within the ahupua'a. There are no plans to link both projects or other HHL land holdings at any Maui via HHL funded roadways.

J. T. Harrison
EA Kahikinui
page 3

Alternatives

The purpose of the project at Kahikinui is two-fold. The first is to make lands available to HHL beneficiaries for settlement purposes. The second is to provide the settlement community the opportunity to assist the department in the management of the 22,800 acre parcel based on the ahupua'a concept of land management. To this end, the department has been conducting community-based planning with the HHL beneficiary community of Maui.

The decision to open up Kahikinui lands to native Hawaiians was based on the desire of native Hawaiian HHL beneficiaries on Maui to be given the opportunity to settle and manage Kahikinui. The other alternative would have been to continue to general lease the land for cattle ranching. This alternative was deemed by the department to be politically, economically and environmentally undesirable.

We agree that the land is marginal, however archaeological evidence show that Kahikinui was once home to hundreds of native Hawaiians. A large koa-ohia forest once covered lands at the cloud-belt elevation. The ahupua'a thrived with native plants, animals, sea and shoreline resources which allowed the formation of permanent settlements. There is evidence in the area's natural history that water once flowed from springs found at Kahikinui.

The vision of those wishing to take on the stewardship of the land is to resettle and to restore the ahupua'a of Kahikinui over several generations. The Hawaiian Homes Commission shares this vision and has granted a 15-year license to a Kahikinui community-based organization, Living Indigenous Forest Ecosystems (L.I.F.E.) to manage the 7,050 acre forest watershed at Kahikinui.

HHL, for the past three years, has been working with beneficiary groups on Maui to plan for the resettlement and restoration of the ahupua'a. A segment of beneficiaries are willing to settle the land given its remote location and geographic limitations. However, there are other resources at Kahikinui which makes the area desirable. One has to see the land to appreciate it.

Conclusion

Activities regarding environmental impacts are site specific and that current actions occurring at Kula and Kahikinui are not connected.

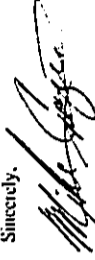
The rationale for choosing Kahikinui appears throughout this response particularly in the alternatives section above. Subsistence agriculture is one facet of economic activities envisioned for Kahikinui. There is good top soil and cinder at the ahupua'a which could be transported, with full consideration given to environmental concerns, to the settlement site for the creation of farm

J. T. Harrison
EA Kahikinui
page 4

plots. Off site farming can also occur within the areas of the ahupua'a with good top soil. These areas were considered for lots but the land was ruled out because of ground shifting. There are other areas at the ahupua'a suitable for community pasturing.

Those resettling Kahikinui will have access for appropriate use of the entire ahupua'a. The department continues to forge ahead in partnership with HHL beneficiaries on Maui in land management, homesteading, and economic development planning for Kahikinui.

Sincerely,



Mike Crozier, Administrator
Land Development Division

cc: ~~Brian Zahradka, Planner~~
~~[Redacted]~~

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(Listed in Chronological Order)

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APPENDIX A
Hydrogeological Assessment

Preliminary Assessment of Usable Water Resources

Kahikinui, Maui

Hawaiian Home Lands

Prepared For R.M. Towill Corporation

Honolulu, Hawaii

Prepared By Mink and Yuen, Inc.

Honolulu, Hawaii

December, 1994

Geology and Hydrology of the Area

Kahikinui lies within the semi-arid region on the south slope of Haleakala between the Southwest Rift Zone of the volcano on the west and the Kamole-Kepuni drainage on the east. The flank of Haleakala is steep, averaging a grade of 15 to 20 percent, and is hardly etched by a drainage network. The volcanic rock which constitutes the surface plunges directly into the sea.

The whole of the southern segment of Haleakala from Kipahulu to the Southwest Rift Zone lies in a rain shadow and consequently receives little orographic rainfall. Average annual precipitation is less than 25 inches, virtually all of which falls during infrequent storms from October to April. The arid climate precludes the formation of appreciable water resources, either as stream flow or as groundwater. Nevertheless, groundwater resources do occur, though their developability is highly constrained by difficulty of access, especially in the vertical dimension, and by sensitivity to salinization. Surface water collection is not a feasible means of creating a reliable water supply.

The surface of the Kahikinui region is covered with highly permeable lavas of the Hana Volcanic Series.

These lavas were the last sequence to originate from the Haleakala volcano but were not erupted until long after the main shield of the volcano was built. In the interval of inactivity the surface was deeply eroded. The Hana series filled the canyons and covered the surfaces between them. In the buried canyons the Hana lavas reach thicknesses on the order of 1000 feet, while on the ridges and facets between valleys the maximum thickness is normally 200 feet or less. In Kahikinui the Hana lavas are probably a few hundred feet thick.

Beneath the Hana series and the erosional unconformity are basalts and andesites of the Kula Volcanic Series. These rocks are less permeable on the average than the Hana rocks. They may be several hundred feet thick as an identifiable unit but grade into the primitive basalts of the Honomanu Volcanic Series, the main and Basement rock of Haleakala.

The Honomanu lavas form the bulk of the volcanic shield. They are highly permeable and contain most of the aquifers in the region. Near the coast these aquifers may include the lower portion of the Kula formation.

Numerous cinder cones associated with the Hana series rise above the steep surface of the volcanic shield. Both the cinder cones and the Hana lavas are so permeable that surface drainage is minimized. Most of the moisture not consumed by evapotranspiration percolates rather than runs off to the sea.

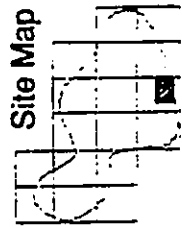
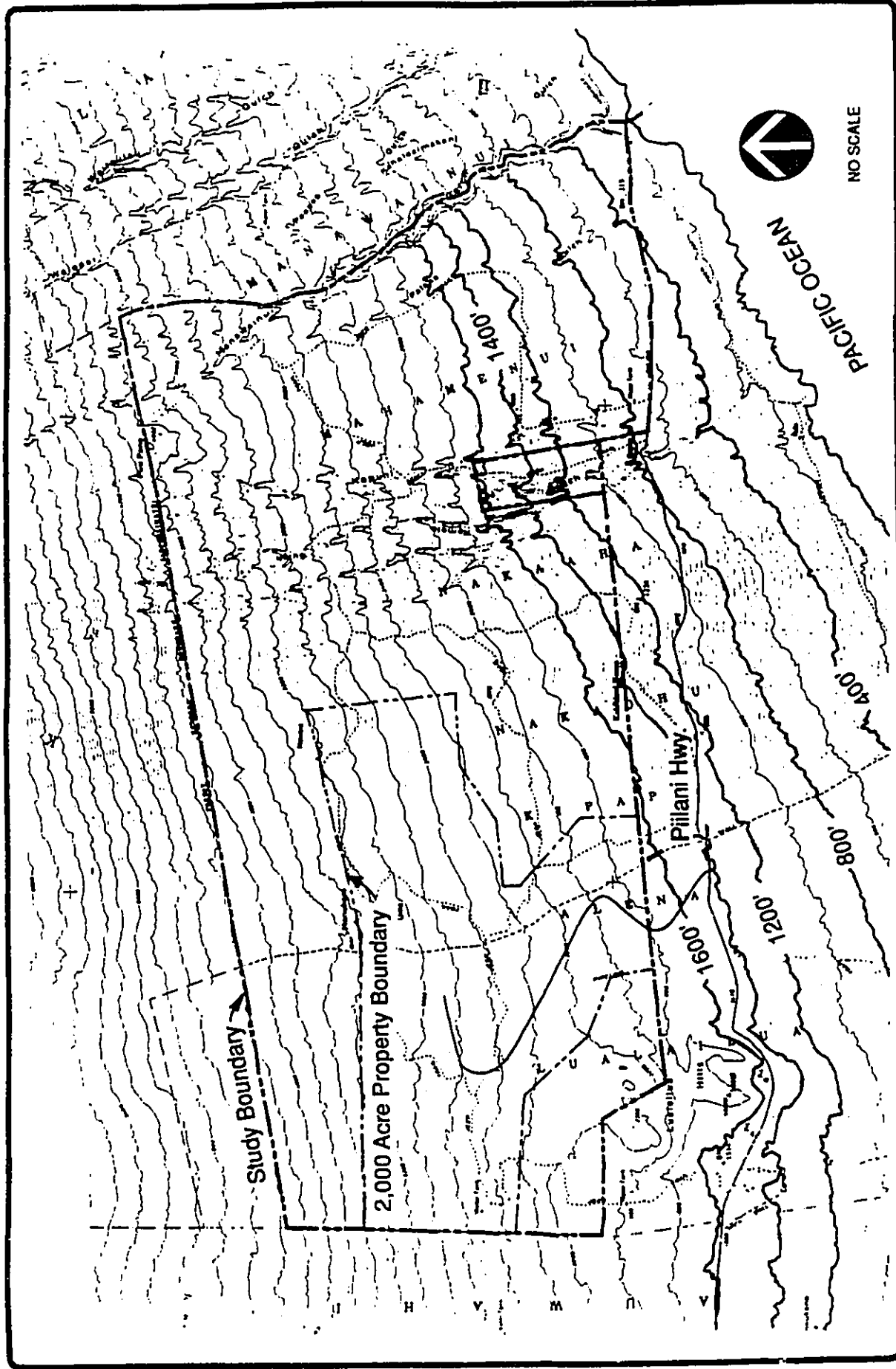
Groundwater Occurrence and Behavior

The groundwater resources of the Kahikinui region have not attracted interest or study because they are assumed to be too small and remote to be economically developable. High level groundwater probably exists in the Southwest Rift Zone and at high elevations south of Haleakala Crater, but its boundaries are unknown nor determinable with the present state of knowledge. In the Aquifer Classification System the seaward limit of the high level water is roughed in at approximately the 7000 feet elevation contour in Kahikinui. Depth to the high level water table is likely to be on the order of 5000 to 6000 feet in this zone. The steep slope of the Haleakala flank places enormous technical and economic constraints on the exploitation of high level groundwater in the region.

Seaward of the high level zone, groundwater occurs in a thin basal lens which freely discharges along the sea coast. A caprock rim does not exist, and consequently heads are low. As in the high level case, the steep surface slope imposes an obstacle to economic development of the basal water. The thin lens precludes the employment of high capacity wells while the depth to water, and consequently lift to the surface, would be great. About a mile inland of the coast, ground elevation is 750 feet, and two miles inland it is 1500 feet. A site map is shown in Figure 1.

In a basal lens in which flux is low, as in Kahikinui, unit extraction rates, such as for a pumped well, are restricted to several hundred gallons per minute at best. Successful wells would have to be located where head is 3 feet or greater. In Kahikinui this condition probably does not occur within a mile of the coast.

Because the water table is virtually at sea level, pump lift to the surface would be 1000 feet or so. At one mile inland the water is likely to be brackish, perhaps usable for irrigation but not for drinking.



Map Showing Area of HHL Property

Mink and Yuen, Inc.
 Honolulu, Hawaii
 December, 1994

Figure 1

The information base on groundwater in Kahikinui is sparse, indeed. Nevertheless a rough estimate of how the basal water behaves can be made to suggest the limits of developability.

Assuming recharge from rainfall as equal to 10 inches per year, based on storm rainfall of 25 inches per year, the average outflow at the coast is approximately 2.8 mgd/mile. The basal lens has a parabolic surface, and assuming that hydraulic conductivity is 2000 ft/day (a typical value for primitive basalt, such as the Honomanu series), head at one mile inland is 3 feet, which follows from the simple geometry of parabolic curvature in the equation,

$$q = 41kh^2/2x$$

in which q is flow per unit width over depth of the lens, k is hydraulic conductivity, h is head, and x is distance from the coast where head is zero. The equation is highly simplified but nevertheless is justified in the absence of a better information base.

A basal head of 3 feet allows for a pump capacity of between 150 and 200 gpm to yield usable quality water.

At this head in Kahikinui the groundwater is likely to be brackish but useful for irrigation. Ground elevation is 750 feet, therefore lift to the surface will be at least 750 feet.

Further inland head increases slowly. At two miles the head is about 4.3 feet, which is adequate in other locations, such as West Maui, for pumping between 350 and 400 gpm of potable water. Ground elevation at this distance is 1500 feet, thus lift would be at least 1500 feet. It is possible that greater quantities of potable water may be developed further inland at higher elevations but economics will be the prime consideration since deeper wells would be needed. In Kahikinui attempts to develop basal water will have to be regarded initially as exploratory ventures. Wells can be designed for exploratory purposes, then converted to producers.

No information exists about the high level water except for local perched springs. None of these springs are sufficiently copious to sustain a community. The high level water that is voluminous and reliable occurs in dike aquifers in the rift zone. A strong suggestion, though not always a certainty, about the limits of high level groundwater occurrence can be obtained through

geophysical surveys. The easiest to undertake, TDEM (Time Domain Electro Magnetic), has been employed in Hawaii elsewhere. The method predicts depth to salt water; if salt water does not register at a reasonable depth, say 1000 feet below sea level, the groundwater is high level.

Conclusions

Groundwater resources exist in Kahikinui, but flux is small and developability is highly constrained. No investigations directed at establishing the elements of groundwater occurrence and behavior have been done. The information base is sparse and needs to be expanded.

Nevertheless, basal groundwater underlies much of the region and may yield usable water if carefully exploited. High level groundwater probably exists where the ground surface exceeds about 5000 feet elevation on the south side of Haleakala Crater and somewhat lower along the Southwest Rift Zone. The cost of developing groundwater would be even higher than expectable for the basal lens zone.

If potential groundwater development opportunities meet economic criteria, the program of development will have to be done in an exploratory-development framework. The success of the exploratory phase becomes the initiation of the development phase. Exploratory drilling, convertible to production drilling, will be necessary.

Mink & Yuen, Inc.

100 N. Beretania Street • Suite 303 • Honolulu, Hawaii 96817 • Telephone: (808) 536-0081 • Fax: (808) 536-0082

January 17, 1995

Mr. Brian Takeda, Senior Planner
R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817-4941

Re: Revision of Hydrogeological Study for Kahikinui Kuleana Project--Maui

This is a follow-up to our recent report on the above study, the scope of which was included in our proposal of May 5, 1994. The following items are as listed in your letter:

1. Water Needs for Domestic and Irrigation Use

a. Domestic Needs

- Assume a total of 150 lots accommodating five (5) persons per lot.
- Assume domestic need of 150 gpd/person.

Therefore, total domestic need is:
 $150 \times 150 \times 5 = 112,500 \text{ gpd.}$

b. Irrigation Needs

For pastoral/subsistence type uses, we are assuming a need of about three (3) acres per family, two acres for farming and one acre for a cow or a goat. This would involve minimal needs, such as whatever farming is required to serve the needs of one family and sufficient water to service a cow or a goat. For this type of demand, it is assumed that a water need of 4,000 gals/acre would be adequate for farming and 1,000 gals/day to sustain a cow.

Therefore, pastoral/irrigation needs would be about
 $4,000 \times 2 + 1,000 \text{ gpd.}$

For 150 lots, the total need would be
 $(8,000 + 1,000) \times 150 = 1,350,000 \text{ gpd.}$

Total needs for domestic and irrigation purposes =
 $112,500 + 1,350,000 = 1,462,500 \text{ gpd, say, } \underline{\underline{1.50 \text{ mgd}}}$

January 17, 1995

2. Number, Capacity, Depths, and Possible Sites of Wells

For a total demand of 1.5 mgd, three 12-inch wells with 350 gpm pumps would be required. They could be located at about the 1,750 ft. contour at a spacing of about 500 feet. Assuming an open hole of 50 ft., the total depth of each well would be about 1,800 feet.

3. Sustainable Yield of Wells

Each well should be able to produce about 500,000 gpd of water on a sustained basis. However, this figure should not be confused with the sustainable yield of the well. The sustainable yield is significantly greater than the sustained pumpage of 500,000 gpd.

4. Cost Factors

Latest cost figures indicate that the cost of each well, including casing and pump testing, is estimated at \$ 500.00/ft. The cost of a pump and control station is estimated at \$ 175,000.00.

Therefore, the total cost of each well is estimated at:

$$\begin{aligned} & 1,800 \times 500 + 175,000 \\ & = 900,000 + 175,000 \\ & = \underline{\underline{\$ 1,075,000.00}} \end{aligned}$$

With a 10% contingency, the total cost is in the neighborhood of \$ 1.2 M.

This is only for the cost of the well alone. Added to it would be the cost of power and infrastructure to transmit the water to points of need. It is emphasized that the number of wells recommended are for minimal needs only. Future needs would have to be determined on the basis of actual needs experienced by homesteaders.

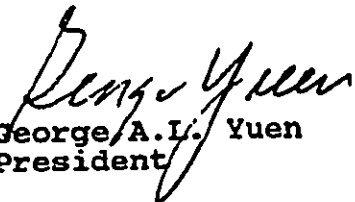
Mr. Brian Takeda
R.M. Towill Corporation
Page Three

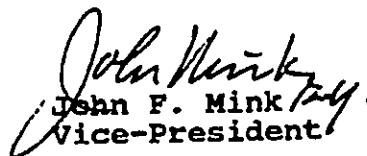
January 17, 1995

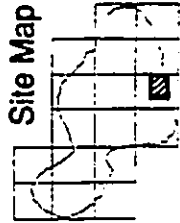
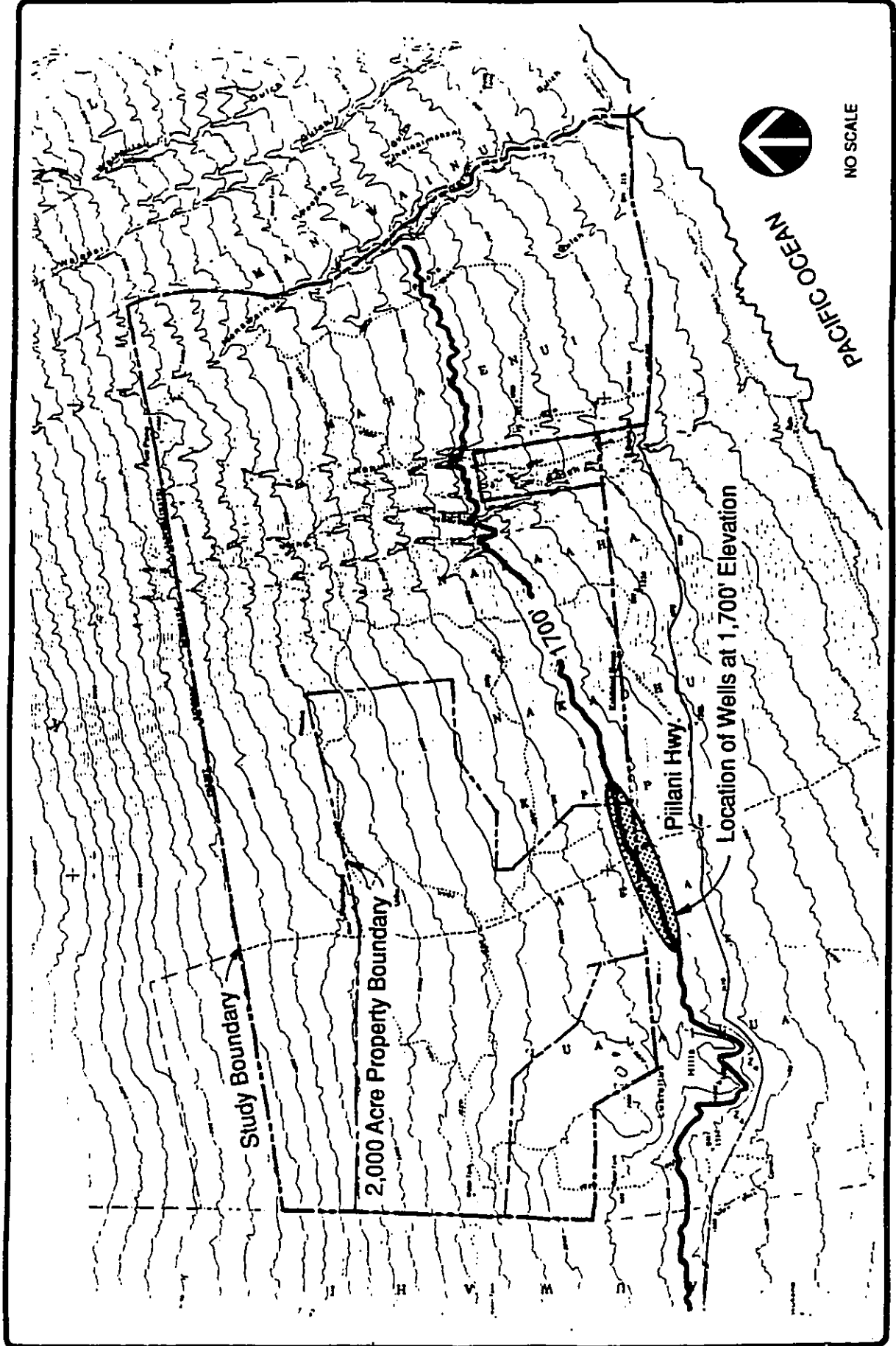
The above figures are only rough estimates. They should be updated and refined when the system is being designed.

Please let us know if you need clarification or additional information.

Very truly yours,


George A. L. Yuen
President


John F. Mink
Vice-President



Site Map

Map Showing Area of HHL Property

Mink and Yuen, Inc.
 Honolulu, Hawaii
 December, 1994

APPENDIX B

Flora Resources

1
2
3
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7
8
9
10
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12
13
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17
18
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**BOTANICAL SURVEY REPORT FOR THE
PROPOSED KAHIKINUI KULEANA PROJECT SITE**

**FOR
RMTc - R. M. TOWILL CORPORATION
420 WAIKAMILO ROAD, SUITE 411
HONOLULU, HAWAII 96813**

**BY
EVANGELINE J. FUNK, PH.D.
BOTANICAL CONSULTANTS
HONOLULU, HAWAII
1994**

TABLE OF CONTENTS

	page
INTRODUCTION.....	1
METHODS.....	1
RESULTS AND DISCUSSION.....	1
VEGETATION TYPES.....	2
LANTANA SCRUB.....	3
OPEN KIKUYU GRASSLAND.....	3
PLANTS OF NOTE.....	4
ENDANGERED SPECIES	6
BIBLIOGRAPHY.....	7
SPECIES LIST.....	8

INTRODUCTION

The Kahikinui Kuleana Project Site is located north and east on the Lualailua Hills on the south slope of Haleakala Crater on the island of Maui, Hawaii. It is made up of approximately two-thousand acres of south facing, rolling, open, abandoned pasture land. This site can be described as a series of shallow gullies and low, rocky ridges.

Annual rainfall in this locality is reported to be between ten and thirty inches (250mm to 750mm State of Hawaii 1982) and the soils have been described in varying degrees of stoniness, from very stony to very stony silt loam (Foote et al. 1972).

The purpose for a survey of this remote, two-thousand acre site was to collect data for the preparation of a species list of all taxa growing on the site; to describe the vegetation of the site; and to ascertain if any plant species protected by Federal Law are present in the area.

METHODS

A series of wandering transects which took investigators to all parts of the site were walked by a two person team over a period of ten days. The rock wall which traverses the site from north to south through the central portion of the site was used as the end point for the transects. In addition, forays were made into the site from all convenient jeep trails. The openness of the site and the paucity of trees and shrubs made most woody plants visible from great distances.

RESULTS AND DISCUSSION

Comparatively little has been written about the botany of the area east of the Lualailua Hills. In 1920, C. N. Forbs made extensive collections of

botanical specimens in the area. However, in his description of the vegetation of the dry regions or lava fields of the lower forest zones such as Kahikinui, Maui, Rock wrote that this area had "been entirely neglected by botanical collectors who have previously visited these islands" (Rock, 1913). He further stated that on the "southern slopes (of Haleakala) nothing remains to be considered, as the grassy plains have not even a remnant of the once existing forest" (Ibid).

In 1986, the Cooperative National Park Resources Studies Unit (Medeiros et al. 1986) published a technical report on the status of the native flowering plants of the south slope of Haleakala, East Maui, Hawaii. Although the field studies undertaken to prepare this report included all parts of the south slope of Haleakala Crater, the emphasis was on the surviving dry forests which persist in other parts of the study area.

During this survey, one-hundred twenty-nine species of vascular plants were found. Of these, thirty percent or thirty-eight taxa were found to be endemic or indigenous to the Hawaiian Islands.

VEGETATION TYPES

Basically two vegetation types can be distinguished on the proposed Kahikinui Kuleana Project Site. These are Lantana Scrub and Open Kikuyu Grassland. The boundary between these vegetation types is extremely irregular. Open Kikuyu Grassland is found at higher elevations in the northern part of the site which reaches into the fog belt. Lantana Scrub covers the dryer, rocky southern part of the site. In addition scattered individual Lantana shrubs can be found throughout the Open Kikuyu Grassland and long fingers of Lantana Scrub reach as high as 2700 feet elevation on the rocky ridges in the eastern portion of the study area.

Lantana Scrub. *Lantana camara* L. is a spreading, thicket forming woody shrub with multicolored flowers and is considered to be one of the world's worst weeds (Holm et al. 1977). On the study site, Lantana shrubs are usually less than three feet in height. In some shallow swales plants four feet or more are not uncommon. Frequently found among Lantana shrubs are Texas sage (*Salvia coccinea* Etl.) and blue morning glory flowers (*Ipomoea indica* (J. Burm.) Merr.). The Lantana scrub vegetation is interspersed with frequent rock outcrops, steep gullies, and rocky ridges. These gullies and rocky ridges provided protected habitat for most of the native plants found during the survey, for example Hawaiian wili wili (*Erythrina sandwicensis* Degener), Lama (*Diospyros sandwicensis* (A. DC) Fosb.), sandalwood (*Santalum ellipticum* Quad.), Hao (*Rauwolfia sandwicensis* A. DC), 'Ohe (*Reynoldsia sandwicensis* A. Gray) and Ohia (*Metrosideros polymorpha* Gaud.). Other native plants such as Ulei (*Osteomeles anthyllifolia* (SM) Lindl.) and Alahe'e (*Canthum odoratum* (G. Forster) Seem.) appear to be thriving among the Lantana shrubs where they are protected from grazing animals.

Open Kikuyu Grassland. Kikuyu grass (*Pennisetum clandestinum* Hochst.) is an aggressive, creeping, sod-forming, perennial grass that spreads by stolons and rhizomes (Holm et al. 1977). Although important as a pasture grass it is considered to be one of the world's worst weeds. On the proposed Kahikinui Kuleana Project Site the Open Kikuyu Grassland is vegetated by more than just kikuyu grass. African dropseed (*Sporobolus africanus* (Poir.) Robyns & Tournay), McCoy grass (*Cyperus gracilis* R. Br.), Kili'o'opu (*Kyllinga brevifolia* Rottb.), two types of tick clover (*Desmodium* spp.), and several other weedy species form enclaves within the kikuyu grass mat.

Also within the Open Kikuyu Grassland there can be found some deep gullies,

rocky ledges and rock outcrops which offer protected habitat for native plants. Aulu (*Pisonia sandwicensis* Hillebr.), Keahi (*Nelsoluma polynesianum* (Hillebr.) Baill.) and 'Ala'a (*Pouteria sandwicensis* (A. Gray) Baehni & Degener) were found in just such places.

Scattered throughout this area some alien trees are beginning to become established. Silk oak (*Grevillea robusta* A. Cunn. ex R. Br.), Christmas berry (*Schinus terebinthifolius* Raddi), and yellow guava (*Psidium guajava* L.) are the most common.

In addition there are some low, flat places where there is some soil and some water accumulates. In these places wild pigs congregate to root for grubs and to wallow in the available moisture. In these wallows can be found large collections of some of the worst weeds in Hawaii. Plants such as Apple of Sodom (*Solanum linnaeanum* Hepper & P. Jaeger), balloon plant (*Asclepias physocarpa* (E. May), Castor bean (*Ricinus communis* L.) and jimson weed (*Datura stramonium* L.), all of which are toxic. Others like spiny amaranth (*Amaranthus spinosus* L.), bull thistle (*Cirsium vulgare* (Savi) Ten.), hairy abutilon (*Abutilon grandifolium* Sweet), Maui pamakani (*Ageratina adenophora* (Spreng.) R. King & H. Robinson), and Hamakua pamakani (*Ageratina riparia* (Regel) R. King & H. Robinson) are plants not even eaten by goats.

PLANTS OF NOTE

One of the outstanding botanical features of the study area is the abundance of mature Halapepe trees (*Pleomele auwahiensis* St. John) found in the eastern and western portions of the site. These trees inhabit the rocky ridges of both the Open Kikuyu Grasslands and the Lantana Scrub. They vary in size from eight inches to thirty inches in diameter at breast height. Most are thirty feet in height and many were fruiting at the time of the survey. There was no evidence of regeneration in the Halapepe population.

A second species of note was the Kolea (*Myrsine lanaiensis* Hillebr.). These small trees can be found in small enclaves of two or three trees to fairly large stands of twenty-five trees or more throughout the site. Many were in flower and fruit. Formerly kolea trees were heavily browsed by cattle and goats. Now, since the browsers have been taken off the site the Kolea trees are beginning to coppice (sprout from the base) and some seedlings are managing to overtop the Kikuyu grass.

Ulei (*Osteomeles anhyllidifolia* (Sm.) Lindl.) is usually a woody, prostrate shrub with white flowers and fruits. At lower elevations on the study site it grows in this fashion. At higher elevations, within the fog belt, Ulei becomes an erect shrub or small tree. Often it is festooned with the bright orange lichen (*Teloschistes flavicans*). Ulei is one of the most successful native plants making a comeback on this site. Seedlings and saplings of Ulei are scattered throughout the study area and all appear to be thriving. Ethnobotanically, ulei was very important to the early Hawaiians. The seeds and young shoots were used medicinally, the wood was used for spears and o'o sticks and the long pliable branches were used to make fish traps.

Near the southwestern boundary of the study site, there is a small, very rocky ridge upon which is found a thriving community of coast sandalwood (*Santalum ellipticum* Gaud.). There are approximately one-hundred fifty trees of all sizes from seedlings to mature, fruiting individuals.

Two other native species which appear to be doing very well below two-thousand feet elevation are Wiliwili (*Erythrina sandwicensis* Degener) and Lama (*Diospyros sandwicensis* (A. DC) Fosb.). Small groves of these medium to large sized trees can be found at the base of rocky gulches. They no doubt persist in these areas because the rock gulches afforded some protection

from grazing animals. Now that the grazers are gone, the trees appear to be making a comeback. Both Wiliwili and Lama were important to the early Hawaiians.

ENDANGERED SPECIES

No Candidate, proposed, or listed threatened or endangered species as set forth in the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543), were found on the Proposed Kahikinui Kuleana Project Site. One individual of a potential candidate for listing, 'Ahakea (*Bobea sandwicensis*), was reported from approximately 2600 feet elevation, north of the Lualailua Hills. In 1986, a single, half dead tree was reported to be within one-third of a mile of the above mentioned location. An extensive search in this area did not locate the 'Ahakea tree and it is presumed to have died.

In addition, Medeiros et al. (1986) report that *Bonamia menziesii* A. Gray, *Acacia koaia*, *Portulaca villosa* Cham., and *Bidens micrantha* Gaud. subsp. *kalealaha* can be found within five miles of a site located at 3000 feet elevation in the western portion of the study site. This information had been gleaned from the field notes of C. N. Forbs who had visited the area in 1920. Of these taxa, *Bidens micrantha* subsp. *kalealaha* is a listed endangered species. It was reported by Medeiros et al (1986) from "between Manawainui and Wailaulau" between 5200 and 6400 feet elevation. Two of the others, *Acacia koaia* and *Portulaca villosa* are listed as potential candidates for listing. *Portulaca villosa* has been collected by several botanists along the coast near the study site and along the beach from Kanaio to Kaupo in east Maui. However, there is still some question as to the status of *Acacia koaia*. Wagner et al (1990) do not list this taxon as a distinct species. *Bonamia menziesii* is a proposed endangered species which has been

reported from between 1100 and 2400 feet elevation in the Lualailua ahupa'a.

At 3000 feet elevation the vegetation of the site was found to be dense Kikuyu Grassland with scattered rock outcrops where Lantana shrubs could be found. The scattered trees were Christmas berry, guava, 'Akia, and an occasional Halapepe, Ulei or sandalwood tree. To the west, at this elevation, the cattle ranch next door maintains an even purer pasture of Kikuyu grass. A search of the western end of the site did not turn up any of the above mentioned plants. "Within five miles" could really mean anywhere on or off the study site. None of the above mentioned plants were found during the survey.

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**CHECKLIST OF PLANTS FOUND ON THE PROPOSED KAHIKINUI KULEANA
PROJECT SITE**

The plant families in the following species list have been alphabetically arranged within three groups, Ferns, Monocotyledons, and Dicotyledons. The genera and species are arranged alphabetically within families. The taxonomy and nomenclature follow that of St. John (1973) and Wagner, Herbst and Sohmer (1990). For each taxon the following information is provided:

1. An asterisk before the plant name indicates a plant introduced to The Hawaiian Islands since Cook or by the aborigines.
2. The scientific name.
3. The Hawaiian name and or the most widely used common name.
4. Abundance ratings are for this site only and they have the following

meanings:

Uncommon = a plant that was found less than five times.

Occasional = a plant that was found between five to ten times.

Common = a plant considered an important part of the vegetation.

Locally abundant = plants found in large numbers over a limited area. For example, plants found in grassy patches.

This species list is the result of an extensive survey of this site at the beginning of the wet season (October 1994) and it reflects the vegetative composition of the flora during a single season. Minor changes in the vegetation will occur due to introductions and losses and a slightly different species list would result from a survey conducted during a different growing season.

<u>Scientific Name</u>	<u>Common Name</u>	<u>Abundance</u>
FERNS AND FERN ALLIES		
PSILOTACEAE - Psilotum Family		
<i>Psilotum nudum</i> (L.) Beauv.	Moa	Locally abundant
ADIANTACEAE - Maidenhair Fern Family		
* <i>Pityrogramma calomelanos</i> (L.) Link.	Gold fern	Occasional
POLYPODIACEAE - Common Fern Family		
* <i>Pellea ternifolia</i> (Cav.) Link	Cliffbrake	Common
* <i>Phlebodium aureum</i> (L.) J. Sm.	Laua'e	Uncommon
<i>Pleopeltis thunbergiana</i> Kaulf.		Common
<i>Polypodium pellucidum</i> Kaulf.		Occasional
* <i>Pteridium Aquilinum</i> (L.) Kuhn	Braken fern	Common
* <i>Nephrolepis exaltata</i> Schott.	Boston fern	Locally abundant
PTERIDACEAE - Pteris Family		
<i>Doryopteris</i> sp.		Common
MONOCOTYLEDONES		
AGAVACEAE - Agave Family		
<i>Cordyline fruticosa</i> (L.) A. Chev.	Ti	Rare
<i>Pleomole auwahiensis</i> St. John		Common
COMMELINACEAE - Spiderwort Family		
* <i>Commelina benghalensis</i> L.	Hairy honohono	Locally abundant
* <i>Commelina diffusa</i> N. L. Burm.	Honohono	Locally abundant
CYPERACEAE - Sedge Family		
* <i>Cyperus gracilis</i> R. Br.	McCoy grass	Locally abundant
* <i>Cyperus rotundus</i> L.	Nut grass	Occasional
* <i>Kyllinga brevifolia</i> Rottb.	Kili'o'opu	Common
<i>Mariscus hillebrandii</i> (Boeck.) T. Koyama		Common
GRAMINEAE - Grass Family		
* <i>Bothriochloa bladhii</i> (Retz.) S.T. Blake	Beardgrass	Abundant
* <i>Bothriochloa pertusa</i> (L.) A. Camus	Pitted beardgrass	Locally abundant
* <i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass	Occasional
* <i>Digitaria ciliaris</i> (Retz.) Koeler	Henry's crab grass	Occasional
* <i>Holcus lanatus</i> L.	Common velvet grass	Locally abundant

<u>Scientific Name</u>	<u>Common Name</u>	<u>Abundance</u>
GRAMINEAE - Grass Family con't		
* <i>Melinis minusiflora</i> P. beauv.	Molasses grass	Locally abundant
* <i>Paspalum scrobiculatum</i> L.	Ricegrass	Uncommon
* <i>Pennisetum clandestinum</i> Chiov.	Kikuyu grass	Common
* <i>Rhynchosytrum repens</i> C.E. Hubb	Natal redtop	Common
* <i>Sacciolepis indica</i> (L.) Chase	Glenwood grass	Locally abundant
* <i>Sporobolus africanus</i> (Poir.) Robyns & Tournay	Smutgrass	Common
* <i>Sporobolus diander</i> (Retz.) P. Beauv.	Indian dropseed	Common
DICOTYLEDONES		
AMARANTHACEAE - Amaranth Family		
* <i>Amaranthus spinosus</i> L.	Spiny amaranth	Occasional
* <i>Amaranthus viridis</i> L.	Slender amaranth	Occasional
ANACARDIACEAE - Mango Family		
* <i>Schinus terebinthifolius</i> Raddi	Christmas berry	Common
APIACEAE - Parsley Family		
* <i>Petroselinum crispum</i> (Mill.) A. W. Hill	Parsley	Common
APOCYNACEAE - Dogbane Family		
<i>Rauwolfia sandwicensis</i> A, DC	Hao	Uncommon
ARALIACEAE - Ginseng Family		
<i>Reynoldsia sandwicensis</i> A. Gray	'Ohe	Rare
ASCLEPIADACEAE - Milkweed Family		
* <i>Asclepias physocarpa</i> (E. May) Schlechter	Balloon plant	Common
ASTERACEAE - Sunflower Family		
* <i>Ageratina adenophora</i> (Spreng.) R. King & H. Robinson	Maui pamakani	Occasional
* <i>Ageratina riparia</i> (Regel) R. King & H. Robinson	Hamakua pamakani	Common
* <i>Bidens alba</i> (L.) DC		Occasional
* <i>Bidens cynapiifolia</i> Kunth		Locally abundant
* <i>Bidens pilosa</i> L.	Spanish needle	Common
* <i>Cirsium vulgare</i> (Savi) Ten.	Bull thistle	Occasional
* <i>Conyza bonariensis</i> (L.) Cronq.	Hairy horseweed	Common

<u>Scientific Name</u>	<u>Common Name</u>	<u>Abundance</u>
ASTERACEAE - Sunflower Family con't		
* <i>Emilia sonchifolia</i> (L.) DC	Flora's paintbrush	Occasional
* <i>Heterotheca grandiflora</i> Nutt.		Locally abundant
* <i>Hypochoeris radicata</i> L.	Hairy cat's ear	Common
<i>Lipochaeta</i> sp.		Rare
* <i>Pluchea symphytifolia</i> Gillis	Sour bush	Occasional
* <i>Sigesbeckia orientalis</i> L.	Small crown beard	Uncommon
* <i>Sonchus oleraceus</i> L.	Sow thistle	Occasional
* <i>Tridax procumbens</i> L.	Coat buttons	Common
* <i>Xanthium strumarium</i> L.	Cocklebur	Occasional
BRASSICACEAE - Mustard Family		
* <i>Brassica campestris</i> L.	Field mustard	Locally abundant
* <i>Lepidium virginicum</i> L.		Uncommon
CACTACEAE - Cactus Family		
* <i>Opuntia ficus-indica</i> (L.) Mill.	Panini	Uncommon
CHENOPODIACEAE - Goosefoot Family		
* <i>Atriplex suberecta</i> Verd.		Locally abundant
* <i>Chenopodium murale</i> L.	'Aheahea	Uncommon
CONVOLVULACEAE - Morninglory Family		
* <i>Ipomoea indica</i> (J. Burm.) Merr.	Koaki 'awa	Common
* <i>Ipomoea obscura</i> (L.) Ker-Gawl		Occasional
CUCURBITACEAE - Cucumber Family		
* <i>Cucumis dipsaceus</i> Ehrenb. ex Spach	Hedgehog	Locally abundant
* <i>Momordica charantia</i> L.	Balsam pear	Occasional
EBENACEAE - Ebony Family		
<i>Diospyros sandwicensis</i> (A. DC) Fosb.	Lama	Locally abundant
EPACRIDACEAE - Epacris Family		
<i>Styphelia tameiameia</i> (Cham. & Schlechtend.) F. v. Muell.	Pukiawe	Uncommon
EUPHORBIACEAE - Spurge Family		
<i>Antidesma pulvinatum</i> Hillebr.	Hame	Rare
* <i>Chamaesyce hirta</i> L.	Hairy spurge	Occasional
* <i>Euphorbia cyathophora</i> J. A. Murray	Mexican fire plant	Uncommon
* <i>Ricinus communis</i>	Castor bean	Occasional

<u>Scientific Name</u>	<u>Common Name</u>	<u>Abundance</u>
FABACEAE - Bean Family		
* <i>Acacia mearnsii</i> De Wild	Black wattle	Uncommon
* <i>Chamaecrista nictitans</i> (L.) Moench	Partridge pea	Common
* <i>Desmodium sandwicense</i> E. Mey.	Spanish clover	Common
* <i>Desmodium tortuosum</i> (Sw.) DC	Florida beggerweed	Common
<i>Erythrina sandwicensis</i> Degener	Wiliwili	Locally abundant
* <i>Glycine wightii</i> (Wight & Arnott) Verdc.		Common
* <i>Indigofera suffruticosa</i> Mill.	Iniko	Common
* <i>Leucaena leucocephala</i> deWit	Koa-haole	Occasional
* <i>Macroptilium lathyroides</i> (L.) Urb.	Wild bean	Locally abundant
* <i>Medicago minima</i> (L.) Bartal.	Small bur clover	Locally abundant
* <i>Senna occidentalis</i> (L.) Link	Coffee senna	Occasional
* <i>Trifolium repens</i> L.	White clover	Locally abundant
* <i>Ulex europaeus</i> L.	Gorse	Uncommon
* <i>Vicia sativa</i>	Common vetch	Occasional
GERANIACEAE - Geranium Family		
* <i>Erodium cicutarium</i> (L.) L'Her	Pin clover	Occasional
LAMIACEAE - Mint Family		
<i>Plectranthus parviflorus</i> Willd.	Spurflower	Locally abundant
* <i>Prunella vulgaris</i> L.		Occasional
* <i>Salvia coccines</i> Etl.	Texas sage	Common
MALVACEAE - Mallow Family		
* <i>Abutilon grandifolium</i> Sweet	Hairy abutilon	Common
* <i>Malva parviflora</i> L.	Cheese weed	Locally abundant
* <i>Malvastrum coromandelianum</i> Garcke	False marrow	Common
<i>Sida fallax</i> Walp.	'Ilima	Common
* <i>Sida rhombifolia</i> L.	Cuba jute	Occasional
* <i>Sida spinosa</i> L.	Prickly sida	Occasional
MENISPERMACEAE - Moonseed Family		
<i>Cocculus trilobus</i> (Thunb.) DC	Huehue	Common
MYOPORACEAE - Myoporum Family		
<i>Myoporum sandwicense</i> A. Gray	Naio	Uncommon
MYRSINACEAE - Myrsine Family		
<i>Myrsine lanaiensis</i> Hillebr.		Common

<u>Scientific Name</u>	<u>Common Name</u>	<u>Abundance</u>
MYRTACEAE - Myrtle Family		
<i>Metrosideros polymorpha</i> Gaud.	Ohia	Occasional
* <i>Psidium guajava</i> L.	Guava	Uncommon
NYCTAGINACEAE - Four-o'clock Family		
<i>Pisonia sandwicensis</i> Hillebr.	Aulu	Uncommon
OLEACEAE - Olive Family		
<i>Nestegis sandwicensis</i> (A. Gray) Degener, I. Degener, & St. John	Olopua	Occasional
OXALIDACEAE - Oxalis Family		
<i>Oxalis corniculata</i> L.	Yellow wood sorrel	Common
PAPAVERACEAE - Poppy Family		
* <i>Argemone mexicana</i> L.	Mexican poppy	Occasional
PASSIFLORACEAE - Passion flower Family		
* <i>Passiflora subpeltata</i> Ort.	White passionflower	Common
PIPERACEAE - Pepper Family		
<i>Peperomia cookiana</i> C. DC	'Ala'ala wai nui	Occasional
PLANTAGINACEAE - Plantain Family		
* <i>Plantago lanceolata</i> L.	Buckhorn	Common
PLUMBAGINACEAE - Plumbago Family		
<i>Plumbago zeylanica</i> L.	'Ilie'e	Occasional
POLYGONACEAE - Buckwheat Family		
* <i>Rumex acetosella</i> L.	Sheep sorrel	Locally abundant
PORTULACACEAE - Portulaca Family		
<i>Portulaca lutea</i> Sol. ex G. Forster	'Ihi	Occasional
* <i>Portulaca oleracea</i> L.	Pigweed	Occasional
* <i>Portulaca pilosa</i> L.	Akulikuli	Occasional

<u>Scientific Name</u>	<u>Common Name</u>	<u>Abundance</u>
PRIMULACEAE Primrose Family		
* <i>Anagallis arvensis</i> L.	Scarlet pimpernel	Occasional
PROTEACEAE - Protea Family		
* <i>Grevillea robusta</i> R. Br.	Silk oak	Occasional
ROSACEAE - Rose Family		
<i>Osteomeles anthyllidifolia</i> (Sm.) Lindl.	Ulei	Common
* <i>Rubus argutus</i> Link	Prickly blackberry	Occasional
* <i>Rubus rosifolius</i> Sm.	Thimbleberry	Occasional
RUBIACEAE - Coffee Family		
<i>Canthium odoratum</i> Seem.	Alahe'e	Uncommon
SANTALACEAE - sandalwood Family		
<i>Santalum ellipticum</i> Gaud.	Coast sandalwood	Locally abundant
SAPINDACEAE - Soapberry Family		
<i>Dodonaea viscosa</i> Jacq.	A'ali'i	Uncommon
SAPOTACEAE - Sapodilla Family		
<i>Nelsoluma polynesianum</i> (Hillebr.) Baill.	Keahi	Uncommon
<i>Pouteria sandwicensis</i> (A. Gray) Baehni & Degener	'Ala'a	Uncommon
SOLANACEAE - Nightshade Family		
* <i>Datura stramonium</i> L.	Jimson weed	Occasional
* <i>Physalis peruviana</i> L.	Poha	Occasional
<i>Solanum americanum</i> Mill.	Popolo berry	Occasional
* <i>Solanum linnaeanum</i> Hepper & P. Jaeger	Apple of Sodom	Common
STERCULIACEAE - Stink tree Family		
* <i>Waltheria indica</i> L.	Hi'aloa, uha-loa	Common
THYMELAECEAE - Akia Family		
<i>Wikstroemia monticola</i> Skottsbo.	'Akia	Common

<u>Scientific Name</u>	<u>Common Name</u>	<u>Abundance</u>
TILIACEAE - Linden Family		
* <i>Triumfetta semitriloba</i> Jacq.	Sacramento bur	Common
VERBENACEAE - Verbena Family		
* <i>Lantana camara</i> L.	Lantana	Common
* <i>Stachytarpheta jamaicensis</i> (L.) Vahl.	Jamiaca vervain	Occasional
* <i>Verbanea litoralis</i> Kunth	Owi	Occasional

APPENDIX C
Faunal Resources

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT STATE OF
HAWAII DEPARTMENT OF HAWAIIAN HOMELANDS PROPERTY AT
KAHIKINUI, MAUI

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INTRODUCTION

This report summarizes the findings of a three day (18-20 November 1994) bird and mammal field survey of approximately 2000 acres of State of Hawaii Department of Hawaiian Homelands (DHHL) at Kahikinui, Maui (Fig. 1). Also included are references to pertinent literature and unpublished reports.

The objectives of the field survey were to:

- 1- Document what bird and mammal species actually or potentially occur on the property.
- 2- Provide some baseline data on the relative abundance of each species.
- 3- Note the presence or likely occurrence of any native fauna particularly those that are listed as "Endangered" or "Threatened".
- 4- Determine if the property contains any special or unique resources that if lost or altered by development might result in a significant impact on the native birds and mammals in this region of the island.

SITE DESCRIPTION

The Kahikinui property investigated by this field survey covered approximately 2000 acres between 1800 and 3400 feet elevation. Habitat in this region is relatively barren and windswept. Vegetation consists of grass with low brush and a few scattered trees. No wetland habitat suitable for waterbirds occurs on this site.

The weather during the survey was partly cloudy and cool. Winds were from the east at 25-35 mph.

STUDY METHODS

The property was surveyed by following existing jeep roads. Field observations were made with the aid of binoculars and by listening for vocalizations.

At scattered locations eight minute counts were made of all birds seen or heard. These data provide the basis for the relative abundance estimates given in Table One. Published and unpublished reports of birds known from similar habitat on Maui were also consulted in order to acquire a better perspective of the possible birds and mammals that could occur in this region (Bruner 1988; Pratt et al. 1987; Hawaii Audubon Society 1993). Observations of feral mammals were limited to visual sightings and evidence in

the form of tracks and areas disturbed by rooting. No attempts were made to trap mammals in order to obtain data on their relative abundance and distribution.

Scientific names of birds and mammals used in this report follow those given in Hawaii's Birds (Hawaii Audubon Society 1993; A field guide to the birds of Hawaii and the Tropical Pacific (Pratt et al. 1987) and Mammal species of the World (Honacki et al. 1982).

RESULTS AND DISCUSSION

Resident Endemic (Native) Birds:

No endemic native landbirds were recorded on the survey. The Short-eared Owl or Pueo (Asio flammeus sandwichensis) forages in agricultural fields and pastures as well as in forested upland habitats (Hawaii Audubon Society 1993). None were recorded on this survey, however, they are seen on Haleakala. This species is listed by the State of Hawaii as endangered on the island of Oahu but not on Maui. No other native resident landbirds would be expected on this site. The endangered Dark-rumped Petrel (Pterodroma phaeopygia) and Nene (Nechosen sandvicensis) can be found at higher elevation in Haleakala National Park. The endangered Akepa (Loxop coccineus) was reported in this region of Maui in 1950. This forest bird

would not be expected on this barren property but may still occur at higher elevation on the NE slope of Haleakala (Hawaii Audubon Society 1993).

Migratory Indigenous (Native) Birds:

Migratory shorebirds winter in Hawaii between the months of August through May. Some juveniles will stay over the summer months as well (Johnson et al. 1981, 1983, 1989). The most abundant shorebird species in Hawaii is the Pacific Golden Plover (Pluvialis fulva). Plover forage in open areas such as mud flats, lawns, pastures, plowed agricultural fields and along roadsides. Plover are extremely sight-faithful and most establish winter foraging territories which they defend vigorously. Such behavior makes it possible to accurately census the plover population in a particular area. These populations likewise remain relatively stable over many years (Johnson et al. 1989). Ninety-four plover were recorded on the survey. These birds were seen in the upper pastureland and in other open habitats on the property. The only other migrant which may occur in this area is the Ruddy Turnstone (Arenaria interpres). They also utilize grassland as well as shoreline habitat. Neither the plover nor the turnstone are listed as endangered or threatened.

Resident Indigenous (Naive) Seabirds:

No seabirds were recorded nor would any be expected at this

location. Predators such as dogs, cats pigs and the Small Indian Mongoose (Herpestes auropunctatus), along with human disturbance restrict seabird nesting to a few isolated and protected locations on the main Hawaiian Islands. The endangered Dark-rumped Petrel nests at higher elevation near the summit of Haleakala. They are not known to occur on this property and at this elevation.

Resident (Native) Waterbirds:

No wetland habitat suitable for waterbirds occurs on this property. No waterbirds would be expected at this site. The endangered Nene or Hawaiian Goose can be found in Haleakala National Park. I would not expect to find them on this property. They normally are seen at higher elevation in more alpine and subalpine habitat.

Exotic (Introduced) Birds:

Only ten species of exotic birds were recorded during the field survey. Table One shows the relative abundance of each. In addition to these species other exotic birds which potentially could occur on the property include: Chukar (Alectoris chukar), Wild Turkey (Meleagris gallopavo), Cattle Egret (Bubulcus ibis), Barn Owl (Tyto alba), Northern Cardinal (Cardinalis cardinalis), Northern Mockingbird (Mimus polyglottus), Warbling Silverbill (Lonchura malabarica), and Red-crested Cardinal (Paroaria coronata) (Bruner 1988; Pratt et

al. 1987; Hawaii Audubon Society 1993).

Feral Mammals:

Small Indian Mongoose and feral cats were observed on the survey. Evidence of pig (Sus scrofa) rooting was abundant, particularly at higher elevations. No Axis Deer (Axis axis) were sighted but they do occur nearby at Ua Palakua (Bruner 1988). Feral Goats (Capra hircus) occur on the site. Two nights were spent searching for the endemic and endangered Hawaiian Hoary Bat (Lasiurus cinereus semotus). Records of this species on Maui are limited (Tomich 1986; Kepler and Scott 1990). I observed a bat in Kula on 28 October 1994. No bats were sighted on this survey. This species is known to roost solitarily in trees and forages for flying insects using echolocation. They have been reported from a variety of habitats including native forest, alpine habitat, agricultural lands, second growth forest, ranchlands, ponds and bays as well as in urban areas. The life history of this species has not been well documented. Kepler and Scott (1990) suggest that bats occur on Maui only as a "migrant, probably from the Big Island". Other's (Duvall and Duvall 1991) report evidence that would suggest there may be a resident breeding population of bats on Maui.

CONCLUSION

A brief field survey of 2000 acres can only provide a general overview of the wildlife that may use the site. The number of species and their relative abundance may vary throughout the year due to resource (food, water) availability and reproductive success. Species which are migratory will only be an important part of the faunal picture at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the faunal community (Williams 1987; Moulton 1990). Thus only long term studies can provide a comprehensive view of the bird and mammal populations in a particular area. However, some general conclusions related to bird and mammal activity at this site can be made. Below is a summary of the findings of this survey.

- 1- The site was surveyed by driving the jeep roads which traverse the property. All habitat types found on the property were sampled. Census data on birds were obtained at random locations (Fig. 1) throughout the property and are reported in Table One.
- 2- The migratory Pacific Golden Plover was the only non-introduced species recorded on the survey. Plover are not endangered or threatened. The pastureland and other open habitats provide foraging grounds for these shorebirds. Pacific Golden Plover

are the most abundant migrant shorebird in Hawaii. Ninety-four were tallied on the survey. This number represents only a portion of those which occur at this site. I am confident that if every plover on this property were accounted for the number would be in the hundreds.

- 3- No native resident birds were found on the survey. The native owl (Pueo) occurs in this region but was not recorded. They are not endangered or threatened on Maui. The endangered Hawaiian Goose (Nene) and Dark-rumped Petrel occur at higher elevation in Haleakala National Park. They would be unlikely to occur on this property. The endangered Akepa was reported from this region 44 years ago in 1950. This forest bird would not be expected on this 2000 acre site but may exist in the higher forested sections of NE Haleakala.
- 4- No seabirds or waterbirds were recorded or should be expected on this site.
- 5- The list of exotic birds recorded on the survey (Table 1) was typical for this region of Maui. Some species were unaccounted for but may occur in this area. No unexpected sightings were obtained. None of these species are listed as endangered or threatened.

- 6- Pigs, goats, mongoose, cats and likely rats and mice occur on this site. The endangered Hawaiian Hoary Bat was not recorded but has been seen in similar habitat elsewhere on Maui. The occurrence and abundance of this species on Maui has not been extensively studied. Only isolated records made from brief observations or recovered specimens confirm its existence.

- 7- The long term ranching of this property has significantly altered the habitat. Presently the site is used predominantly by introduced species of birds and mammals. Similar habitat exists in abundance in this region of Maui.

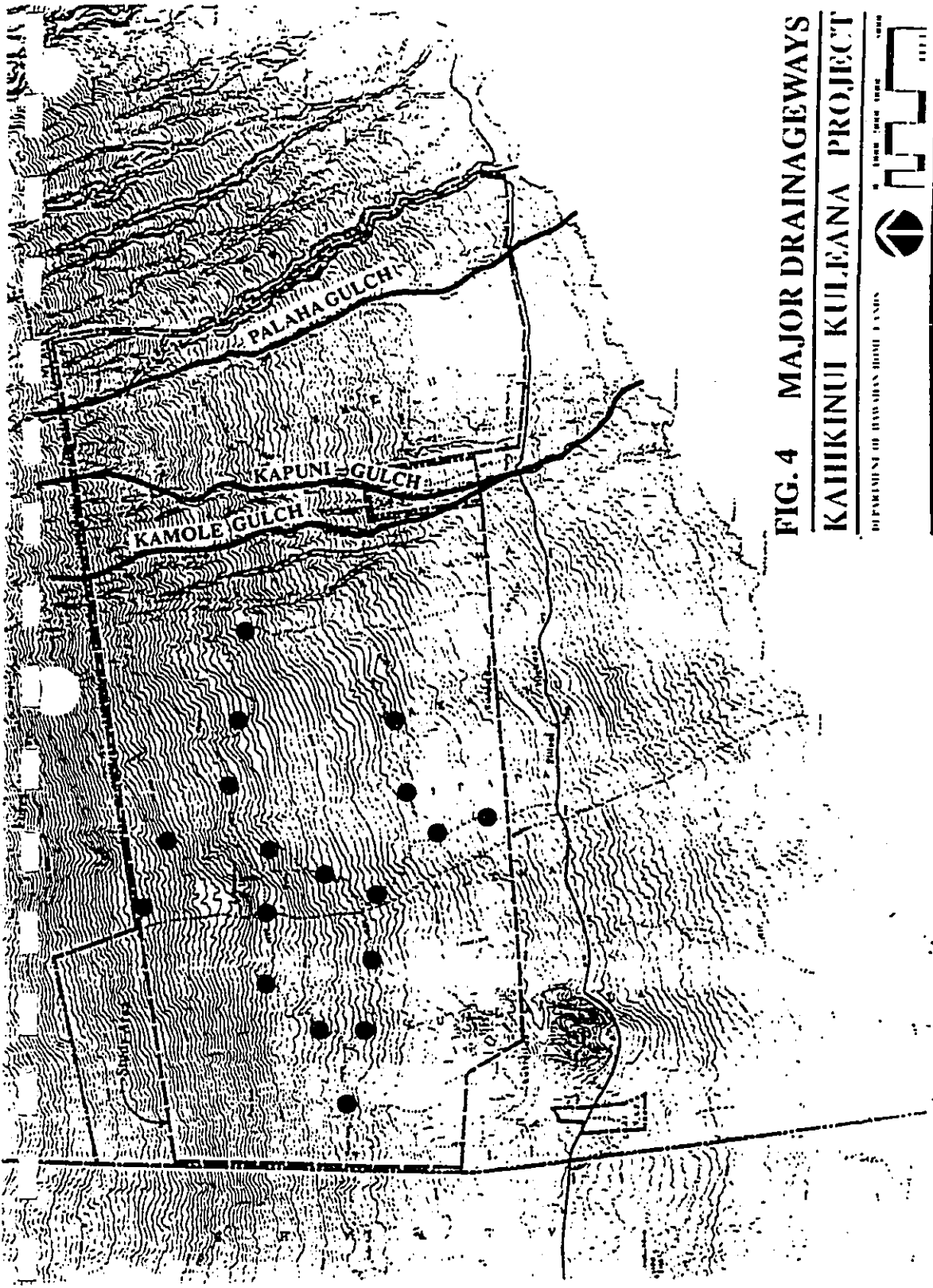


FIG. 4 MAJOR DRAINAGEWAYS

KAHIKINUI KULEANA PROJECT

DEPARTMENT OF LAND AND NATURAL RESOURCES
HAWAIIAN TERRITORY
1954

U.S. GOVERNMENT PRINTING OFFICE

Fig. 1. Location of faunal (bird & mammal) survey with census stations shown as solid circles.

TABLE 1

Exotic species of birds recorded at the State of Hawaii, Department of Hawaiian Homelands, Kahikinui property, Maui.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*
Ring-necked Pheasant	<u>Phasianus colchicus</u>	R = 12
Black Francolin	<u>Francolinus francolinus</u>	R = 1
Gray Francolin	<u>Francolinus pondicerianus</u>	U = 2
Spotted Dove	<u>Streptopelia chinensis</u>	U = 1
Zebra Dove	<u>Geopelia striata</u>	U = 2
Eurasian Skylark	<u>Alauda arvensis</u>	A = 15
Common Myna	<u>Acridotheres tristis</u>	R = 6
Japanese White-eye	<u>Zosterops japonicus</u>	U = 3
Nutmeg Mannikin	<u>Lonchura punctulata</u>	C = 6
House Finch	<u>Carpodacus mexicanus</u>	A = 13

*(see page 12 for key to symbols)

KEY TO TABLE 1

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

A = abundant (ave. 10+)

C = common (ave. 5-10)

U = uncommon (less than 5)

R = recorded (seen or heard on one count only or at times other than on 8 min. counts. Number which follows is the total number of individuals seen or heard)

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APPENDIX D
Archaeological Reconnaissance

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
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18
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**ARCHAEOLOGICAL RECONNAISSANCE OF AN 8,300-ACRE
PROJECT AREA, KAHIKINUI, MAUI
TMK 1-9-01:3**

by

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Prepared for

R.M. TOWILL CORPORATION

by

CULTURAL SURVEYS HAWAII
SEPTEMBER 1994

ABSTRACT

An archaeological reconnaissance was conducted of an 8,300-acre project area in Kahikinui Ranch lands, southern Maui. This reconnaissance involved daily use of a helicopter and was performed with the intention of defining the boundaries of major site complexes, as well as locating areas of the project without sites. Forty-one numbered sites and site complexes were recorded. Fifteen survey sections were designated to describe relative site density and to characterize for potential archaeological impact. This portion of Kahikinui clearly contains major site complexes which have never been formerly recorded.

ACKNOWLEDGEMENTS

Mr. Steve Kellogg and Mr. Brian Takeda of R.M. Towill provided essential support and guidance. We would also like to acknowledge the assistance of Dr. Michael Kolb and his assistant Mr. Jim Hayden of DLNR/State Historic Preservation Division for their support during the fieldwork. Dr. Kolb shared his expertise on the area and provided use of a GPS to locate sites and site areas. Ms. Elizabeth Anderson of Maui County Planning Department was also of great assistance during the fieldwork. Her good spirit and fine field notes are greatly appreciated. Mr. Don Shearer and Mr. Duke Baldwin provided the helicopter services of Windward Aviation. Both of them showed great skill and expertise. It is through their efforts that we were able to collect as much information as we did in four days of fieldwork. Mr. Shearer also provided us with a four-wheel drive vehicle during our fieldwork. Mr. Joe Chu of the Department of Hawaiian Home Lands provided information and maps on past surveys. Ms. Theresa Donham of DLNR State Historic Preservation Division provided much useful information and selected copies of previous archaeological research in the area. All of these efforts are greatly appreciated.

TABLE OF CONTENTS

ABSTRACT	i
ACKNOWLEDGEMENTS	ii
LIST OF FIGURES	iv
I. INTRODUCTION	1
Purpose of Study	1
Description of Project Area	1
Boundaries	1
Natural Landmarks	1
Vegetation	4
Man-made Landmarks	4
Ahupua'a and Place Names	4
Scope of Work	5
Methods	6
II. KAHIKINUI: THE DOCUMENTARY RECORD	8
III. PREVIOUS ARCHAEOLOGY	13
Walker Survey	13
Bishop Museum Survey	13
Connolly and Hommon State-wide Inventory	16
Chapman and Kirch Excavations	16
Erkelens Survey	16
IV. RECONNAISSANCE RESULTS	18
Survey Section Summaries	59
Survey Section B	59
Survey Section C	59
Survey Section D	59
Survey Section E	60
Survey Section F	60
Survey Section G	60
Survey Section H	60
Survey Section I	60
Survey Section J	60
Survey Section K	61
Survey Section M	61
Survey Section N	61
Survey Section O	61
V. RECOMMENDATIONS	63
VI. REFERENCES	65
PHOTO APPENDIX	66

LIST OF FIGURES

Figure 1	State of Hawai'i	2
Figure 2	Maui Island Location Map	2
Figure 3	USGS Topographic Map of Luala'ilua Quadrangle, 7.5 Minute Series, Showing Project Location	3
Figure 4	Walker Survey Map Showing Sites in Kahikinui District	14
Figure 5	Bishop Museum Map (Peter Chapman) Showing Surveyed Sites in the Project Area (1966, 1967)	15
Figure 6	USGS Topographic Map Showing Sites in State-wide Survey	17
Figure 7	Project Area Showing Location of Archaeological Sites/Areas Recorded and Survey Sections	19
Figure 8	Plan View of Site 1001	20
Figure 9	Plan View of Agricultural Area in Complex East of Site 1001	20
Figure 10	Plan View of Agricultural Enclosure East of Site 1001	21
Figure 11	Plan View of Site Northwest of Site 1001 Complex in Survey Section A	21
Figure 12	Plan View of Site 1002	23
Figure 13	Plan View of Site 1003	23
Figure 14	Plan View of Site 1004	24
Figure 15	Plan View of Site within 1004A Complex	24
Figure 16	Plan View of Site 1004A	27
Figure 17	Plan View of Site 1005	27
Figure 18	Plan View of Sites 1006 and 1007	29
Figure 19	Cross Section of Site in 1007 Complex	29
Figure 20	Cross Section of Site in 1007 Complex	31
Figure 21	Plan View of Site 1008	31
Figure 22	Plan View of Terrace within Site 1009	33
Figure 23	Plan View of Site 1009A	33
Figure 24	Plan View of Site 1010	35
Figure 25	Plan View of Site 1015	35
Figure 26	Plan View of Site 1020	39
Figure 27	Plan View of Site 1021	39
Figure 28	Plan View of Site 1022	41
Figure 29	Plan View of Site 1023	41
Figure 30	Plan View of Site 1024	43
Figure 31	Plan View of Site 1025	43
Figure 32	Plan View of Site 1026	44
Figure 33	Plan View of Site 1027	44
Figure 34	Plan View of Site 1028	46
Figure 35	Plan View of Site 1029	46
Figure 36	Plan View of Site 1029A	47
Figure 37	Plan View of Site 1030	47
Figure 38	Plan View of Site 1032	49
Figure 39	Plan View of Site 1033	49
Figure 40	Site Configuration of Sites 1035, 1036, and 1038 in Survey Sections L and M	51
Figure 41	Plan View of Site 1038	51
Figure 42	Plan View of Site 1039	53

Figure 43	Plan View of Site 1040	53
Figure 44	Plan View of Site 1041	55
Figure 45	Plan View of Site within 1042 Complex	55
Figure 46	Plan View of Site within 1042 Complex	57
Figure 47	Plan View of Site 1043	57
Figure 48	Plan View of Site 1044	58
Figure 49	Plan View of Site 1045	58
Figure 50	Survey Area Showing Location of Archaeological Sites/Areas and Survey Zones A through O (Same as Figure 7)	62
Figure 51	Project Area Showing Areas (Shaded) of Highest Site Density Including Major Site Complexes	64

PHOTO APPENDIX

Figure 52	Dr. Michael Kolb and Pilot Duke Baldwin at a Site, Area 1001, Survey Section A	67
Figure 53	Site 1003 in Survey Section B	67
Figure 54	Site 1004, Survey Section C, <i>Mauka</i> Enclosure, View <i>Mauka</i>	68
Figure 55	Burial Mound (unnumbered site) at 1400' elevation in Survey Area C, East Transect Between 1004 and 1004A	68
Figure 56	Notched <i>Heiau</i> , <i>Nakaaha Heiau</i> , State Site 1156, Site 1008, Survey Section D	69
Figure 57	Site 1035, Complex in Western Portion of Survey Section M	69
Figure 58	Notched <i>Heiau</i> ?, Site 1043, Survey Section M, East of Luala'ilua Hills, View <i>Makai</i>	70
Figure 59	Site 1045, Survey Section N, View <i>Makai</i>	70
Figure 60	Sites in 1006-1007 Complex, Survey Section D	71
Figure 61	Site 1010, Notched <i>Heiau</i> in Survey Section E, Showing Notch, View to SE from <i>Mauka</i> Wall	71
Figure 62	Double Notched <i>Heiau</i> in Northwest Portion of Survey Section F	72
Figure 63	Site 1020 Complex, Survey Section B, Near Manawainui Gulch	72
Figure 64	Platform Site (unnumbered) in SE Corner of Survey Section G	73
Figure 65	Unnumbered Sites in Western Portion of Survey Section A, Near <i>Pi'ilani</i> Highway, View <i>Makai</i>	73
Figure 66	Site 1038, Large Enclosure with Interior Sites in Survey Section M on the <i>Mauka</i> Site of Luala'ilua Hills, View <i>Makai</i>	74
Figure 67	Site 1033 at 2640' Elevation, Survey Section K, View SW	74

I. INTRODUCTION

Purpose of Study

This archaeological reconnaissance of an 8,300-acre project area (TMK 1-9-01:3) within the district of Kahikinui in southeast Maui was requested by R.M. Towill Corporation on behalf of the Department of Hawaiian Home Lands for the purpose of designating an approximately 2000-acre area for possible homestead locations which contain the least probable impact to archaeological resources.

This study was not intended as an inventory survey but more as a broadly defined study for the purpose of characterizing the archaeological resources of a large acreage. One of the requirements of this study was that it be completed in a timely manner and that the information generated be useful as much for planning purposes as for archaeological research.

Description of Project Area

Boundaries

The project area of 8,300 acres is located on the southern slope of Haleakalā in the district of Kahikinui, between 4000-foot elevation and sea level. The *mauka* boundary of the project area is defined as the Forest Reserve boundary which stretches from Manawainui Gulch on the eastern side across the peak of Pu'upane to above Luala'ilua Hills on the western side. The eastern boundary runs down the center of Manawainui Gulch over most of its length to the base of the gulch at sea level. The *makai* boundary runs westward along Pi'ilani Highway to an exclusion in the heavily dissected area of Kepuni and Kamole Gulches. The *makai* boundary, which is not defined by any landmarks, then proceeds westward to Kahikinui House to Luala'ilua Hills between 1400- and 1800-foot elevation. The boundary then extends *mauka* across the *mauka* end of Luala'ilua Hills. The western boundary is a cattle wall that extends *mauka* to the Forest Reserve boundary.

Rainfall And Wind Patterns

Kahikinui lies in the rain shadow of Haleakalā. The mean annual rainfall for the project area is around 30 inches. The 30-inch isohyet follows the 2,000 ft. contour fairly closely along the length of the project area. Above 2,000 ft. rainfall increases toward 40 inches annually toward the rim of Haleakalā Crater. Generally, the morning in Kahikinui is calm, wind picks up about 10 or 11 o'clock, reinforced by trade winds wrapping around the east side of Haleakalā. The area is partly influenced by daily on- and off-shore wind patterns.

Natural Landmarks

Major cinder cone landmarks are Pu'upane in the northeastern portion of the project area at elevation 4032 feet and Luala'ilua Hills in the southwestern corner of the project area which reach a maximum elevation of 2398 feet. Major gulches are, from east to west: Manawainui Gulch, Palaha Gulch, Kepuni Gulch, and Kamole Gulch. There are many other smaller unnamed gulches in the central and western portions of the project area.

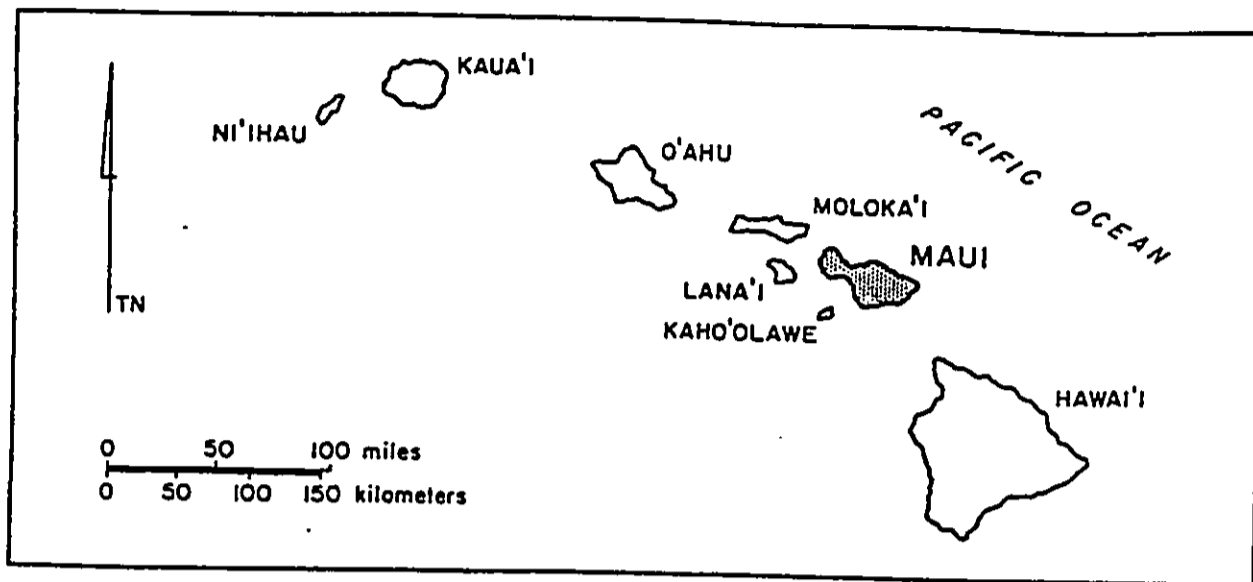


Figure 1 State of Hawai'i

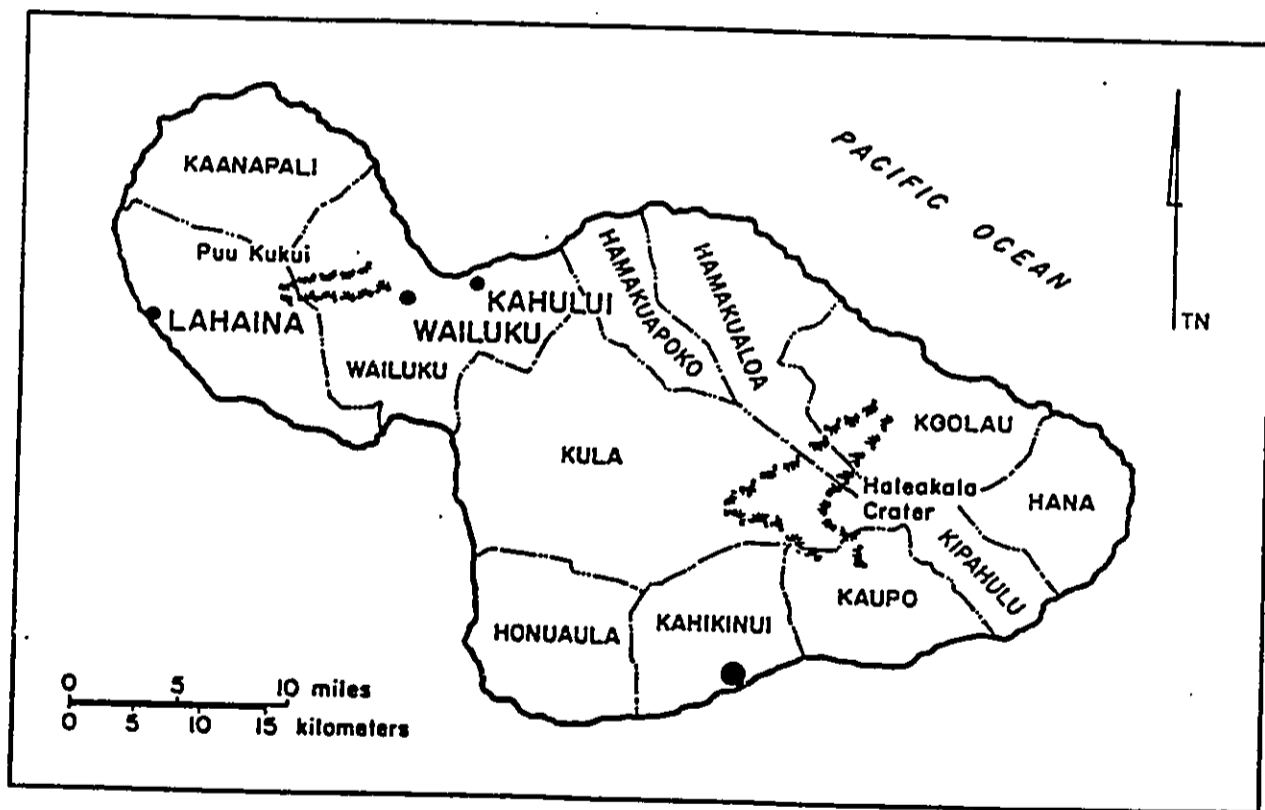


Figure 2 Maui Island Location Map

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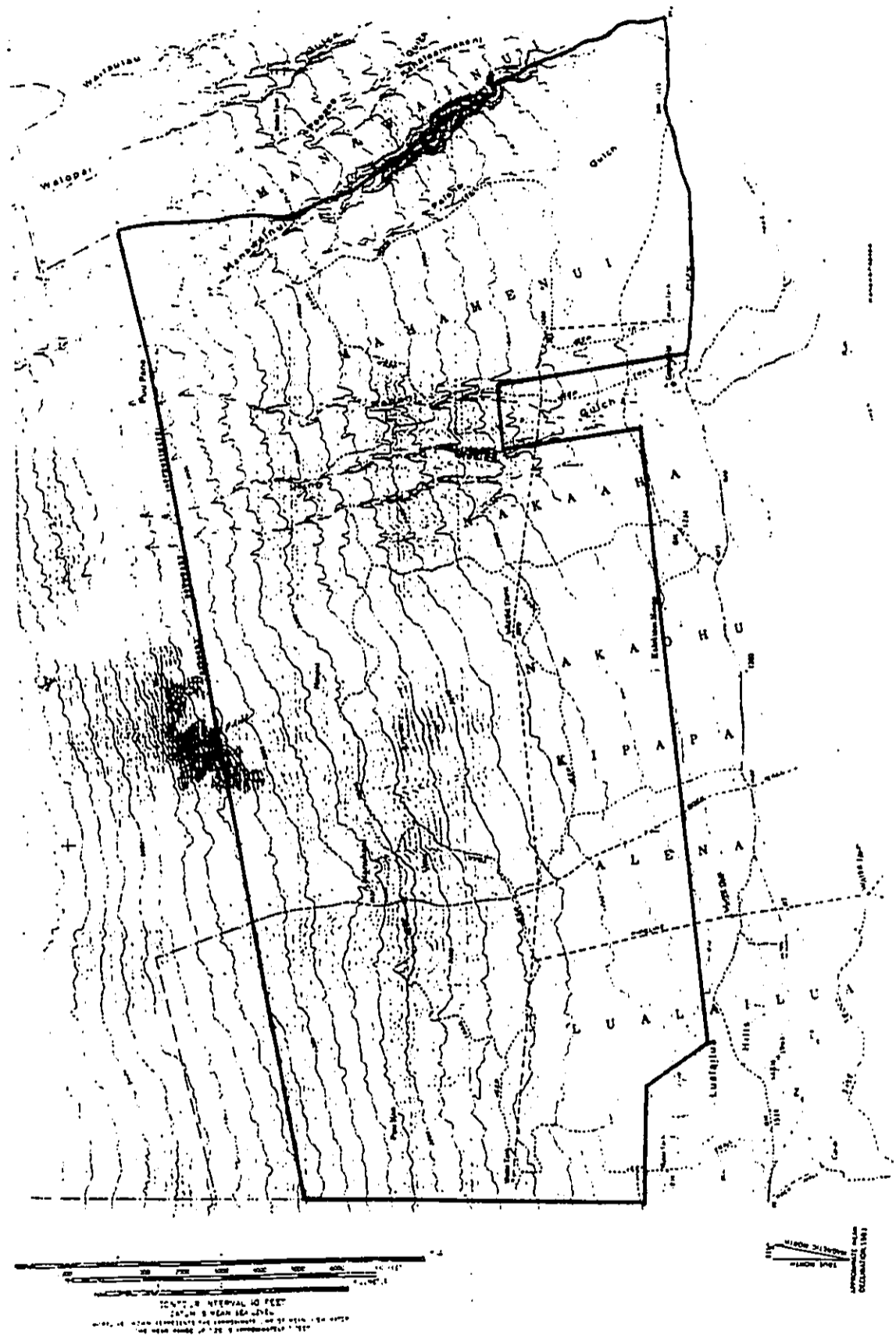


Figure 3 USGS Topographic Map of Lualu'lua Quadrangle, 7.5 Minute Series, Showing Project Location

The landscape varies from soil (volcanic ash) covered slopes in the eastern end of the project area on both sides of Palaha Gulch to rough a'a and pahoehoe lava in the western end of the project area. The rockiest terrain is to be found *mauka* of Luala'ilua Hills.

Vegetation and Animals

The project area has been used for cattle grazing for well over a century. The vegetation reflects this long-term land use. Low grasses form the major ground cover in *makai* areas which increase in lushness at higher elevations. Because cattle operations have been recently withdrawn from the project area, lantana, christmasberry, *koa haole* and other shrub and small tree vegetation are increasing, particularly in *makai* areas. Trees are thinly scattered within the project area. However, in more watered low-lying areas of the landscape are groves of native wiliwili. *A'ali'i* is also present. In recent years cattle ranching has been discontinued, as is evident by increasing growth of shrubs in pasturelands. A few feral cattle still roam the project area along with wild goats and pigs.

Man-made Landmarks

The entire project area is uninhabited and the only traces of modern human activity are the remnants of former ranch infrastructure including roads, a water system, stone corrals, and Kahikinui House. A complex of ranch roads is mostly concentrated in *makai* areas but extends up to approximately 3200-foot elevation. The most heavily used road connects Pi'ilani Highway to Kahikinui House in the south central portion of the project area.

The water system consists of galvanized iron pipelines extending cross-country, mostly east to west, connecting water tanks and watering troughs in the *makai* portion of the project area. Some of the water tanks shown on the current U.S.G.S. map have collapsed and are only visible as stone foundations and piles of milled wood.

Stone corrals occur generally near water tanks and watering troughs. The walls of these corrals are in many cases well-built, dry masonry and are representative of the historic cattle ranching era.

The only structure in the project area is Kahikinui House in the *makai* central portion of the project area at 1400-foot elevation. The house is still standing and is of board and batten construction with a shingled gable roof. It is associated with the early history of Kahikinui Ranch and is believed to have been built around 1875. This house formed a major landmark for taking compass bearings and dead-reckoning field location during the reconnaissance survey fieldwork.

Ahupua'a and Place Names

The project area includes portions of seven adjacent *ahupua'a*. These are, from east to west: Manawainui (a small portion at the extreme northeast corner of the project area), Mahamenui, Nakaaha, Nakaohu, Kipapa, Alena, and, at the western end of the project area, Luala'ilua.

The boundaries of these *ahupua'a* do not appear to conform, in most cases, to prominent natural landmarks and the exact boundaries are not marked on the current U.S.G.S. map. However, the patterns of archaeological site distribution noted during the present survey appear to have some correlation to the *ahupua'a* configurations (see RECONNAISSANCE RESULTS and SUMMARY sections below).

Scope of Work

The following scope of work was presented to R.M. Towill Corporation as the most appropriate level of study, given the anticipated goals:

1. A combination helicopter and ground reconnaissance survey of the entire 8300-acre project area to locate archaeological sites, to define the outer boundaries of these sites, to identify the most significant of these site areas, and to define the areas within the project that are devoid of archaeological sites. This will be accomplished with a four to five day field reconnaissance survey in which a helicopter will be used for up to 8 hours of flying time and up to 16 hours total time. The entire area will be covered with helicopter transects following the contour of the land. The surveyors will be dropped off at the major site complexes, which will have been identified from the air, to make general observations on content and to specifically define the boundaries of these complexes.

It is anticipated that the GPS locational system and the altimeter built into the helicopter will be useful for accurate site locations. A hand-held GPS will be used to supplement the locational information.

2. Historic background and literature search will be confined to an examination of historic survey maps, location of Land Commission Awards within the project, and search of the literature for previously recorded sites within the area.
3. A report will be produced which will contain the results of the field survey, including a map of the entire 8300-acre property showing the boundaries of the site complexes as well as isolated site locations. The results of the literature and historic background section will be reported with emphasis on the location of previously located archaeological sites. The report will present: a) an assessment of the archaeological resources within the entire 8300-acre project area; and b) recommendations for the selection of a 2,000-acre portion of the total project area with the least archaeological constraints. This research will be particularly useful in defining the cost and scope for further archaeological studies which may eventually be required. Hopefully, it will be possible through this study to define large areas containing no archaeological sites, in which little or no further study will be required.

Methods

Fieldwork was conducted over a period of four days from August 16 to 19, 1994. Cultural Surveys Hawaii staff included the two authors. Dr. Michael Kolb of the Department of Land and Natural Resources (DLNR) participated on the first two days of fieldwork. On the third day, Ms. Elizabeth Anderson of the Maui County Planning Department and Mr. Jim Hayden of DLNR were present.

As mentioned in the Scope of Work, the fieldwork was conducted through a combination of helicopter transects and walking transects. In general the survey proceeded from east to west. The time spent on the helicopter each day varied according to the helicopter schedule, refueling requirements and necessity for checking located sites on the ground.

The project area was divided into sections according to natural and man-made landmarks that were visible from the air (gulches, jeep roads, pipelines and water tanks). These sections were surveyed separately and are treated as discrete units - for purposes of description of archaeological resources - in the RECONNAISSANCE RESULTS section of this report. Whenever possible, depending on the availability of the helicopter, air transects were accomplished of each particular section followed by ground inspection of major site complexes within that section.

It was noted during the first day of fieldwork, in transit to and from the eastern end of the project area, that most of the *mauka* lands of the project area are devoid of archaeological sites. This was confirmed by long east-west helicopter transects during the first two days of fieldwork, and was established with high confidence because of excellent visibility of the land surface. Thus the *mauka* land was treated as a single survey unit (because of the lack of sites).

No attempt was made to describe individual features, sites or site complexes in the detail required for an inventory survey. Site recording generally consisted of a few sentences of notes on dimensions, construction and probable function, supplemented by selective site sketches and photographs. Sites were recorded on the ground as well as in the air. Generally, the ground recording was more thorough. In the air, photography was emphasized and at times it was possible to sketch sites and site complex configurations while the helicopter maintained its position above the site. There were also instances, especially with isolated site complexes, in which the helicopter was able to land next to the site and the field team spent ten to fifteen minutes recording the features within the complex.

Site locations were plotted on a 1 in.=1000 ft.-scale enlargement from the Luala'ilua Hills orthophotoquad (prepared by R.M Towill Corp.). Generally, site dimensions are given in meters and in most cases are visual estimates without actual on-the-ground measurements. Locational information such as estimates to nearest landmarks, cross-country distances, etc. are given in feet to match the scale and contours of the USGS map. This photograph contains 40-ft. contours, jeep road routes, and some vegetation patterns. In isolated cases, particularly with massive structures, archaeological sites were visible directly on the orthophotoquad.

Locational information on sites and site complexes include:

- 1) GPS information from the hand-held instrument provided by Dr. Michael Kolb of DLNR. This also included elevational readings, although they are of questionable accuracy.
- 2) GPS information read from the on-board instrument of the helicopter. These readings are in longitude and latitude, and include accurate elevations.
- 3) Elevational readings from a hand-held altimeter taken by the senior author.
- 4) Estimates of location plotted by compass bearings to major landmarks (such as Kahikinui House, Pu'upane, and Luala'ilua Hills) in combination with altimeter readings and correlation to land forms as shown on the enlarged orthophotoquad and the U.S.G.S. topographic map.

There was no attempt at this reconnaissance level to assign State site numbers to sites or site complexes, however field numbers were assigned to sites in order of their discovery, in most cases, one field number corresponded to a group of features, but in some cases was assigned to a single feature. Field numbers started with 1001 and ended with 1045. GPS information was recorded in relation to these numbers.

Generally, the areas with denser sites were selected for foot transects. These include the *makai* portion of Mahamenui *ahupua'a*, the area between Kamole Gulch and Kahikinui House extending up to the 2200 ft. elevation, and the area to the west of Kahikinui House extending westward to the stone wall. Even though it is known that the site density is high west and northwest of Kahikinui House, there was no attempt to cover this area on the ground because it was mapped in the Chapman survey of 1966-67 obtained from the Department of Hawaiian Home Lands. This map was the only information available from this 1960s Bishop Museum survey. The area mapped by Chapman was superimposed on the orthophotoquad used in the field and was considered during the field work as a known site area and thus, was only inspected by air with selective photographs taken of major site areas.

II. KAHIKINUI: THE DOCUMENTARY RECORD

The district of Kahikinui is mentioned in a legend telling of the first peopling of the Hawaiian islands. Hawaii-nui, a fisherman from Kahiki-Honua-Kele

found this group of islands. First he saw the island of Kauai, but he kept on sailing and found Oahu and then the islands of the Maui group, then, seeing the mountains of Hawaii, he kept on until he reached that island. There he lived and named the island after himself. The other islands from Maui to Kauai were named for his children and for some who sailed with him (Beckwith 1978:76).

Hawaii-nui had eight steersmen with him on his voyage to Hawaii:

Here are their names: Makalii, a famous steersman and great farmer he was; Iao; Kahiki-Nui; Hoku-Ula, Maiao; Kiopa'a; Unulau; Polohilani. And because of their skill in observing the stars, each one called the star he observed after his own name. One steersman, Kahiki-Nui, has a land district on Maui named after him (*Ibid.*:76).

A legendary reference cannot reveal specifically a traditional political or social preeminence for Kahikinui, but it does suggest that the land area, at the very least, had an established place in the consciousness of the Hawaiian people and must have possessed some distinction - perhaps because of ancient origins, size of population, or political power - to have warranted that placement. That the pioneering nineteenth century Hawaiian historian Samuel Kamakau knew and recorded a surviving Kahikinui tradition also suggests the area was not obscure:

It is the same with Kaneikokala. The body of the god was separate from his body as a shark, but the *kokala* fish was consecrated to him in the ancient worship of him by the ancestors. Their descendants may have heard of Kaneikokala, although they do not worship him; but to this day, the whole district of Kahikinui, Maui, with the exception of the *malihini*, will run away if they see a *kokala* fish cooking, or even the smoke from the cook; and they will eat no "food" or "fish" that has come in contact with it. (Kamakau 1964:87)

However, by the 1930s Kahikinui could be described by E.S. Craighill and Elizabeth Handy as a "vast arid volcanic waste" that was "uninhabited." A more vital past, however, was also noted:

Fishing is comparatively good along its rugged shores, and in former times Hawaiians lived in isolated communities on the broken lava scattered from one end of the district to the other, close to the sea or slightly inland wherever potable water was to be found in some brackish well or submarine spring offshore. We are told by an old informant, born at Kanaio in the next district, that the Hawaiians formerly living along the coast of Kahikinui had their plantations of dry taro and other edibles inland in the forest zone, where the forests along the southern wall of Haleakala came much lower and where

rainfall was more plentiful than it is today. Here, as in Kaupo, cattle grazing over all the higher country have deforested the land. (Handy and Handy 1972:508)

The Handys further cite an earlier writer who

...says that this region was named by first settlers from Kahiki-of-the-South because of their love of their old homeland. These early migrants must have preceded the volcanic desolation now visible to have chosen it as a place of settlement. Now it is partly covered by what is probably the most recent lava flow from the now dormant crater of Haleakala (*Ibid.*:508).

That a former populace of Kahikinui may have outmigrated east to a more viable environment in Hana after the introduction of cattle ranching to Maui during the second half of the nineteenth century is suggested in another account:

Most of the Hawaiian people in the Hana district are said to trace their ancestry to Hawaiians who lived in Kaupo and Kahikinui prior to Cook's arrival. Over time, the population gradually moved out of the remote area into Hana town. Evidently, the establishment of ranches in the area contributed to the dislocation of Hawaiians from those agriculturally marginal areas. The ranches either bought, leased or adversely possessed the lands in the district for raising their cattle. Then, the running of cattle over the land destroyed the native vegetation and contributed to the erosion of topsoil into the streams and the ocean, seriously undermining the agricultural quality of the land (McGregor 1989:368-9).

Since no historic documentation exists of the structure and evolution of Hawaiian life in pre-western contact Kahikinui, an accounting will have to await the progress of the archaeological record for the district. (Previous archaeological studies within Kahikinui are discussed in the next section of this report.)

Among the earliest of the documentation of Kahikinui are the missionary censuses accomplished during the 1830s. These censuses suggest that, even within the first half of the nineteenth century and before the establishment of formal large-scale cattle ranching activities in Kahikinui, that district's population count was already low, when compared with neighboring areas to the east. Thus, in the 1831-1832 census, total population counts for the individual areas are:

Kahikinui	517
Kaupo	3,220
Kipahulu	1,553
Hana	3,816

(from Schmitt 1973:18)

And in the 1836 census:

Kahikinui	449
Kaupo	1,985
Kipahulu	1,196
Hana	2,858

(from Schmitt 1973:36)

These totals likely reflect the impact to the Hawaiian islands of western-introduced diseases and social pressures (e.g. to migrate to developing commercial center). Nevertheless, the sharp differences between the Kahikinui totals and those of the neighboring areas is conspicuous.

Research cited by Conrad Erkelens suggests that the Santa Ynez Catholic Church - presently in ruins and registered as State site 50-15-1537 - located beside the Kaupo-Ulupalakua road was serving a congregation in Kahikinui during the 1840s and 15 children were baptized there in 1846 (Erkelens 1994:14).

Further clues to life in Kahikinui during the 1840s may be extrapolated from records of the mid-nineteenth century Mahele. Kahikinui was retained by the Hawaiian government. A 5280-acre portion of the district - the *ahupua'a* of Auwahi was awarded to Princess Ruta Ke'elikolani. Most tellingly, within the entire district, only one *kuleana* claim - by an individual living on a working his lands - was made. For Land Commission Award (LCA) 5404, Makaole claimed three parcels of .15, 10.1, and 2.07 acres, identified in the Mahele records as located in "Luala'ilua", "Luala'ilua, Kahale", and "Luala'ilua, Waialio" respectively. The current tax map shows one parcel of LCA 5404 to the west of Luala'ilua. The other two parcels are noted as "unlocated."

While Mahele documents certainly reflect the distortions imposed on the evolved Hawaiian social structure by decades of western-induced pressures, these documents may yet provide some clues to possible patterns of traditional Hawaiian existence prior to western contact. Especially since this may be the only evidence recorded by a Hawaiian living in Kahikinui up to mid-nineteenth century, the testimonies recorded for Makaole's claim merit inspection. From the Native Register (vol.6:pg.286):

No.5404 Makaole Kahikinui, 30 Dec. 1848
I hereby state to you, the Land Commissioners, that I, Makaole, have some moku mau'u. At Kakalu are eight moku mau'u. The witness is Kuheleloa.
Furthermore, there is a little house site makai of Lualuilua. On the north is a kula, on the east is an ascent/a trail or road/, on the south is a trail also, on the west is a trail also. The witness is Alaala.
Furthermore, there are some salt pools. The witness is Hanale. I believe I have a right to claim all these things.

From the Foreign Testimony (vol.8:pg.227):

Cl.5404 Makaole June 15 1849
The Claimant appeared, but his witness on whom he depended was dead. He

reported and now Claims 8 potatoe patches in the ili of Kukalei.

Also 4 patches in the ili of Waialio, and 3 patches in Kalalani, and a house lot in Kalalani.

Also several salt pits at Kalalani. Hiokia owns salt pits on the Kaupo sides, and Nihopelu on the Honoaula sides. Hamole, a konohiki gave the salt pits to the Claimant in the year 1845. The Claimant has occupied the lands since 1823. No one ought to dispute this title.

From the Native Testimony (vol.5:pg.360):

No. 5404 Makaole (1 Claim of Kahikinui only) June 14, 1849

This claimant had come without a witness, the witness is deceased. The interests are at Luaialua in the ili land of Kahakalei, consisting of 8 potato kihapais, 4 kihapais at Waialio and 3 at Kalalani, also there are several salt beds in that ili land.

A house lot is also at Luaialua. The salt beds were from Hamole in 1845. The potato patches were received in 1823, and he has lived there continuously without disturbance.

The *kihapai* - or cultivated patches - of potatoes may represent the continuing farming of the likely traditional dryland cultigen of Kahikinui. The mention of other Hawaiians of Kahikinui - Hiokia, Nihopelu, and the *konohiki* Hamole - indicates that these and perhaps even more Hawaiians may have been living in Kahikinui at the time of the Mahele but never made a claim for land.

During the second half of the nineteenth century, the introduction of cattle ranching to Kahikinui apparently initiated the precipitous dispersal of the remaining populace noted above. Kahikinui Ranch, the first large ranch operation in the district, appears to have been fully operative by the 1870s. The ranch is also associated with the Kahikinui house (State site 50-17-1536). It is said to have been built in the 1870s either by Antone Pico, a shipwrecked Spaniard, or by Augustine Enos, Sr. - both of whom credited in different accounts with starting the ranch.

Kahikinui Ranch was sold in 1901 to "Waterhouse & Company, whereupon it became part of what was to be called Raymond Ranch, now known as Ulupalakua Ranch" (Hawaii Register of Historic Places, short form, State site 50-15-1536).

The long-term use of the project area for ranch lands is shown in early maps inspected. For example a 1915 Hawaii Territory survey by W.E. Wall of Kahikinui, Nakula and Papaanui Government Tracts shows Kahikinui as Government land. The single Land Commission Award (LCA) of 10 acres in the project area is shown as a rectangle just *mauka* of Luaialua Hills with a trail leading to it from the Hana Road. In the eastern part of the project area the 119-acre grant #2824 to Hale Kunihi is shown.

A 1927 map surveyed by J.M. Dunn shows a pipeline and a series of water tanks, which match the configuration shown on the modern USGS map. This watering system for the cattle and the ranch house is therefore dated before the 1920s.

Other items of interest on the 1927 map include a road leading to the 3-acre LCA from the west and a trail which roughly parallels the route of the waterline. This map shows a large enclosure inside Grant #2824 which probably corresponds to one of the major corrals observed in that area during the present survey.

The ranch lands comprising the present project area were leased from the Department of Hawaiian Home Lands with the infrastructure improvements - including waterlines, roads, stone walls, and wire fences. In recent times the ranch operation has ceased in the project area and the land is presently unused except for a few abandoned cattle which still range the upper elevations.

III. PREVIOUS ARCHAEOLOGY

Walker Survey (Figure 4)

Winslow M. Walker surveyed the Kahikinui area in the 1930s as part of an island-wide survey of Maui (Walker 1931). His manuscript in rough form was made available by the Bishop Museum in 1981. Based on his map of site locations, Sites 170, 171, 173, 174, 175, 181, 182 and 186 are within the project area (See figure 4). Site 170 is described as a *heiau* east of Kepuni Gulch, in the Mahamenui region, above the trail about 1/4 of a mile. Site 171 is another *heiau* at Poloae, also in the Mahamenui region, near milepost 32 on the Kula trail. This structure, which is described as having a length of 45 ft. is said to have been converted into a goat pen. Site 173 is located above the Kula trail at about 1250 ft. elevation west of Kamole Gulch in the Nakaaha region. The dimensions are 40 ft. by 50 ft. Site 174 is also in the Nakaaha region on the Kula trail on the junction of the eastern side trail leading to Kahikinui House. This site is another *heiau* site and its dimensions are given as 60 ft. x 75 ft. In the Nakaohu region is the next site (175) located on the Kula trail just below Kahikinui House. Site 181 is a *heiau* in the Alena region, described in a note dated 10/82 as being in the Kipapa *ahupua'a* on the pipeline trail about a mile northeast of Luaia'ilua Hills at an elevation of about 250 ft. It is described as having 2 terraced platforms, the lower terrace 50 x 72 ft. and the upper terrace 50 x 60 ft. Site 182 is a *heiau* in the Luaia'ilua region, on the north side of the hills, near the trail which comes up from the southeast. It is described as a notched *heiau* 38 ft. long and 23 ft. wide. Site 186, in the Luaia'ilua region, is located northwest of the hills on a high shelf of land. It is called the *heiau* of Koholuapapa, described as a large walled structure of a regular plan, (110 feet long with massive walls). The structure includes three enclosures with two platforms at the lower level on the *makai* side.

Based on the rough locational information provided in Walker's manuscript it would be very difficult to correlate Walker's sites to those located in the present reconnaissance survey.

Bishop Museum Survey

In 1966 associates of the Bishop Museum conducted a settlement pattern survey at Kahikinui in the *ahupua'a* of Kipapa and Nakaohu (Chapman 1966). This survey included a broad coastal area of both *ahupua'a* as well as another dense cluster of archaeological sites *makai* of Pi'ilani Highway. Within the present project area Peter Chapman surveyed a large area extending north and northwest of Kahikinui House. A tremendous variety of sites were recorded, including enclosures, platforms, caves, pens, iava tubes, burials, walls, and temples. Unfortunately, the only information readily available is Chapman's settlement pattern map showing numbered sites with a key showing 13 different site categories. Judging by the configuration of the survey area it appears that Chapman oriented his study according to existing ranch roads. This may have been done for the convenience of site location. Judging only from the map, Chapman located a large number of archaeological sites which must have involved long-term fieldwork with a hardy crew.

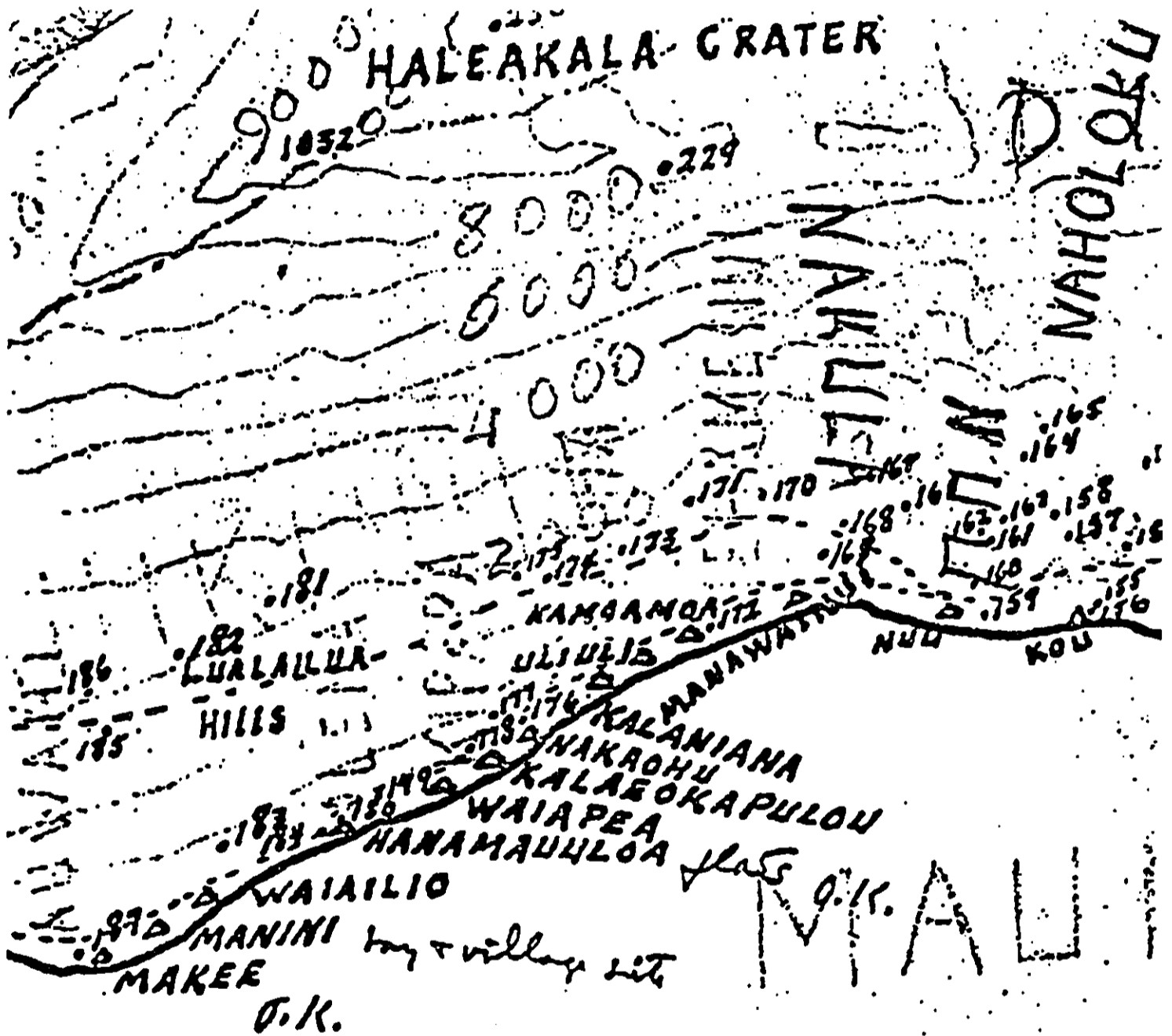


Figure 4 Walker Survey Map Showing Sites in Kahikinui District

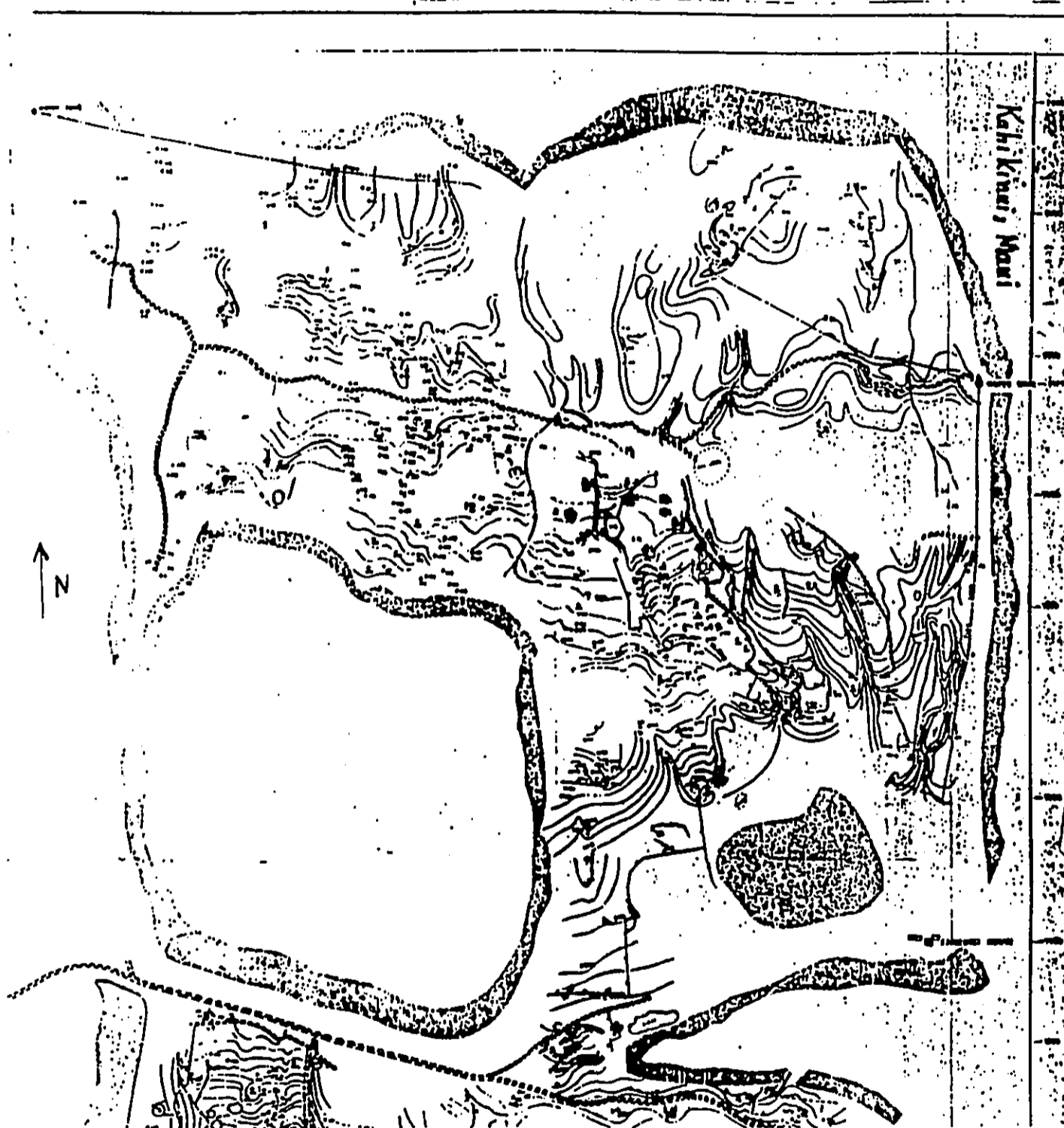


Figure 5 Bishop Museum Map (Peter Chapman) Showing Surveyed Sites in the Project Area (1966, 1967)

Connolly and Hommon State-wide Inventory

In the early 1970s archaeologists from the Bishop Museum conducted further documentation of known sites for the State-wide inventory effort. Some of Chapman's sites were relocated and redescribed, such as Site 170, 182, and 186. More recently recorded sites include Nakaaha *heiau* (Site 1156) at Kamole Gulch at the 2,000 ft. elevation, Site 1162, Papakea Petroglyphs, a series of petroglyphs within a pahoehoe lava flow on the north side of Luala'ilua. These petroglyphs were visited by Emory in 1922. Site 1163, also behind Luala'ilua Hill is described as a large enclosure, which is probably a historic cattle corral. This site is in the area of the single Land Commission Award recorded within the 8,300-acre project area. The final site -1536 is the historic structure of Kahikinui House, which is said to have been built in the 1870s as a ranch house. The locations of these sites are shown on Figure 6 (Hommon 1974; Connolly 1974).

Chapman and Kirch Excavations .

In 1979 Chapman and Kirch published the results of excavations at seven archaeological sites in the area of Kahikinui. Two of these sites (M7 and M9) are within the present project area, and specifically within Chapman's survey area, north and west of Kahikinui House. These two sites were considered temporary shelters. These sites were excavated in order to establish a regional sequence in southeast Maui, an area in which little controlled excavation had taken place.

Kennedy

In 1994, Archaeological Consultants of Hawaii conducted a brief investigation at the base of Manowainui Gulch to assess impact on a replacement of Manowainui Bridge along the Pi'ilani Highway. Moore located portions of State Site -572 and Site -3519, neither of which was close enough to the bridge to be endangered. State site -572 is a remnant of the Pi'ilani Trail which traverses much of the shoreline of Maui. In this area it consisted of an unmortared basalt revetment.

It is of interest to note that in the present survey, a foot-trail was noted which enters the survey area at Palaha Gulch and heads westward climbing to around the 1,000 ft. elevation to Kahikinui House. This trail is marked on the USGS map, but it is easily distinguishable on the ground in that it has never been modified for wheeled vehicles (Kennedy 1994).

Erkelens Survey

Also in 1994, Conrad Erkelens performed a cultural resources survey for the Hawaii Geothermal project. The survey area was a corridor on either side of Pi'ilani Highway proposed for a geothermal power line to cross southern Maui. Erkelens provides a brief historical summary and a discussion of the expected settlement pattern for Kahikinui and adjacent areas (Erkelens 1994).

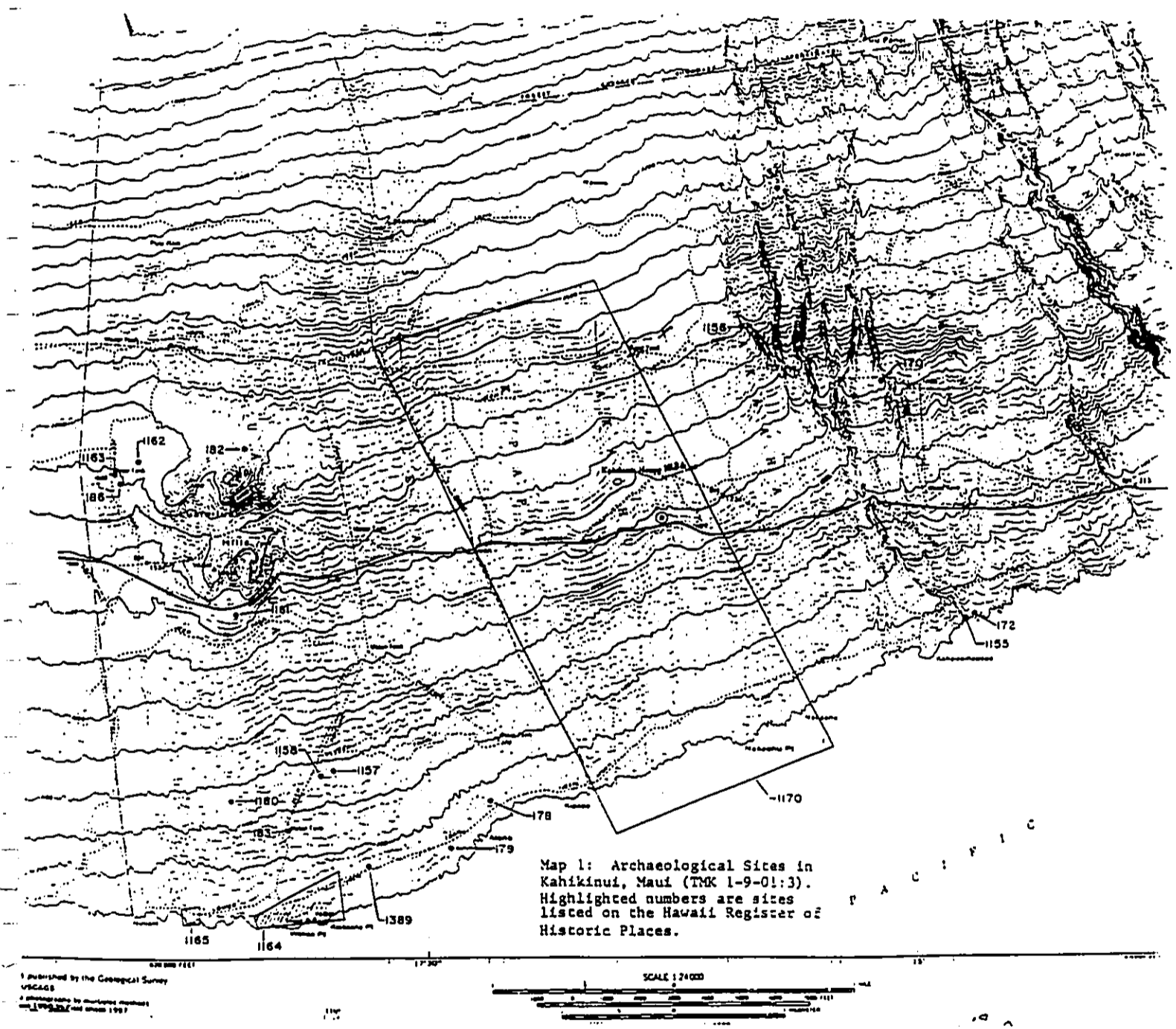


Figure 6 USGS Topographic Map Showing Sites in State-wide Survey

IV. RECONNAISSANCE RESULTS

Each of the 45 site areas, which in some cases correspond to helicopter stops, are described below (Figure 7). These descriptions are tied into the particular survey section in which the site or site complex is located. In some cases, the information is supplemented with field sketches. These site/area notes are followed by an archaeological characterization of each of the survey zones. These characterizations are provided for land-planning purposes.

Site/Area Notes

CSH Site/Area: 1000
Survey Section: A
Helicopter Location:
Hand-Held GPS Location: East 78 7366; North 228 2781
Elevation: 800' (HH¹); approx. 1500-2000 ft. from lower water tank at 52° T
Site Type: Habitation and Agriculture
Total Features: 15+
Dimensions: Unknown large area

Notes:

The helicopter landed in a level area 100 ft. mauka of the foot-trail leading westward to Kahikinui House. H. Hammatt surveyed southeastward on either side of the trail and observed seven habitation sites on both sides of the trail in addition to one large, habitation enclosure. Agricultural clearing areas were evident. Just mauka of the trail, and easily visible from it, is an overhand with a well-built wall on the east and southern sides. This site looks very imposing from the makai side and may be Walker's site 171. Clearly, the sites continue toward the southeast, but become less frequent toward Palaha Gulch.

W. Folk traversed eastward and observed large agricultural enclosures with well-built walls. A grindstone was observed in one of the enclosures with water-rounded rocks.

M. Kolb proceeded mauka to a large prominent bedrock outcrop observing a series of agricultural walls and a permanent habitation site to the northeast. He observed that sites appeared to continue well above the 1,000 ft. elevation.

CSH Site/Area: 1001 (Fig. 8, 9, 10, 11)
Survey Section: A
Helicopter Location:

¹ HH = Hallett Hammatt

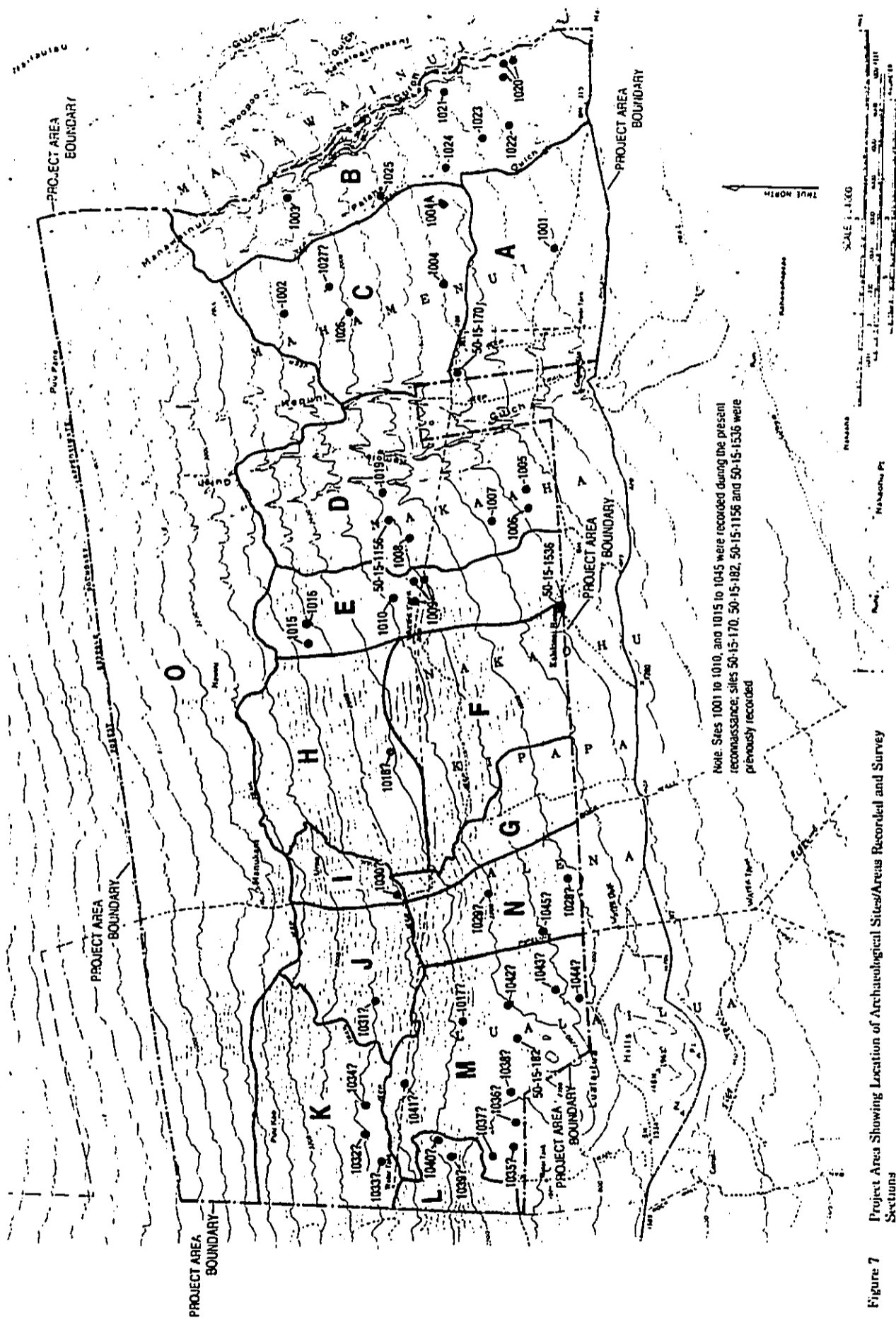


Figure 7 Project Area Showing Location of Archaeological Sites/Areas Recorded and Survey Sections

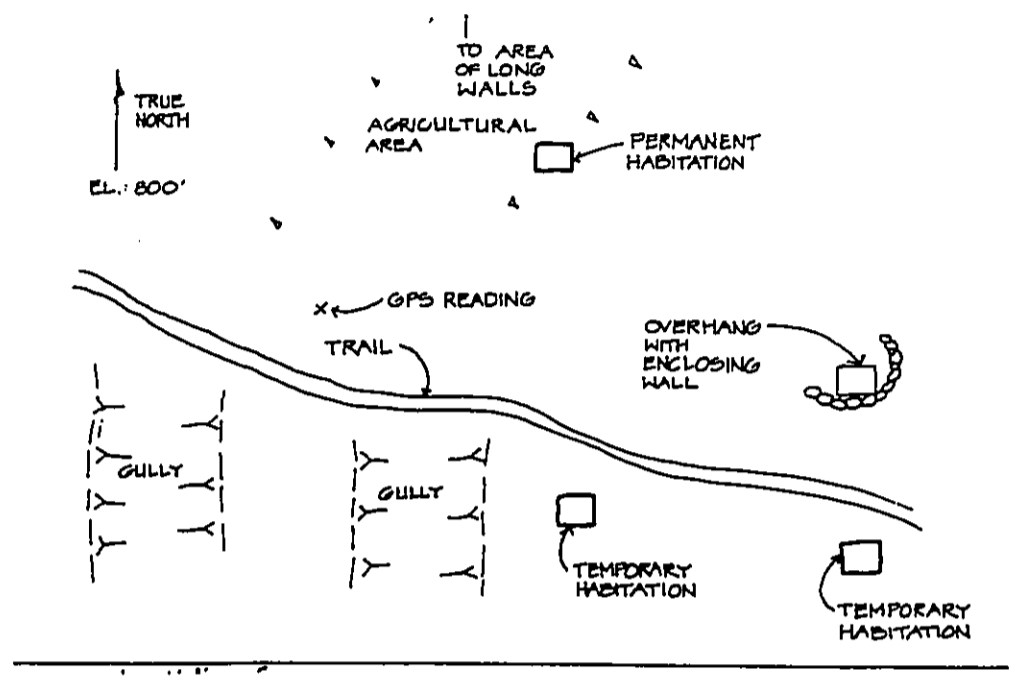


Figure 8 Plan View of Site 1001

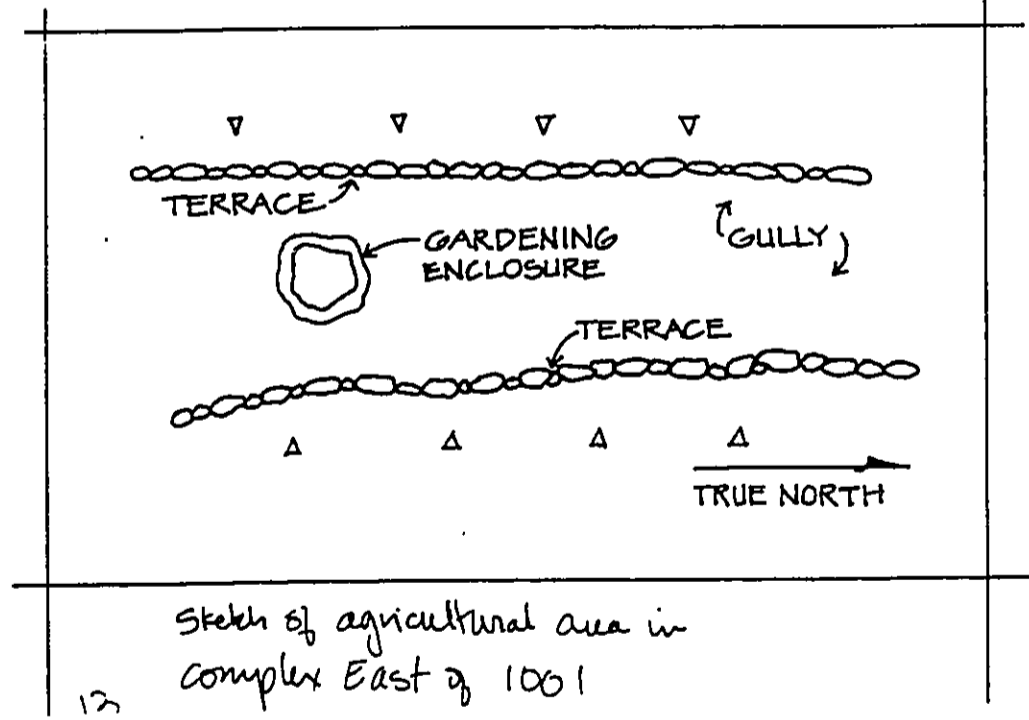


Figure 9 Plan View of Agricultural Area in Complex East of Site 1001

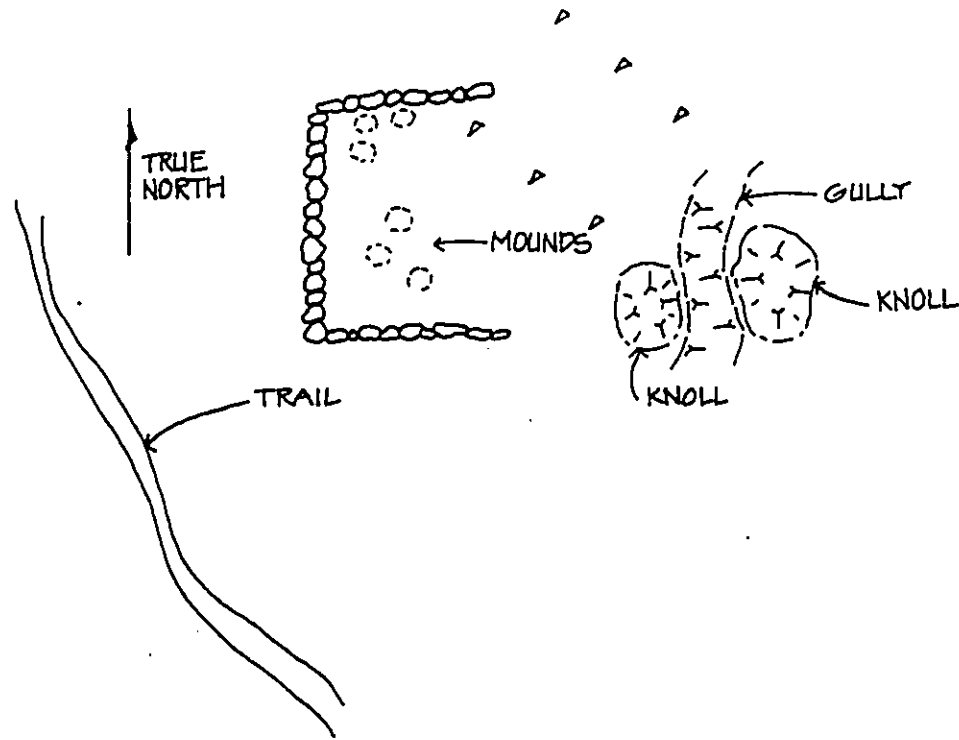


Figure 10 Plan View of Agricultural Enclosure East of Site 1001

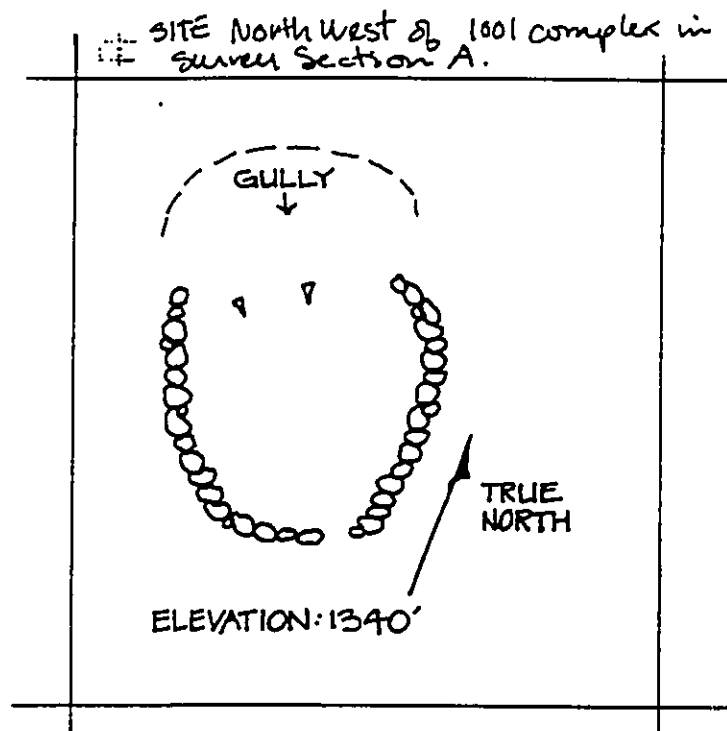


Figure 11 Plan View of Site Northwest of 1001 Complex in Survey Section A

Hand-Held GPS Location:	E 78 7511; N 228 3052
Elevation:	
Site Type:	Agriculture & Habitation
Total Features:	10+
Dimensions:	Unknown
Notes:	A prominent bluff area mauka of Locality 1000, surrounded of agricultural sites, mostly consisting of large walled enclosures on the lee side of the hill. These sites extend <i>mauka</i> and westward towards Kepuni Gulch.
CSH Site/Area:	1002 (Fig. 12)
Survey Section:	C
Helicopter Location:	N 20 38.57; W 15615.69
Hand-Held GPS Location:	E 787 167; N 228 5092; E 787 140; N 228 5082
Elevation:	2340' (HH)
Site Type:	Large enclosure
Total Features:	1
Dimensions:	15 m. (EW) x 30 m. (<i>Mauka/Makai</i>)
Notes:	Single isolated site on bluff top consisting of a large enclosure, possibly an animal pen related to historic ranching activities. Site density is very sparse at this elevation.
CSH Site/Area:	1003 (Fig. 13)
Survey Section:	B
Helicopter Location:	
Hand-Held GPS Location:	E 787 920; N 228 4955
Elevation:	2160' (HH)
Site Type:	Large enclosure
Total Features:	1
Dimensions:	20 m. (EW) x 30 m. (<i>Mauka/Makai</i>)
Notes:	A single isolated large enclosure with a small habitation site 100 ft. to NE (15 m EW x 10 m.) on a knoll at the western edge of Manowainui Gulch. A bottle was found at the large enclosure, indicating historic use, probably ranching-era activity. The large enclosure is probably an animal pen.
CSH Site/Area:	1004 (Fig. 14)
Survey Section:	C
Helicopter Location:	
Hand-Held GPS Location:	M. Kolb has readout, not recorded in field

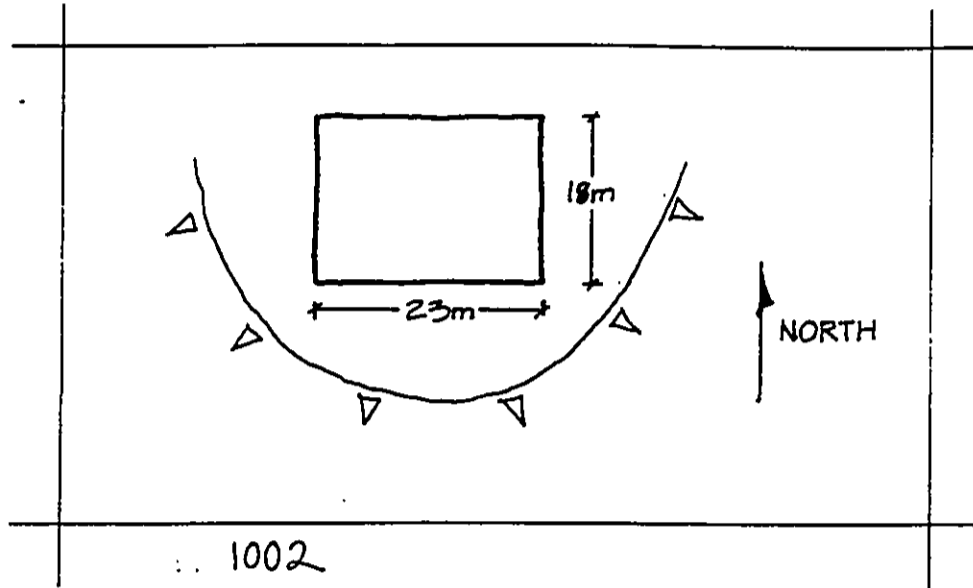


Figure 12 Plan View of Site 1002

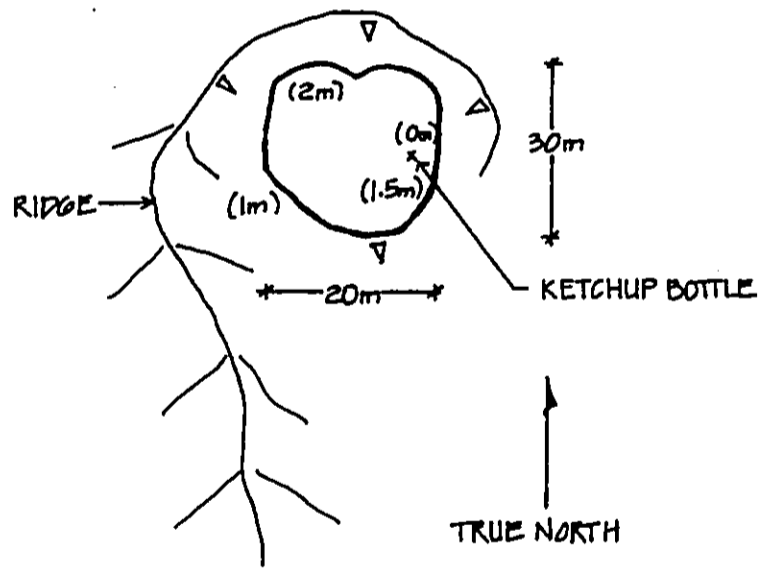


Figure 13 Plan View of Site 1003

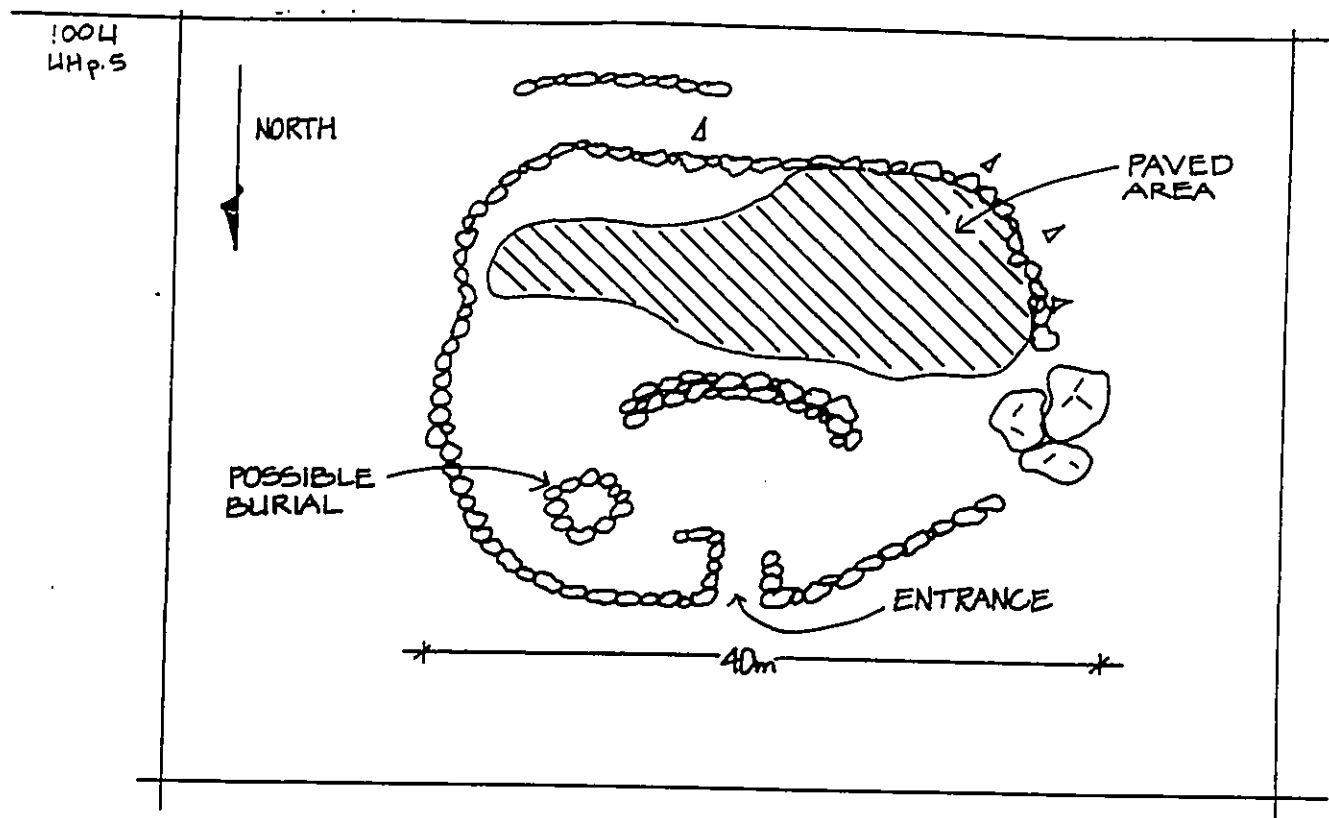


Figure 14 Plan View of Site 1004

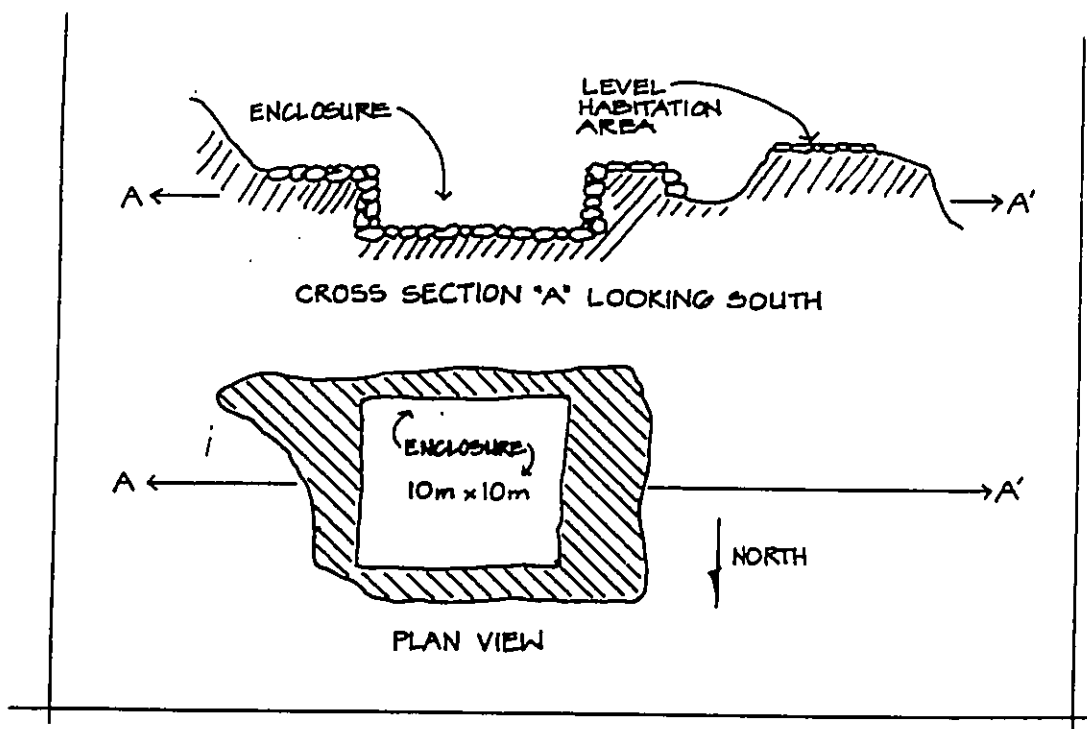


Figure 15 Plan View of Site within 1004A Complex

Elevation: 1400' (HH)
Site Type: *heiau*
Total Features: 2+
Dimensions: variable

Notes:

A bearing was taken from this point to the water tank to the SW. with an angle of 255° True. The first site is a prominent structure on a bluff with a large paved area on the *makai* side. Because of its location, its overview, its size and design it is interpreted as a *heiau*. There is a probable entrance on the *mauka* side with what appears to be a burial in the NW corner. Stone terraces retain the slope *makai* of this site downslope toward the jeep trail.

The other site is 800' north of the *heiau* up a stony depression which is a lava feature rather than a drainage. The enclosure measures 10 m. square and is built inside the lava depression with a free-standing wall on the east side. On the slope above this wall is a level habitation area. It appears that this *heiau* and enclosure form a central place of religious and residential activity overlooking a fairly dense cluster of sites to *makai*. Hal took a compass bearing of 179° True to Area 1001. At this point Hal and Bill proceeded on a foot transect toward the east at the same elevation as Site 1004, Hal on the upslope side and Bill on the downslope side. On this west to east transect moving to Palaha Gulch at 1400-1450' elevation, few sites were observed, one possible burial mound was noted approx. 2000 east of area complex 1004, 1 habitation enclosure was noted along the ridge side near the burial, and minor ag. mounds were noted in gullies, mostly on the lee or western side of the gullies. Bill's transect to the east, around 1200' found more sites than Hal's, with habitation sites on bluffs and agricultural sites on slopes and side swales. Side swales where they join the main gullies appear to be favorite places for agricultural modifications. The largest habitation site noted was 10 x 12 m. with smaller enclosures and terraces attached. Some walls are as high as 1.5 m.

CSH Site/Area: 1004A (See Fig. 15)
Survey Section: C/A boundary
Helicopter Location: None
Hand-Held GPS Location: None
Elevation: Approx. 1300' (HH)
Site Type: Enclosures, Habitation?
Total Features: 3+

Dimensions:

various

Notes:

Two habitation enclosures were located at the eastern end of the east/west transect. These enclosures are 700-800' west of the jeep road which heads up the west of Palaha Gulch. The *mauka* enclosure measures 12 m. (EW) by 10 m. (NS). The *makai* enclosure 30' away measures 12 m. (NS) by 7 m. (EW). Agricultural terraces and other terraces and mounds are noted on the *makai* slope. Across the road and *makai* at approx. 1200' elev. is a C-shaped structure just above the bend in the road at it curves toward the west. The location of these sites was not recorded by GPS but was located by the curve of the jeep road. We are confident in the locational information. After the jeep road, the transect continued westward with Bill at the upper elevation (around 1200', covering both sides of the jeep road, and Hal *makai* of Bill moving westward at between 1000 and 1100' elevation. Habitation and agricultural sites were noted by Bill on either side of the road near a prominent gully just west of the curve of the jeep road. Hal noted almost continuous habitation and associated agriculture. Much of the agriculture seems to be located in shallow gullies, consisting of terraces, mounds and gardening enclosures. The habitation sites are located on ridges overlooking the agricultural areas. Hal, after crossing the second gully, noted a break in site density, with only occasional informal agricultural features. This break in site density is located within 1000' to the east and slightly *mauka* of Site 1001. Large rectangular walled fields, 400-500' in length and width were noted within 500-800' east of Site 1001. Mounds occur in the interiors of these enclosures. The walls appear to be able to exclude cattle. This may indicate historic-era agricultural activity. Hal's transect continued westward to the water line and then proceeded *mauka* to the water tank at elev. 1389'. Along this route, particularly within 500' *makai* of the water tank, major habitation sites were noted along the eastern edge of Kepuni Gulch. In later helicopter transects it was observed that these sites continue *mauka* to above 1600' both on the east and west sides of Kepuni Gulch. There is a major concentration of habitation sites from 1100 to 1300' elev. Sites are continuous from Site 1001 *mauka* to 1004, making the west portion of Section A of heavy site density.

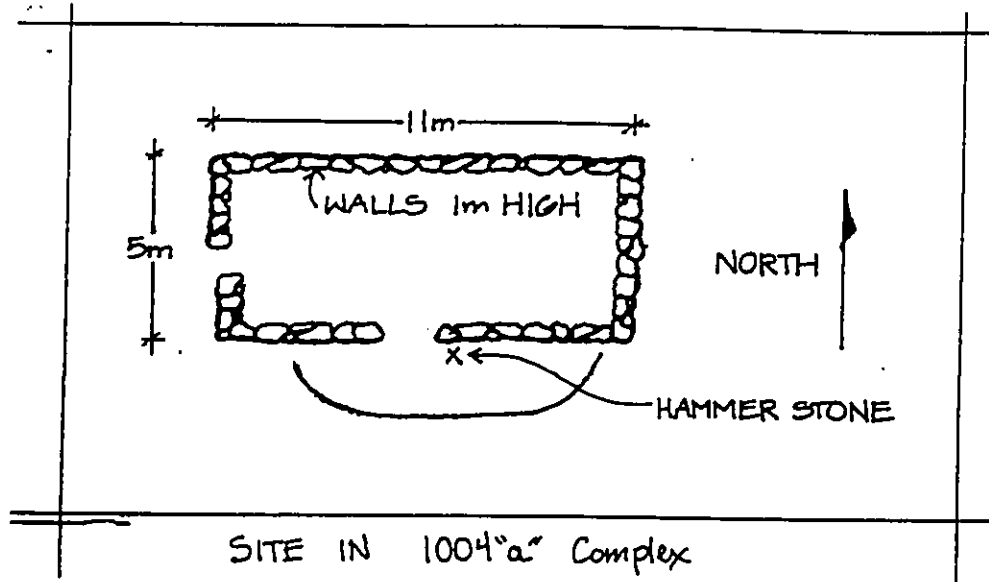


Figure 16 Plan View of Site 1004A

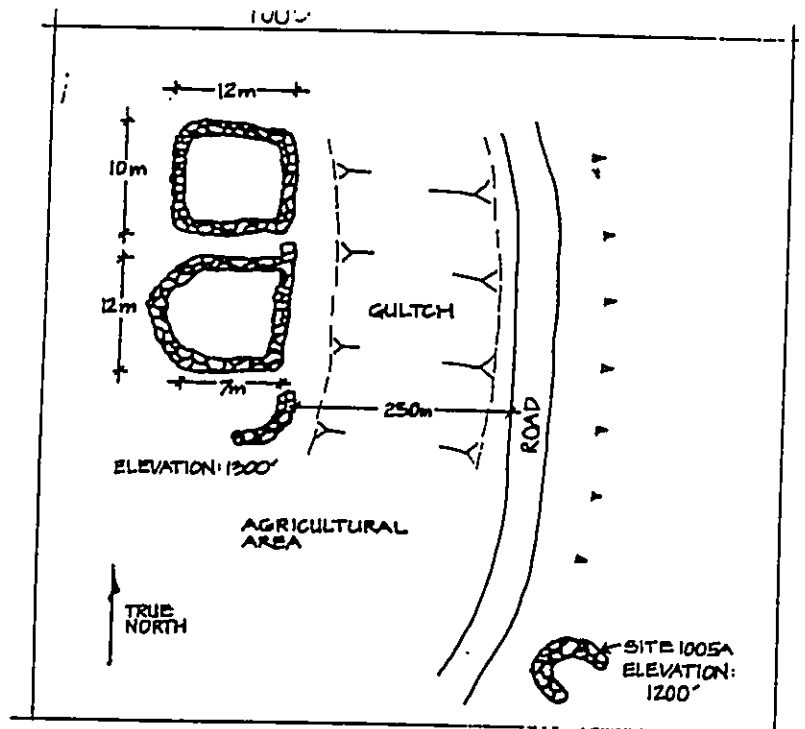


Figure 17 Plan View of Site 1005

CSH Site/Area: 1005 (See Fig. 17)
Survey Section: D
Helicopter Location:
Hand-Held GPS Location: E 785 501; N 228 2769
Elevation: approx. 1000-1200' (HH)
Site Type: C-shape
Total Features: 1
Dimensions: Unknown

Notes:

The GPS reading taken by Michael Kolb was the first site located on a *mauka* sweep after the helicopter dropped the crew off near an old water tank at the junction of the foot trail to Kahikinui House and a *mauka/makai* jeep road. On this transect four people spread from 70-150' apart proceeding *mauka* on the east side of the *mauka/makai* jeep road to the east of Kahikinui House. Elizabeth was just to the east of the jeep road, then Bill, then Hal and then Mike on the far eastern end of the transect. Sites 1005, 1006, 1007, 1008 and 1009 were all found on this transect.

CSH Site/Area: 1006 (Fig. 18)
Survey Section: D
Helicopter Location:
Hand-Held GPS Location: E 785 405; N 228 3079
Elevation: 1300' (HH)
Site Type: Habitation
Total Features: 2+
Dimensions: 4 m. by 4 m.

Notes:

This site is at the lower end of a large complex of habitation and agricultural sites. Site density *makai* of this point is fairly low. Agricultural walls and terraces proceed *mauka* connecting the habitation sites.

CSH Site/Area: 1007 (See Fig. 18; Figs 19-20)
Survey Section: D
Helicopter Location:
Hand-Held GPS Location: E 785 259; N 228 3254
Elevation: 1500' (HH)
Site Type: Agricultural and Habitation
Total Features: Complex
Dimensions: Unknown

Notes:

The GPS reading was taken on the upper part of complex, Hal took a compass bearing of 45° T from Kahikinui House to Site 1007. Kahikinui House is clearly

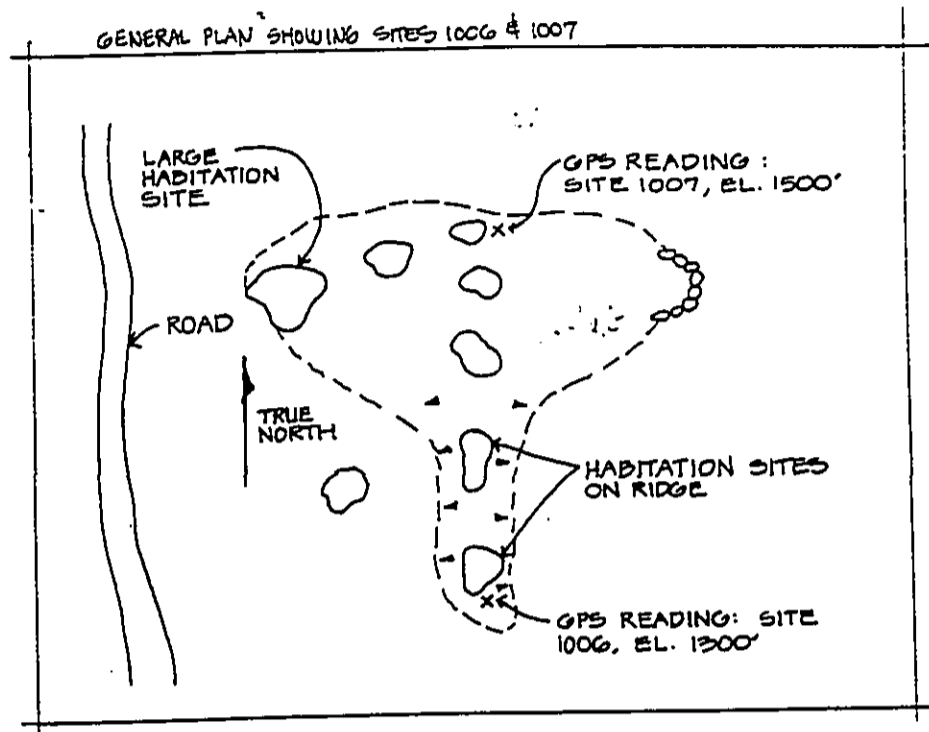


Figure 18 Plan View of Sites 1006 and 1007

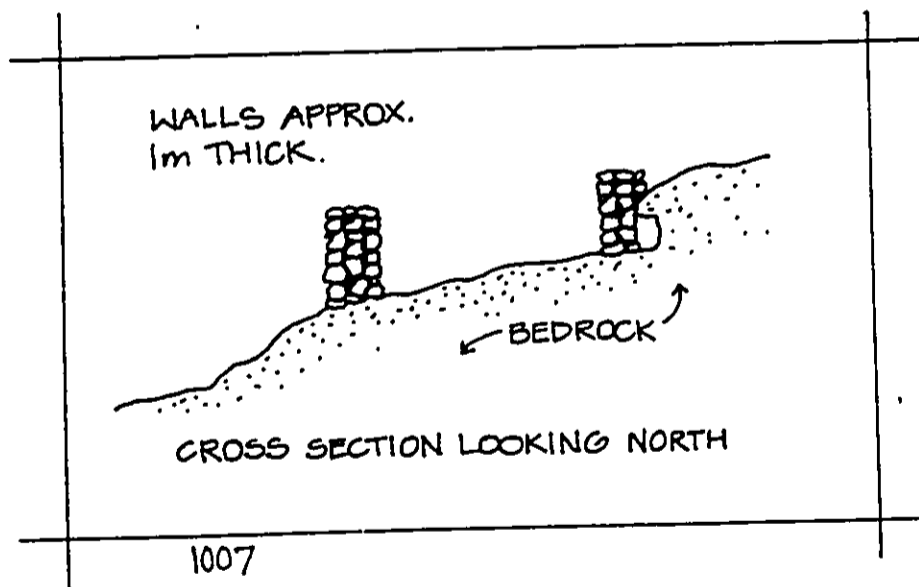


Figure 19 Cross Section of Site in 1007 Complex

visible to the SW. No detailed site information or dimensions were recorded, except for a rough sketch map of the configuration was prepared. A *he'e* sinker was found on the east side of the complex by Michael Kolb. Sites continued *mauka* with note of enclosures, one of which measures 16 by 24 m. on Elizabeth's sweep, a possible burial mound, also on Elizabeth's sweep. On Hal's sweep at 1700' 600' *mauka* of Site 1007, was a crude, probable agricultural feature with low walls measuring 8 m. by 10 m. Hal took a reading of 33° T. from Kahikinui House to this site. The transect proceeded to the EW pipeline and sites were located up to and slightly above 1600' elev. Above this point site density drops off.

Elizabeth on the west side of the transect, closest to the *mauka/makai* jeep road made the following notes on sites she encountered:

1. Enclosure, approx. 200 m. distant from the water tank where we started, west of jeep, outside dimensions approx. 6 m. x 11 m., terrace wall on *makai* side, approx. 2 m. from enclosure wall, walls approx. .7 m. high, 1 m. wide, disarrayed, no midden observed.
2. Enclosure, elev. 1500', double walls, core-filled, in good condition, outside dimensions approx. 7 m. x 12 m.; walls avg. 1 m. in height, no midden, but 5 cm. rim of cowrie shell, and a piece of coral.
3. Enclosure, approx. 30 m. distant from #2 above; double walls, core-filled, in good condition, outside dimensions approx. 16 m. x 24 m., walls avg. 7 m. in height, no midden, floor notably level and higher than ground surface outside.
4. Burial? very approx. 12 m. upslope from # 3 above, small enclosure, approx. 2.5 m. square, double course of exterior wall, completely filled with 'a'a chunks to top of walls.
5. Rubble wall habitation site w/ lānai; recorded by W. Folk, sightings 122° to Site 10007, 028° to Pu'u Pane

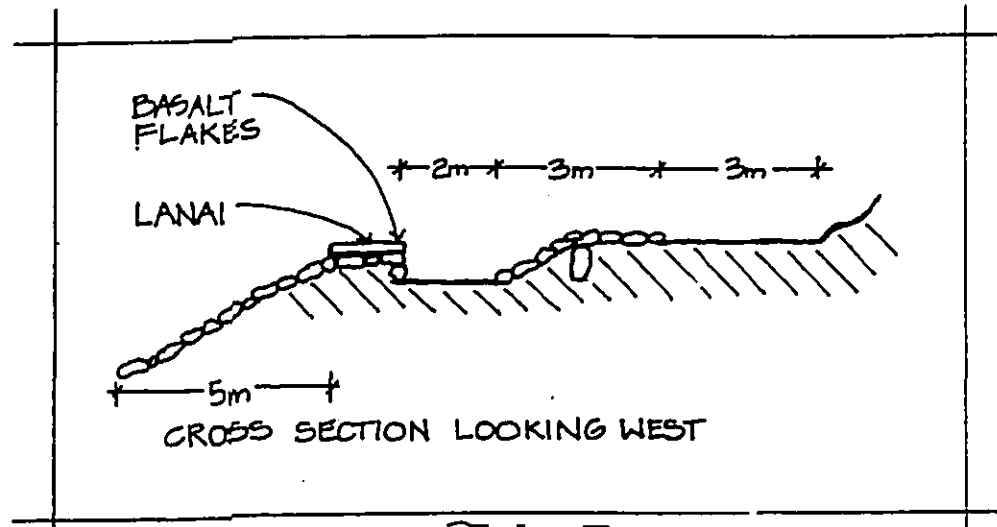


Figure 20 Cross Section of Site in 1007 Complex

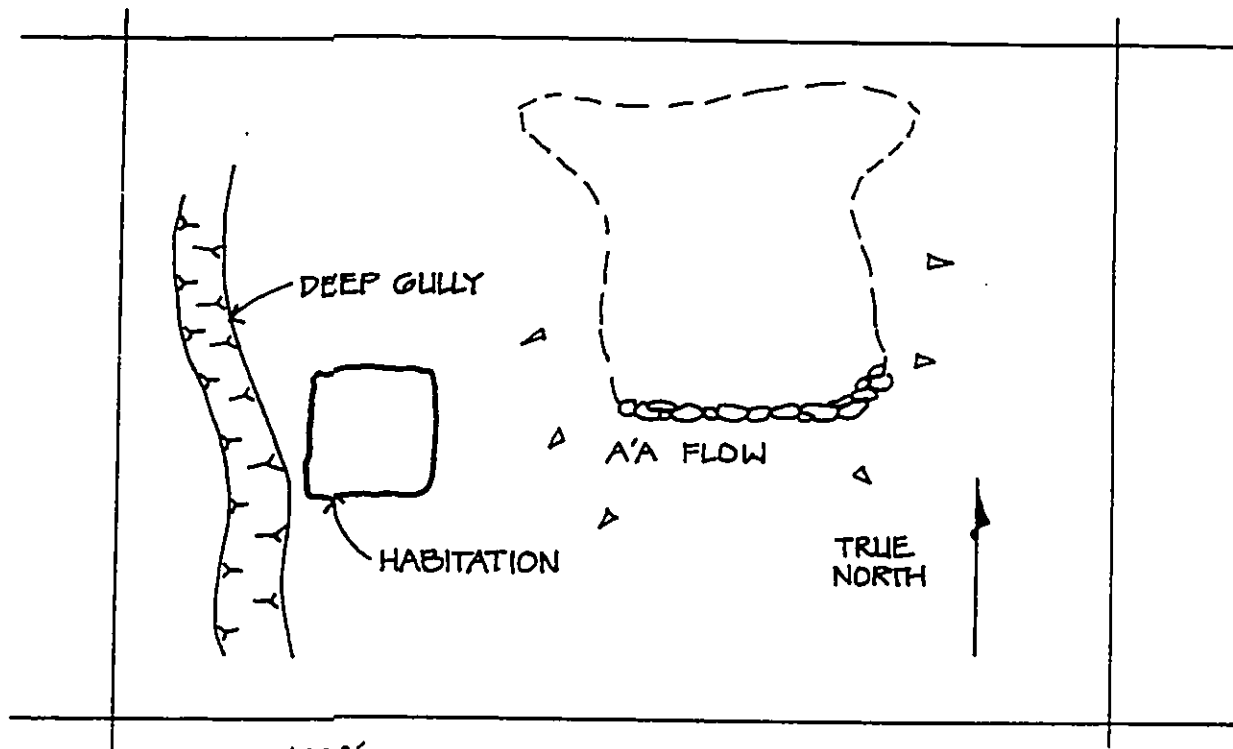


Figure 21 Plan View of Site 1008

CSH Site/Area: 1008 (See Fig. 21)
Survey Section: D
Helicopter Location:
Hand-Held GPS Location: E 785 119; N 228 3923
Elevation: 1960' (HH)
Site Type: Large habitation or *heiau*
Total Features: 2+
Dimensions: various

Notes:

A major site, easily visible from the *makai* area was located to the east of the top of Mike Kolb's sweep. Hal took a compass bearing of 24° from Kahikinui House to 1008. The site lies on the east side of a deep gully, on a promontory of a younger 'a'a flow. The site measures 30-40 m. (long) by 30 m. wide. It consists of leveled paved areas with a well-constructed *makai* facing. Plentiful basalt flakes occur throughout the paved areas and appear to be flaking stations, possibly related to adz manufacturing. 200' to SW of the SW corner of this site is a well-built habitation enclosure on the edge of a deep gully. This measures 10 m. by 12 m. and has well-built walls. There appear to be other sites to the NW. The land to the E becomes fairly rugged and is dissected by Kamole Gulch. Later helicopter transects confirmed that there are, indeed, major sites N of 1008 extending up to and above 2200' elevation. One of these sites observed from the helicopter appears to be the notched *heiau* previously identified as State Site 1156, Nakaaha *Heiau*.

CSH Site/Area: 1009 (Figs. 22 & 23)
Survey Section: E
Helicopter Location:
Hand-Held GPS Location: E 784 788; N 228 3817
Elevation: 1900' (HH)
Site Type: Large habitation, possible ritual function
Total Features: 2+
Dimensions:

Notes:

This site (1009A) is located on a hilltop to the west of the *mauka/makai* jeep road and within approx. 200' *makai* of the pipeline. The main retaining wall is on the E side of the hilltop. The *makai* slope has multiple terracing. Modification of the top of the hillside is extensive. Basalt flakes are scattered across the slope and an adz and burin were located among flakes of grey basalt. The adz

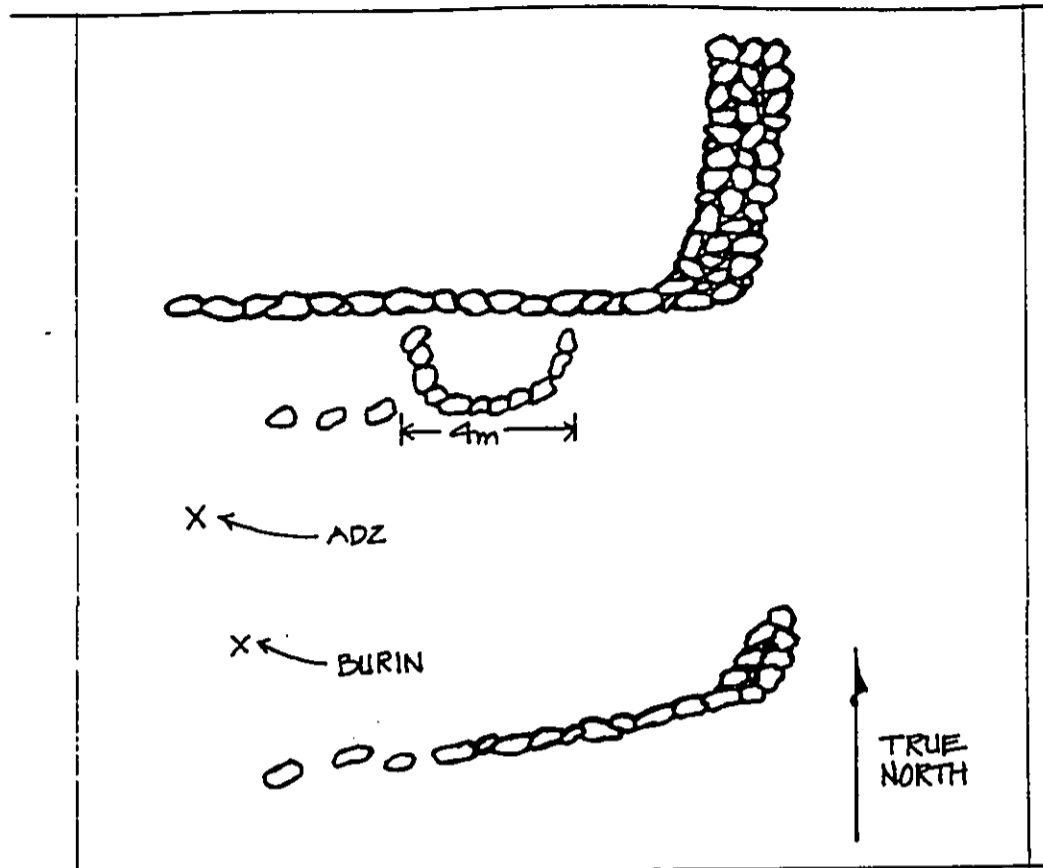


Figure 22 Plan View of Terrace within Site 1009

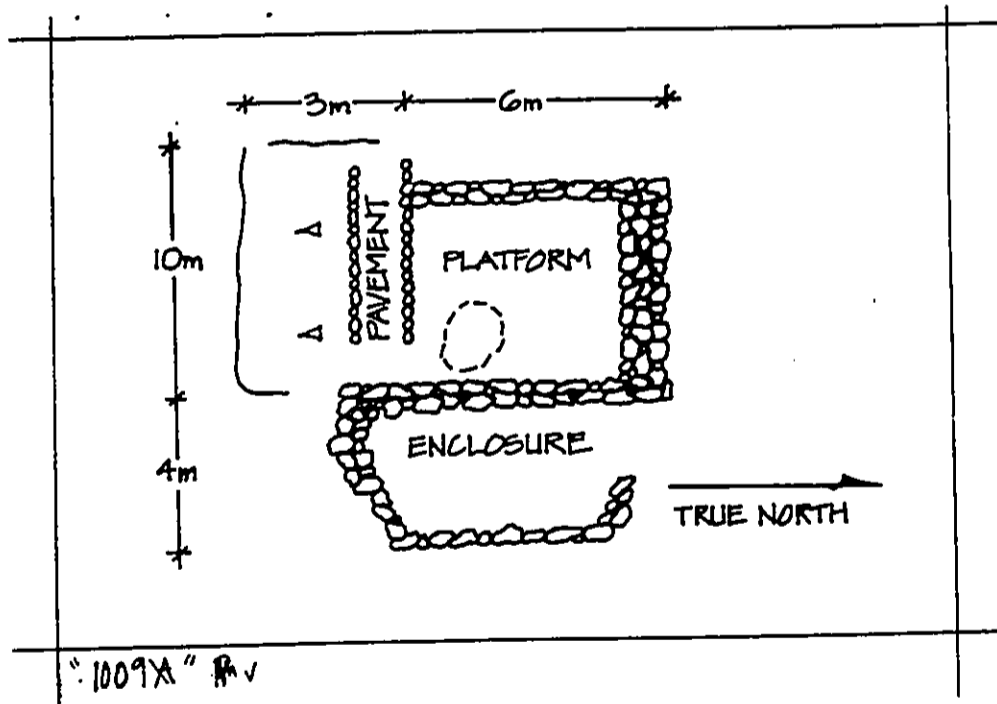


Figure 23 Plan View of Site 1009A

is a butt fragment of a large adz. Elevation and location is similar to that of 1008 to the E. Elizabeth Anderson made a sketch map of this site.

Site 1009B, recorded by Hal, is near the pipeline is a habitation site on an E facing slope. It is about 300' *mauka* of Site 1009A. The sweep proceeded *mauka* and to the W across the jeep trails around the watering trough and proceeded upslope. No additional sites were noted around the watering troughs or at the junction of the jeep roads.

CSH Site/Area: 1010 (Fig. 24)
Survey Section: E
Helicopter Location:
Hand-Held GPS Location: E 784 516; N 228 3939
Elevation: 2100' (HH)
Site Type: Notched *heiau*
Total Features: 1+
Dimensions: 125' EW by 100' NS

Notes:

This site, first observed by Bill Folk, is easily visible from *makai* areas because of its imposing *makai* retaining wall. This site is clearly a *heiau* with walls on all four sides. The notch is on the NE side. The eastern portion of the interior has rectangular alignments separating different areas. In the center is a *mauka/makai* paved area. The western portion of the site forms a somewhat separate walled area which also has a notch in the NE corner and a small notch of uprights in the SW corner. 80' to the west is a wire fence and sitting at a high point next to the fence, about 100' NW of the site, is an abandoned bulldozer. This *heiau* appears to not have been previously recorded from the description and location. It is not correlated with the Nakaaha *heiau*. There appears to be a pattern of these large ceremonial sites at the *mauka* end of habitation and agricultural settlements.

After the notation of this *heiau* the foot-transect proceeded downward paralleling a wire fence leading straight *makai* to Kahikinui House. This fence was the orientation for the sweep and is generally oriented straight NS. Clearly, this fence boundary was a major landmark for the ranching era. It runs along a continuous NS trending ridge at the *makai* end it becomes a stone wall. This could be the western end of the *ahupua'a* of Nakaaha - its border with Nakaohu to the west. Michael Kolb was on the west side of the fence,

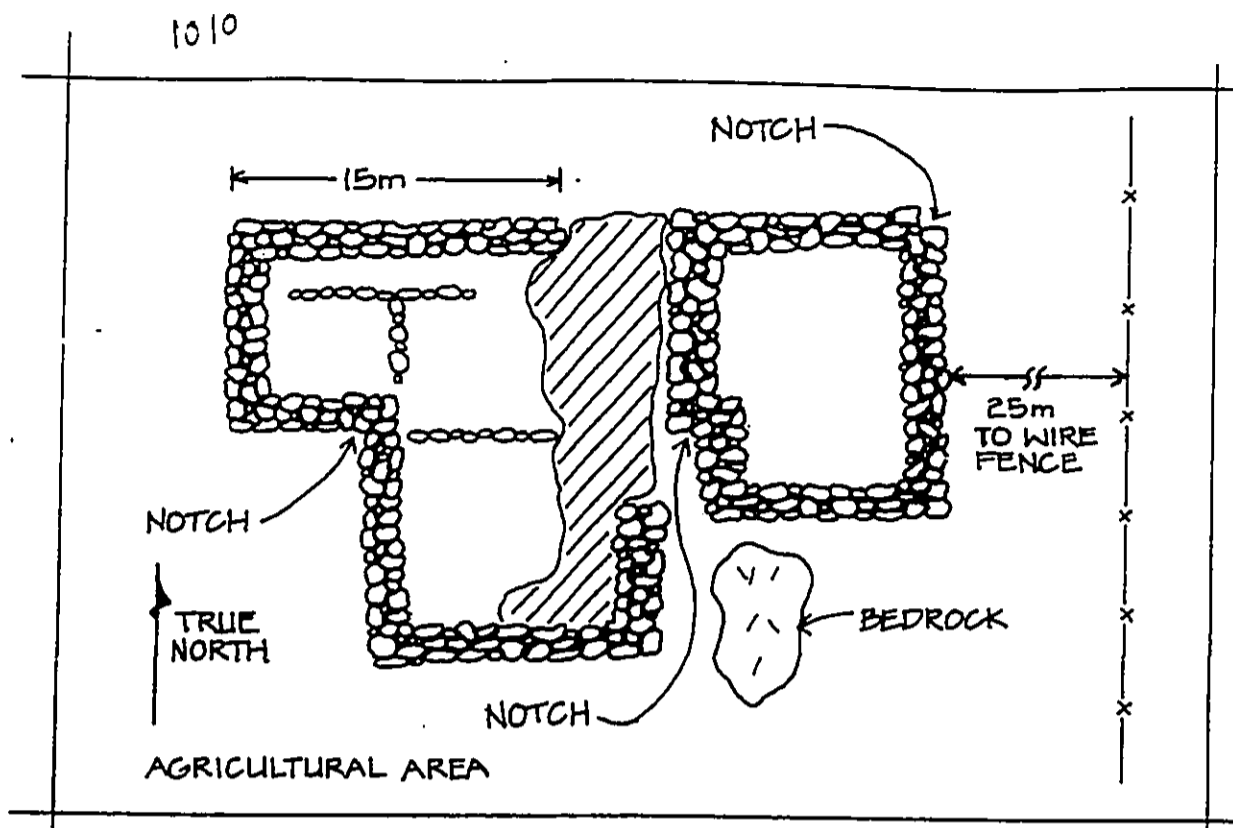


Figure 24 Plan View of Site 1010

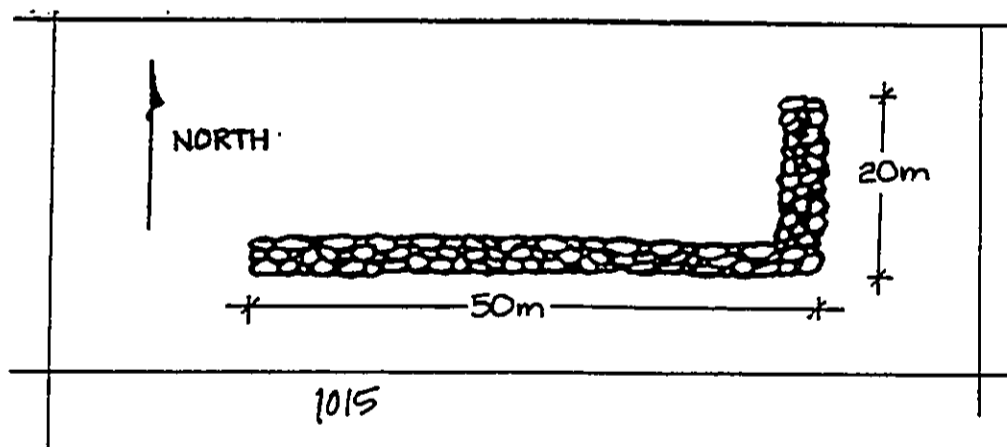


Figure 25 Plan View of Site 1015

on the east was Hal, and to Hal's left were Bill and Elizabeth, with Elizabeth at the eastern end of the *makai* sweep. Mike noted several habitation enclosures on the west side of the fence, approx. 1000' *makai* of the *heiau*. Hal noted depressions in the lava which were faced as agricultural areas containing internal gardening enclosures. These are at 1840' elev. (HH). Hal noted generally few sites in the area below the *heiau*, but Bill recorded a habitation complex at the 1900' elev. The habitation site was noted 150' *mauka* of the pipeline, 500' *makai* of the *heiau*. Elizabeth Anderson recorded a rough stacked enclosure approx. 7 m. square with *makai* lānai.

She also noted 3 more sites consisting of a rough stacked wall each only along the east (windward) slope of level areas along the ridge. West side of walls show smooth straight finish. Interval of roughly 20-40 m. between sites. 2 large flakes observed at one of these sites. There do not appear to be major sites on this downward sweep until elev. 1600' when there are large enclosures NE and *mauka* of Kahikinui House. Hal took a compass bearing of 6° T from Kahikinui House to the *makai* enclosure. Although there are few or no sites *mauka* of these enclosures, sites were observed to the E at the same elev. in the helicopter transect. Sites were also observed *makai* of this area to the boundary of the project at 1400' elev. Some of these consist of major habitation sites. Many are rectangular enclosures with well-constructed walls.

Site/Area Numbers 1011-1014 were GPS locations recorded by Michael Kolb on his *makai* transect between 1010 and Kahikinui House

CSH Site/Area:	1015 (See Fig. 25)
Survey Section:	E
Helicopter Location:	
Hand-Held GPS Location:	E 784 250; N 228 4634
Elevation:	2680' (HH)
Site Type:	Massive L-shaped wall
Total Features:	1
Dimensions:	50 m. (EW) x 20 m. (NS)

Notes: This site was observed in an isolated context, almost directly *mauka* of the notched *heiau*, Site 1010. Hal took a compass bearing of 340° T from the east corner of this site to Site 1010. Site 1015 consists of an L-shaped wall with a long axis running EW. The wall is 2 m. thick in places and 1.5 m. high on the average. There are no clues in the immediate vicinity as to the function of this wall.

A possible interpretation is that it is of religious function and it has the appearance of being part of an unfinished structure. This site is well above the elevation of the complex associated with Site 1010, which does not appear to extend above 2400'. However, the area from Site 1010 to around the 2400' elev. in Section E contains plentiful agriculture and habitation sites.

CSH Site/Area: 1016
Survey Section: E
Helicopter Location:
Hand-Held GPS Location: E 784 523; N 228 4785
Elevation: 2600' (HH)
Site Type: Habitation enclosure
Total Features: 1
Dimensions: 5 m. square

Notes: Hal took a reading of 360° T to the notched *heiau* (Site 1010). Bill Folk took a compass bearing of 140° T to hilltop site 1018. This site is 800-1000' east of Site 1015 and is also in an isolated context.

CSH Site/Area: 1017
Survey Section: M
Helicopter Location:
Hand-Held GPS Location: E 781 052 ; N 228 5481
Elevation: 2480' (HH)
Site Type: Lava tube
Total Features: 2
Dimensions: Not recorded

Notes: This lava tube has 2 entrances, in a *mauka/makai* line, approximately 150' apart. The *makai* entrance is inaccessible without a ladder or rope. The *mauka* entrance is accessible but was not explored beyond the light zone. There were no clear indications of human modification observed during this short inspection of the light zone. Hal recorded a bearing of 20° T from the east peak of Luala'ilua.

CSH Site/Area: 1018
Survey Section: H
Helicopter Location:
Hand-Held GPS Location: E 781 052; N 228 5481
Elevation: 2400' (HH)

Site Type: Paved terrace with *makai* facing
Total Features: 1
Dimensions: 40 m. (long) 4 m. (wide)

Notes: *This site is located at the mauka of the Chapman survey area, generally isolated from other sites. It appears to have been a habitation site.*

CSH Site/Area: 1019
Survey Section: D
Helicopter Location: N 20° 38' 2"; W 156°15'64"
Hand-Held GPS Location:
Elevation: 1950' (hl ²)
Site Type: Paved terrace
Total Features: 1
Dimensions: 7 m. long by 5 m. wide

Notes: This is an isolated habitation enclosure, *mauka* of most of the site concentrations. A compass bearing was taken of 25° from 1008 to 1019, which is estimated to be 800' across a major gully. Major sites were observed extending *mauka* at least 600' and also to the northeast of Site 1008.

CSH Site/Area: 1020 (Fig. 26)
Survey Section: B
Helicopter Location:
Hand-Held GPS Location: E 789 116; N 228 3327
Elevation: 560' (HH)
Site Type: Complex
Total Features: 3 large enclosures
Dimensions: average dimensions 10 m. sq.

Notes: West of Manawainui Gulch a GPS reading was taken at the *makai* end of Feature A. Feature B lies approx. 100' *makai* of Feature A and Feature C is approx. 400' NW of Feature A. A sketch was made of the configuration of the features.

CSH Site/Area: 1021 (Fig. 27)
Survey Section: B
Helicopter Location:
Hand-Held GPS Location: E 788 885; N 228 3648

² hl = helicopter reading

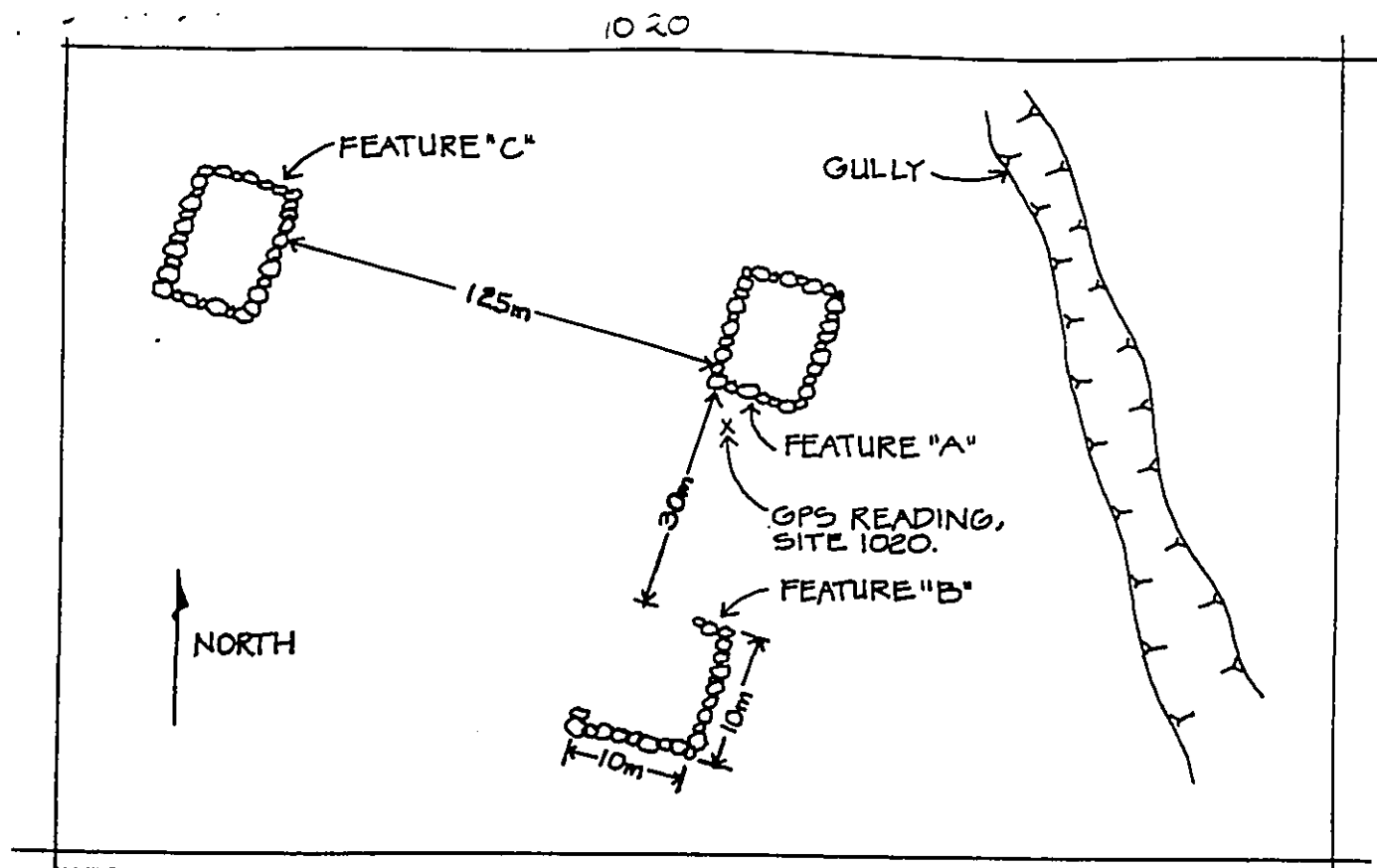


Figure 26 Plan View of Site 1020

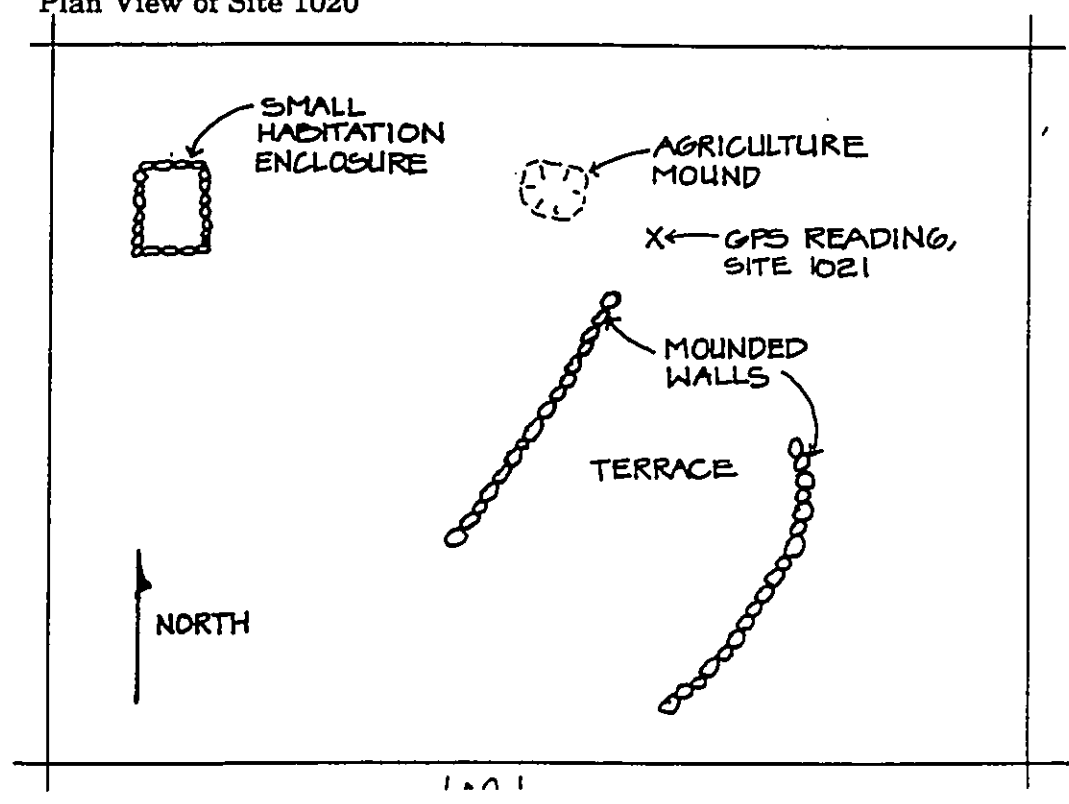


Figure 27 Plan View of Site 1021

Elevation: 806' (HH)
Site Type: Complex walls
Total Features: 4+
Dimensions: variable

Notes: This site consists of a single habitation site surrounded by agricultural mounds and terraced walls. It is in an isolated context.

CSH Site/Area: 1022 (Fig. 28)
Survey Section: B
Helicopter Location:
Hand-Held GPS Location: E 788 771; N 228 3103
Elevation: 700' (HH), 720' (hl)
Site Type: Habitations
Total Features: 2
Dimensions: 8 m. x 8 m.

Notes: These are two connected oval-shaped habitation sites, the western one forms an L-shape. These are in an isolated context.

CSH Site/Area: 1023 (Fig. 29)
Survey Section: B
Helicopter Location:
Hand-Held GPS Location: E 788 718; N 228 3257
Elevation: 920' (HH), 930' (hl)
Site Type: Habitation
Total Features: 1
Dimensions: 12 m. x 12 m.

Notes: A single habitation site forming a U-shape, open *makai* with a central terrace dividing the U-shape into 2 sections.

CSH Site/Area: 1024 (See Fig. 30)
Survey Section: B
Helicopter Location:
Hand-Held GPS Location: E 788 410; N 228 3588
Elevation: 1100' (HH)
Site Type: Habitation complex
Total Features: 5, some connected
Dimensions: variable

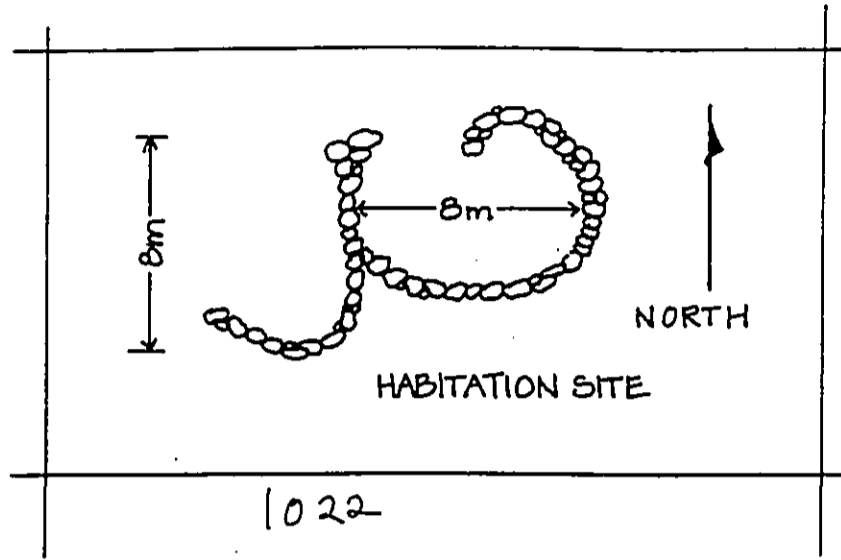


Figure 28 Plan View of Site 1022

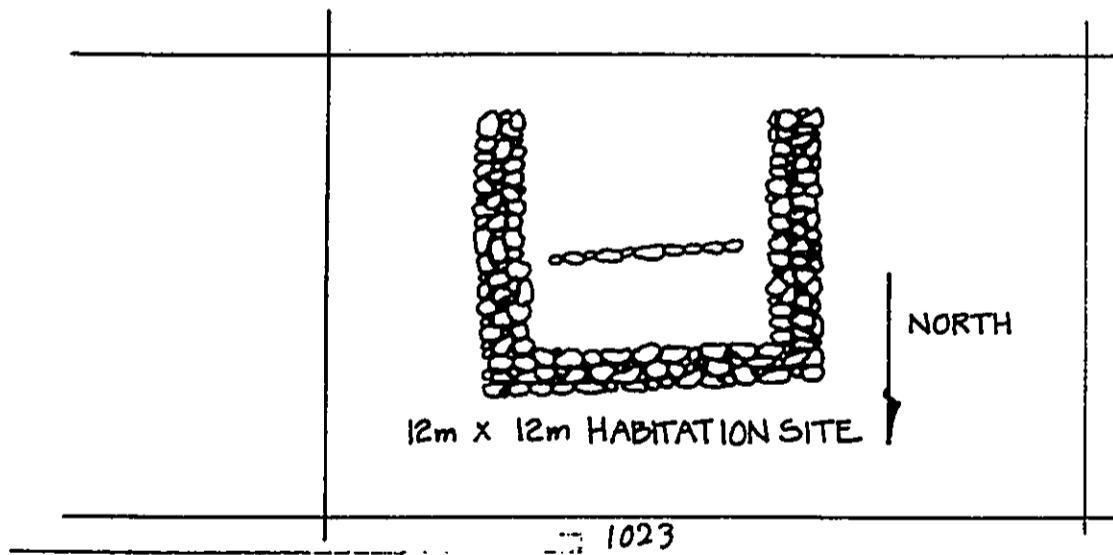


Figure 29 Plan View of Site 1023

Notes: These are large habitation sites, with uprights and multi-connected features which continue upslope. The ranch road at it curves from *mauka* to the west, is visible to the west of this site. This site is situated on the east side of Palaha Gulch. A sketch map showing the configuration of the site was made.

CSH Site/Area: 1025 (Fig. 31)
Survey Section: B
Helicopter Location: N 20°38'12"; W 156°14'7";
Hand-Held GPS Location: E 788 189; N 228 4242
Elevation: 1600'; (HH) 1600' (hl)
Site Type: Habitation
Total Features: 1
Dimensions: 22 m. (*mauka/makai*) x 28 m. (EW)

Notes: This is a single isolated habitation enclosure or possible animal pen. Two additional sites were noted at 1900' elev. 400' to the E, just on the west side of Manawainui Gulch.

CSH Site/Area: 1026 (Fig. 32)
Survey Section: C
Helicopter Location:
Hand-Held GPS Location: E 788 256; N 225? 8406
Elevation: 2000' (HH)
Site Type: Complex
Total Features: 3+
Dimensions: variable

Notes: This complex includes a large agricultural enclosure, 22 m. (EW) by 11 m. (NS) in the bottom of a swale. 100' to the NE is a burial platform 2 x 3 m. and 130' upslope to the NW of the ag. enclosure is a 3 or 4 tiered terrace habitation site with paving and retaining walls. This is one of the few sites which occur at or above the 2000' elevation within this survey section.

CSH Site/Area: 1027 (Fig. 33)
Survey Section: C
Helicopter Location:
Hand-Held GPS Location: E 787 582; N 228 4621
Elevation: 2100' (HH)
Site Type: Habitation enclosure
Total Features: 1
Dimensions: 3 m. x 5 m.

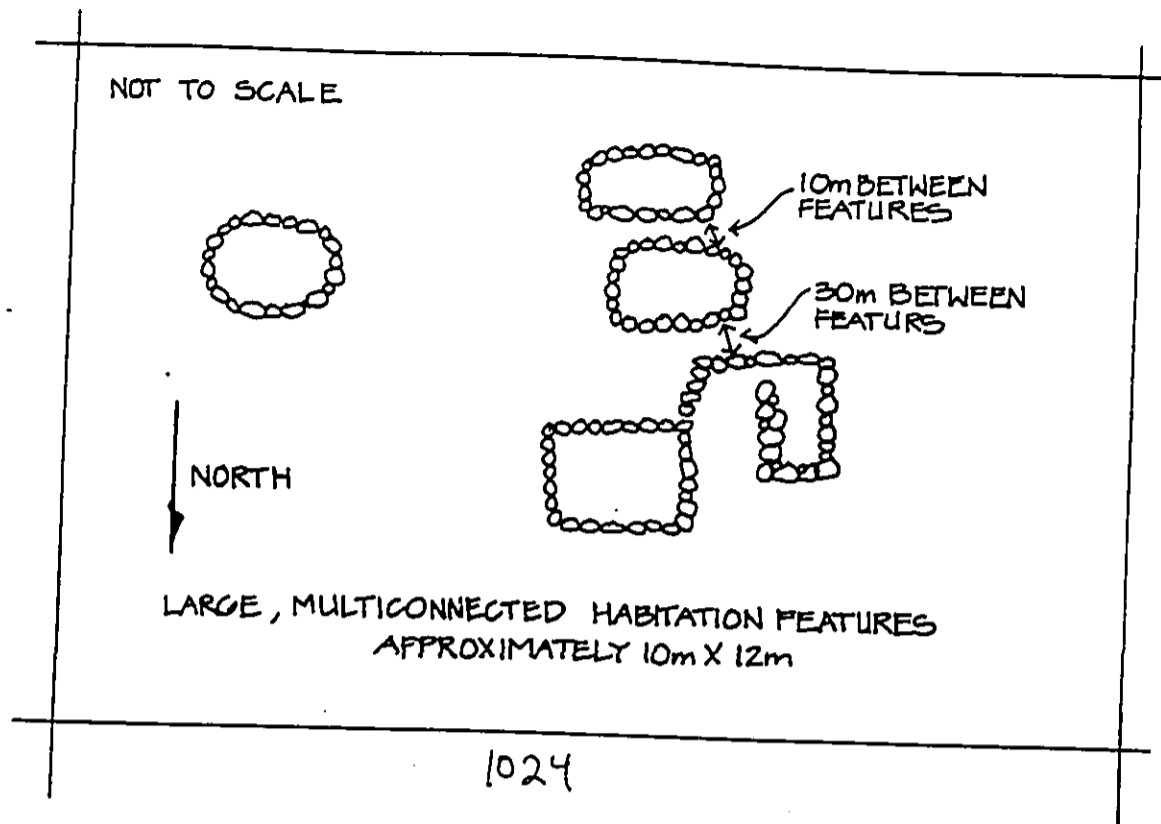


Figure 30 Plan View of Site 1024

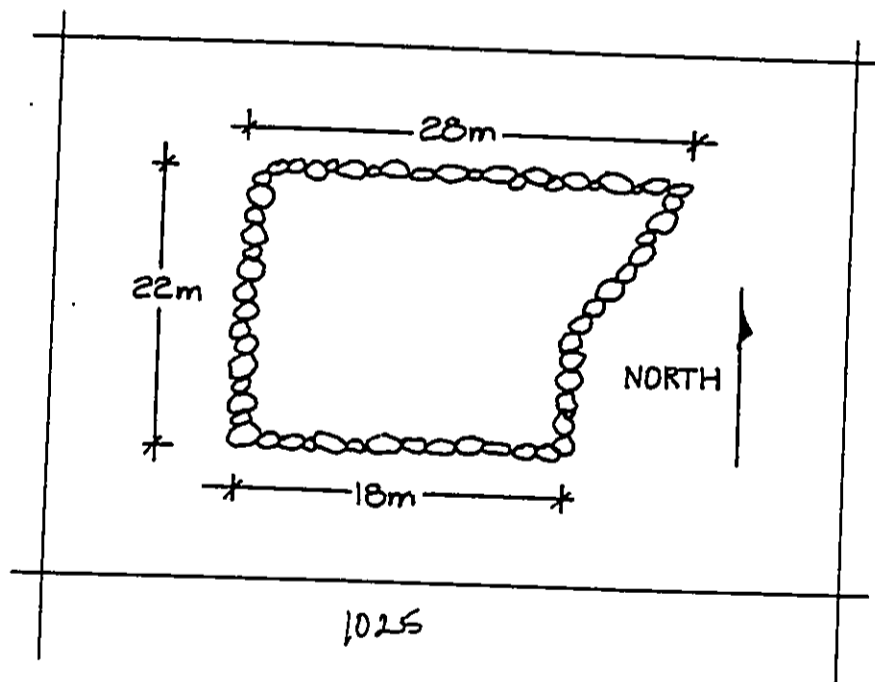


Figure 31 Plan View of Site 1025

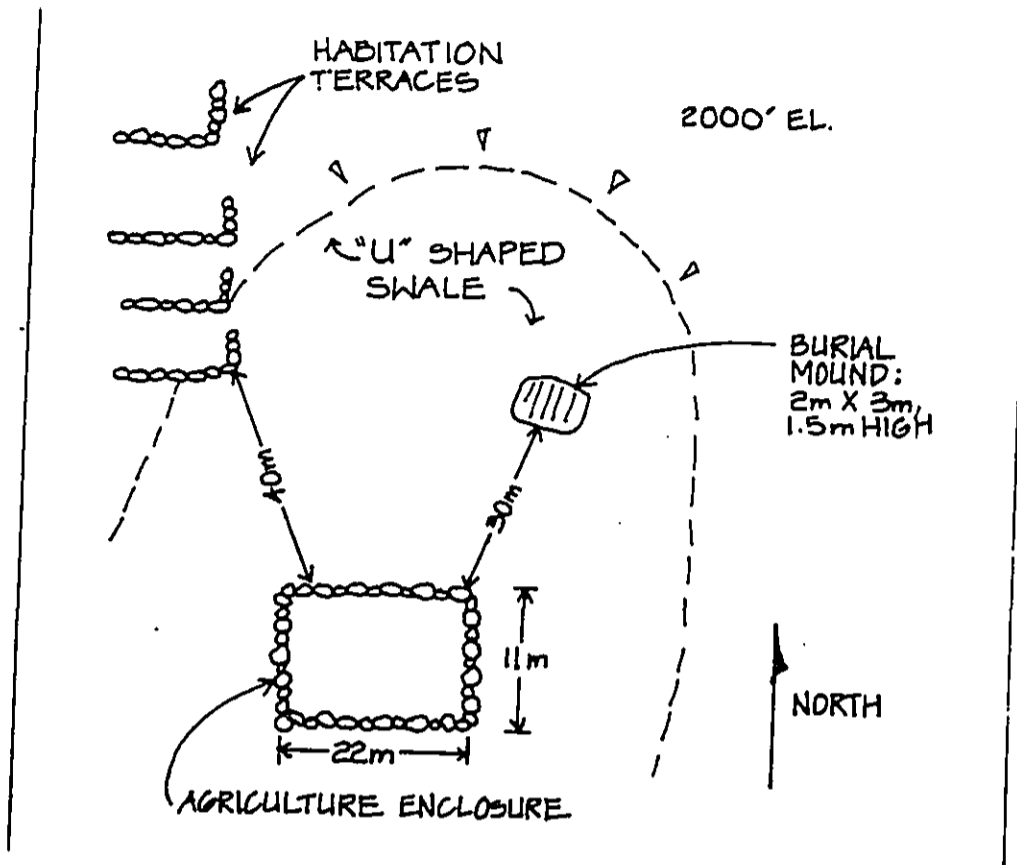


Figure 32 Plan View of Site 1026

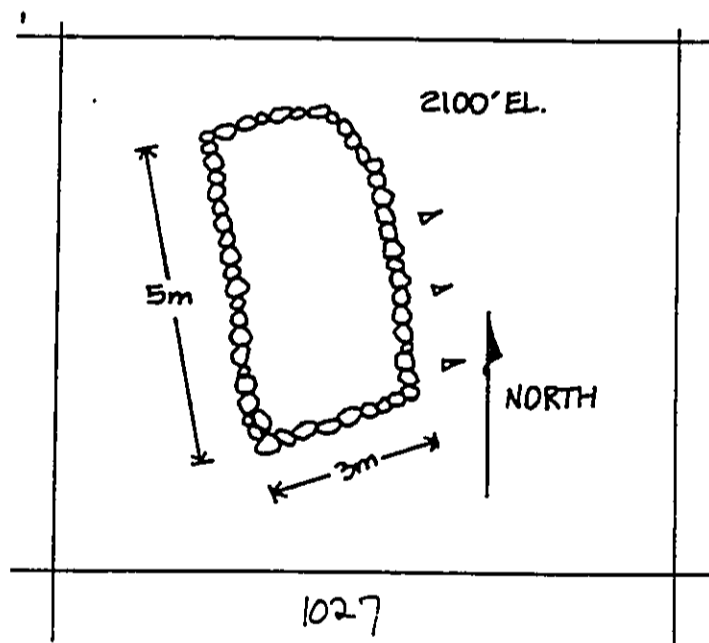


Figure 33 Plan View of Site 1027

Notes: A compass bearing was taken from Site 1003, the large enclosure to Site 1027 with a reading of 223° T.

CSH Site/Area: 1028 (Fig. 34)
Survey Section: N
Helicopter Location: N 20°37'34"; W 156°17'35"
Hand-Held GPS Location: E 785; N 228
Elevation: 1800' (HH), 1850' (hl)
Site Type: Habitation C-shape
Total Features: 1
Dimensions: 15 m. x 8 m.

Notes: Smaller sites are observed *makai* of this C-shape.

CSH Site/Area: 1029 (Fig. 35)
Survey Section: N
Helicopter Location:
Hand-Held GPS Location: E 781 709; N 228 3321
Elevation: 2140' (HH)
Site Type: Lava tube
Total Features: 1
Dimensions: 12 m. sq. (sink)

Notes: Lava tube, no cultural modification visible near entrance

CSH Site/Area: 1029A (Fig. 36)
Survey Section: N
Helicopter Location: N 20°37'61"; W 156°17'89"
Hand-Held GPS Location:
Elevation: 2100' (HH), 2200' (hl)
Site Type: Habitation sites
Total Features: 2
Dimensions: 3 x 5 m. each

Notes: Approx. 600' below pipeline

CSH Site/Area: 1029B
Survey Section: N
Helicopter Location: N 20°37'54"; W 156°17'93"
Hand-Held GPS Location:
Elevation:
Site Type: Habitation
Total Features: 1
Dimensions: 4 x 4 m.
Notes: None

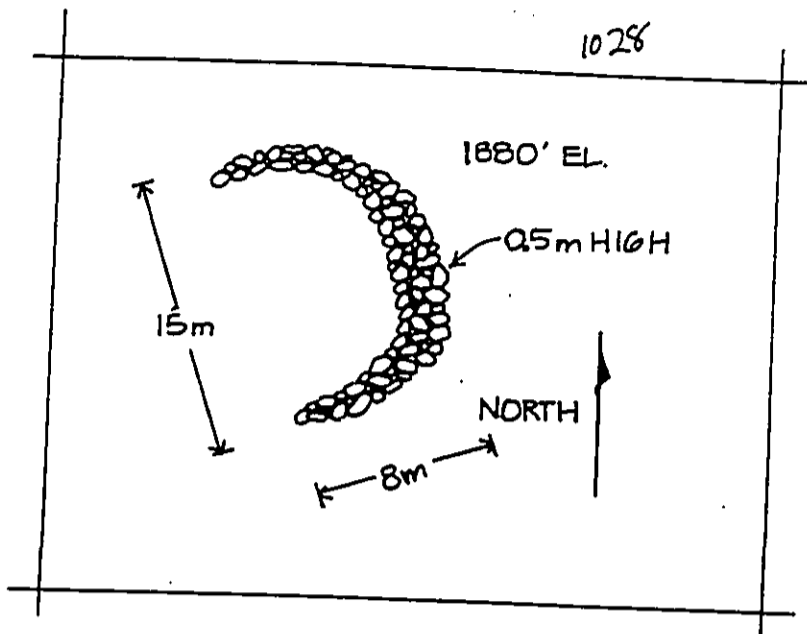


Figure 34 Plan View of Site 1028

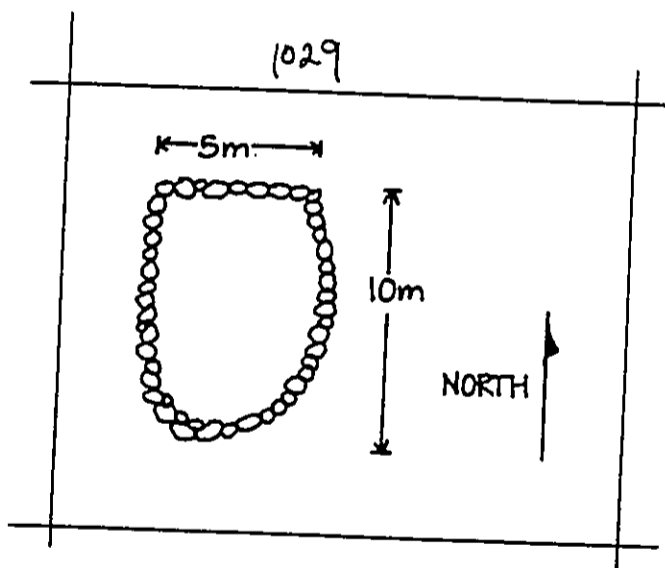


Figure 35 Plan View of Site 1029

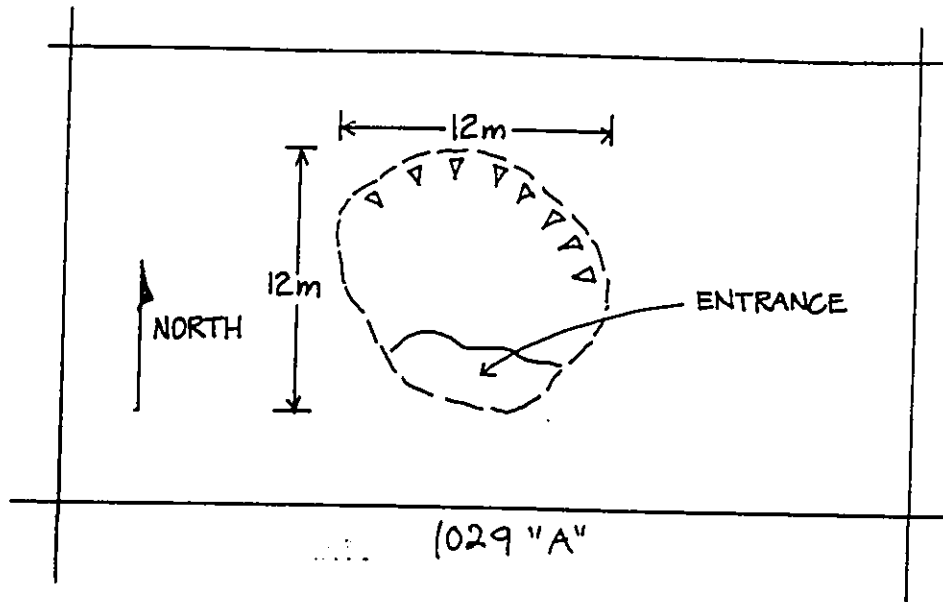


Figure 36 Plan View of Site 1029A

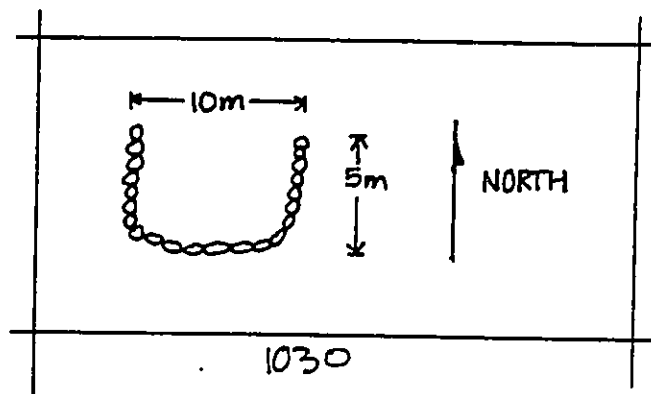


Figure 37 Plan View of Site 1030

CSH Site/Area: 1029C
Survey Section: N
Helicopter Location: N 20°37'45"; W 156°17'87"
Hand-Held GPS Location:
Elevation:
Site Type: Habitation
Total Features: 1
Dimensions: 5 x 10 m.

Notes: Habitation site, 100 m. to east is another feature (8 x 10 m.) or ag. site

CSH Site/Area: 1030 (See Fig. 37)
Survey Section: I
Helicopter Location: N 20°37'99"; W 156°17'53"
Hand-Held GPS Location:
Elevation: 2500' (HH), 2500 (hl)
Site Type: Shelter
Total Features: 1
Dimensions: 18 x 5 m.

Notes: This is the only archaeological site observed during the helicopter survey of Section I.

CSH Site/Area: 1031
Survey Section: J
Helicopter Location: N 20°38'27"; W 156°17'79"
Hand-Held GPS Location:
Elevation: 2800' (HH) 2800' (hl)
Site Type: Cave
Total Features: 1
Dimensions:

Notes: Cave opening 1.5 m. sq.; cave was not inspected

CSH Site/Area: 1032 (Fig. 38)
Survey Section: K
Helicopter Location: N 20°38'10"; W 156°18'77"
Hand-Held GPS Location:
Elevation: 2700' (HH), 2800' (hl)
Site Type: Rectangular platform
Total Features: 1
Dimensions: 3 x 4 m.

Notes: This rectangular platform is on a west-facing slope, Hal took a bearing of 230° Mag. to water tank.

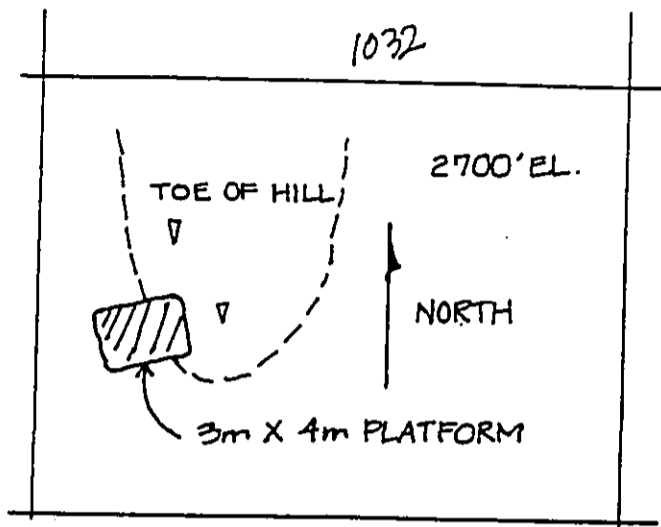


Figure 38 Plan View of Site 1032

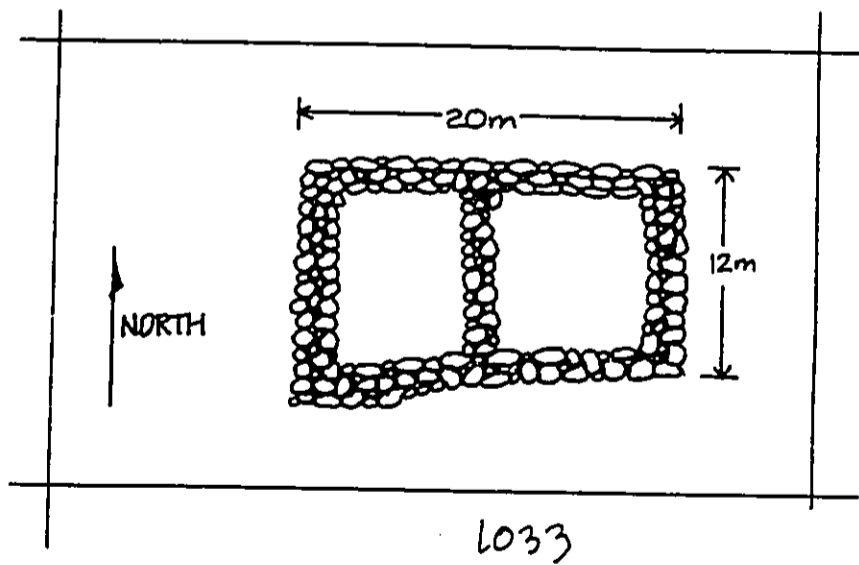


Figure 39 Plan View of Site 1033

CSH Site/Area: 1033 (See Fig. 39)
Survey Section: K
Helicopter Location: N 20°38'01"; W 156°18'89"
Hand-Held GPS Location:
Elevation: 2600' (HH) 2640' (hl)
Site Type: Habitation enclosure
Total Features: 20 x 12 m.
Dimensions:

Notes: This is a 2-room habitation enclosure on puu ENE of water tank.

CSH Site/Area: 1034
Survey Section: K
Helicopter Location: N 20°38'13"; W 156°18'76"
Hand-Held GPS Location:
Elevation: 2700' (HH)
Site Type: Rock shelter
Total Features: 1
Dimensions:

Notes: This rock shelter faces east, and is east of 1032

CSH Site/Area: 1035 (Fig. 40)
Survey Section: L
Helicopter Location: N 20°37'40"; W 156°18'98"
Hand-Held GPS Location:
Elevation: 1900' (HH), 1950 (hl)
Site Type: Complex
Total Features: 5+
Dimensions: 200 m. (*mauka/makai*) x 100 m. (EW)

Notes: A large site complex on 'a'a lava puu, 200 m. mauka/makai 100 m. E/W, probable burial sites at W. end. Much of survey of Section L was observed from the helicopter, and contained almost continuous site distribution.

CSH Site/Area: 1036 (See Fig. 40)
Survey Section: M
Helicopter Location: N 20°37'42"; W 156°19'06"
Hand-Held GPS Location:
Elevation: 1880' (HH), 1900' (hl)
Site Type: Enclosure
Total Features: 1
Dimensions: 8 m. x 10 m.

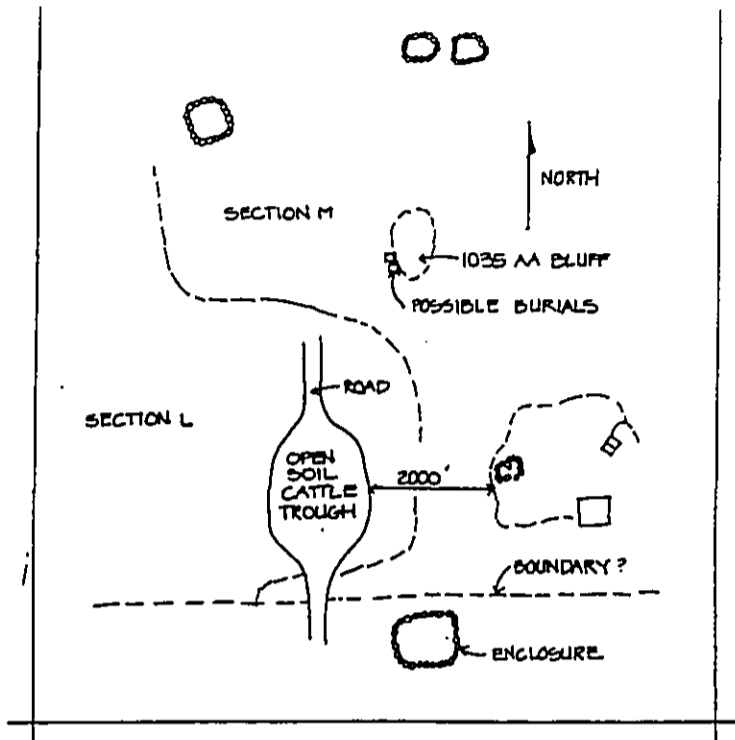


Figure 40 Site Configuration of Sites 1035, 1036, and 1038 in Survey Sections L and M

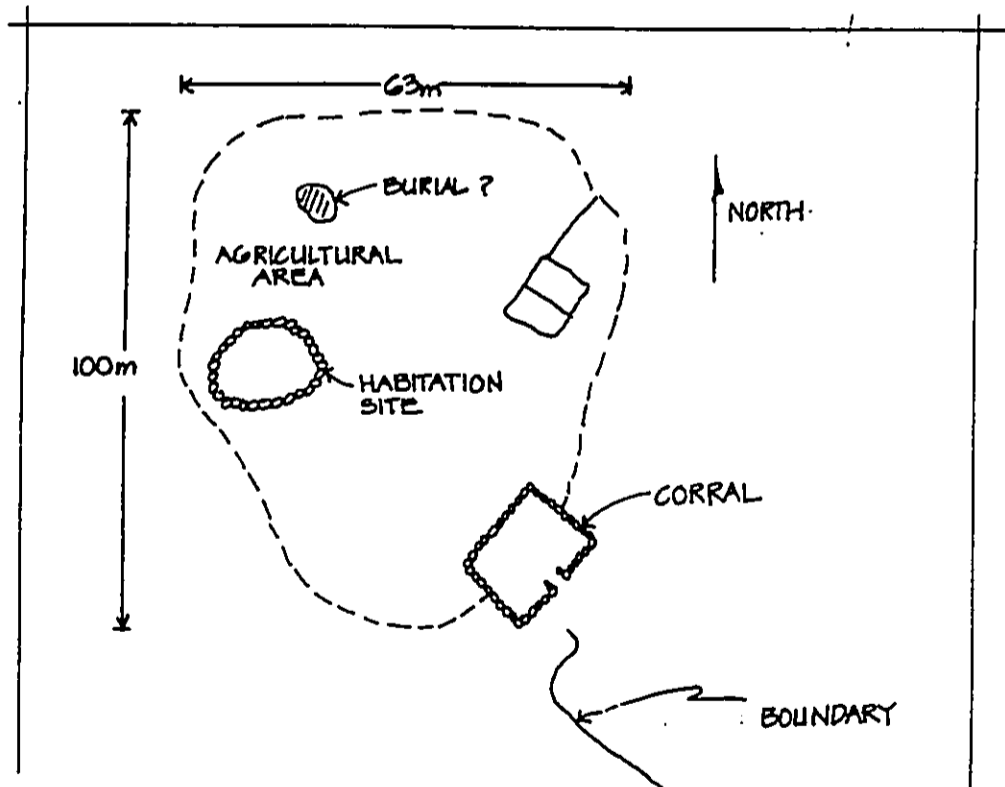


Figure 41 Plan View of Site 1038

Notes:	This is a probable habitation enclosure, surrounded by other similar sites.
CSH Site/Area:	1037
Survey Section:	M
Helicopter Location:	N 20°37'55"; W 156°19'05"
Hand-Held GPS Location:	
Elevation:	1950 (HH), 2000 (hl)
Site Type:	Enclosures
Total Features:	2
Dimensions:	7 m. x 7 m. each
Notes:	Many other sites in the area.
CSH Site/Area:	1038 (See Fig. 40)
Survey Section:	N
Helicopter Location:	N 20°37'39"; W 156°18'70"
Hand-Held GPS Location:	
Elevation:	estimated to be 2200'
Site Type:	Large enclosure
Total Features:	1
Dimensions:	100 m. sq.
Notes:	This is a large enclosure with a corral at SE corner, another enclosure at NE corner, possibly another one at NW corner, all enclosed by wall, located at southern boundary jog.
CSH Site/Area:	1039 (Fig. 42)
Survey Section:	M
Helicopter Location:	N 20°37'79"; W 156°18'76"
Hand-Held GPS Location:	
Elevation:	2340' (HH), 2300' (hl)
Site Type:	Enclosure
Total Features:	1
Dimensions:	10 m. x 12 m.
Notes:	Typical habitation enclosure
CSH Site/Area:	1040 (Fig. 43)
Survey Section:	M
Helicopter Location:	Not taken
Hand-Held GPS Location:	Not taken
Elevation:	
Site Type:	Habitation enclosures
Total Features:	2
Dimensions:	10 m. x 10 m. each

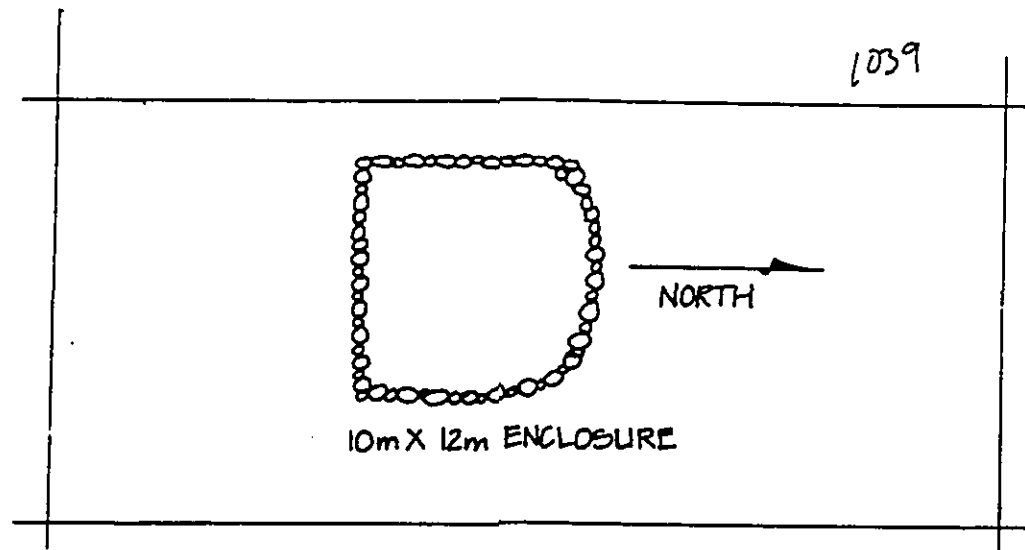


Figure 42 Plan View of Site 1039

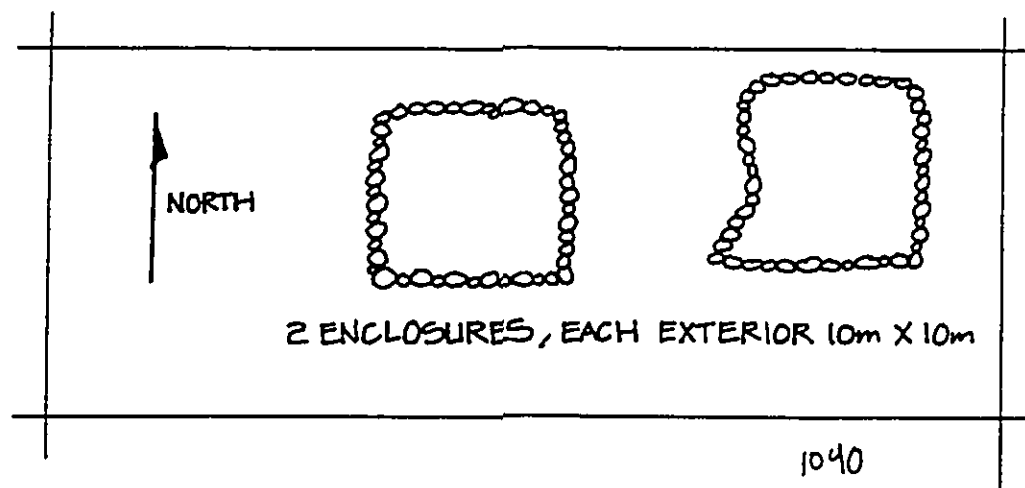


Figure 43 Plan View of Site 1040

Notes: Site 1040 consists of 2 enclosures, within 100' of each other, probably a habitation, the western enclosure is a rectangle, the eastern enclosure is oval-shaped with the long dimension oriented *mauka/makai*.

CSH Site/Area: 1041 (Fig. 44)
Survey Section: M
Helicopter Location: N 20°37'89"; W 156°18'49"
Hand-Held GPS Location:
Elevation: 2500' (HH), 2500 (hl)
Site Type: Complex
Total Features: 3+
Dimensions: variable

Notes: One enclosure, a probable habitation site is located within a 100' of the E/W pipeline, A probable burial mound and more shelters are located closer to the pipeline. Other shelter sites lie *mauka* of the pipeline.

CSH Site/Area: 1042 (Figs. 45 & 46)
Survey Section: M
Helicopter Location: N 20°37'49"; W 156°18'29"
Hand-Held GPS Location:
Elevation: 2180' (HH), 2180 (hl)
Site Type: L-shaped habitation
Total Features: 1
Dimensions: 12 m. x 12 m.

Notes: This is an L-shaped habitation with well-built walls with the opening to the SW.

CSH Site/Area: 1042A
Survey Section: M
Helicopter Location: N 20°37'43"; W 156°18'28"
Hand-Held GPS Location:
Elevation: 2100 (HH), 2160 (hl)
Site Type: Notched enclosure
Total Features: 1
Dimensions: 10 x 20 m.

Notes: The notch is in the SE corner. The walls are thick and well built with core filling. This is a probable *heiau*.

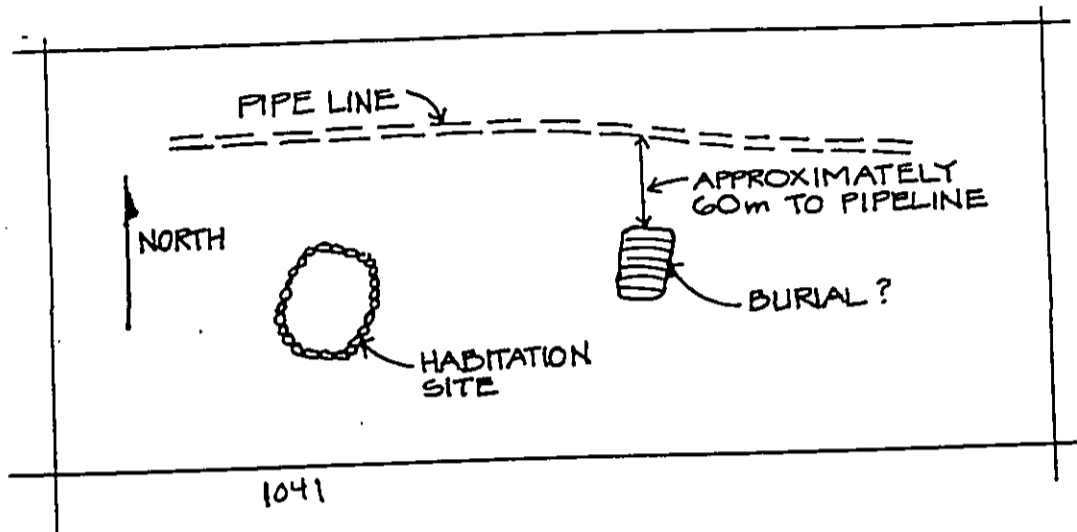


Figure 44 Plan View of Site 1041

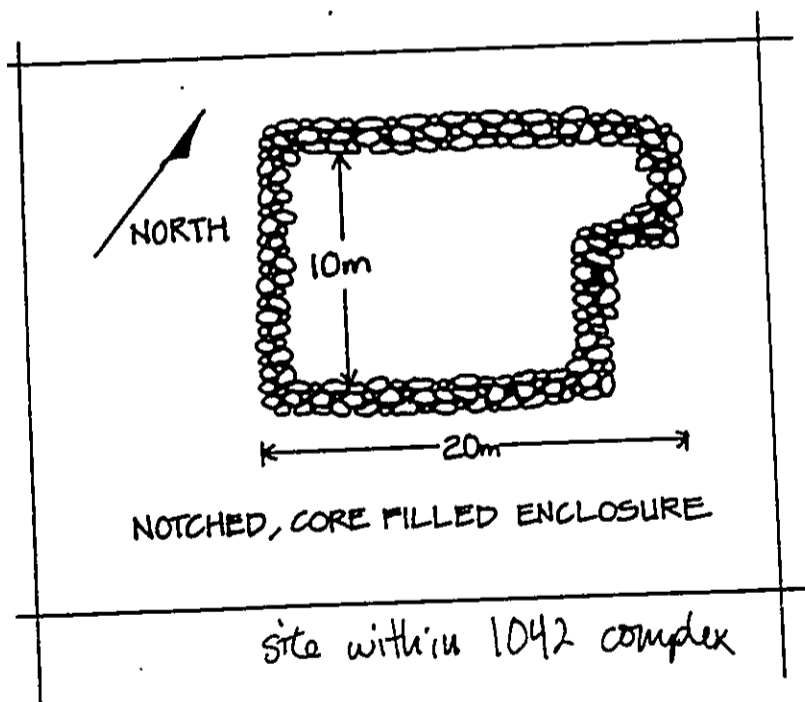


Figure 45 Plan View of Site within 1042 Complex

CSH Site/Area: 1043 (See Fig. 47)
Survey Section: M
Helicopter Location: N 20°37'40"; W 156°18'07"
Hand-Held GPS Location:
Elevation: 2000' (hl)
Site Type: *heiau* and associated sites
Total Features: 2+
Dimensions: variable

Notes:

This *heiau*, notch closed in by cattle wall. This site measures 200' (EW) and 150' (NS). It is a large rectangular totally enclosed by walls with three separate compartments in the interior, defined by 2 interior EW walls. There is a prominent notch in the SE corner and appears to have been closed in in later wall building. Just to the east of this closed in notch is platform which is close to, but independent of the main portion of the site. This site is almost certainly a *heiau* and is without a doubt the largest structure in the entire project area. It was noted from the helicopter that sites are continuous *makai* of Site 1043 all the way to the *makai* boundary. Sites also extend *mauka* and east and west in a radius of 500-600' around Site 1043. This is clearly a major complex of large sites located east of Luala'ilua. Particularly large habitation sites were noted along the *makai* boundary of survey Section M (the project area boundary).

CSH Site/Area: 1044 (Fig. 48)
Survey Section: M
Helicopter Location: N 20°37'16"; W 156°17'92"
Hand-Held GPS Location:
Elevation: 1800' (HH), 1850 (hl)
Site Type: U-shape
Total Features: 12 x 6 m.
Dimensions: 12 m. x 6 m.

Notes:

This U-shape is open to the south.

CSH Site/Area: 1045 (Fig. 49)
Survey Section: N
Helicopter Location: N 20°37'38"; W 156°17'86"
Hand-Held GPS Location:
Elevation: 1980 (HH), 2000' (hl)
Site Type: Complex
Total Features: 3+
Dimensions: 24 (NS) x 12 m. (EW)

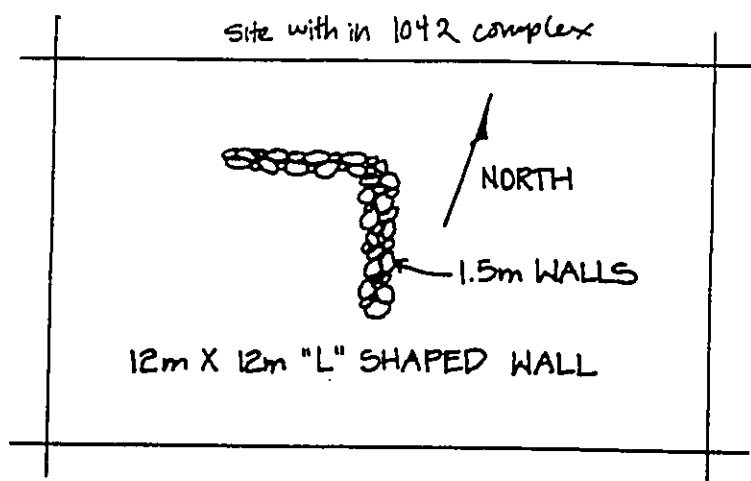


Figure 46 Plan View of Site within 1042 Complex

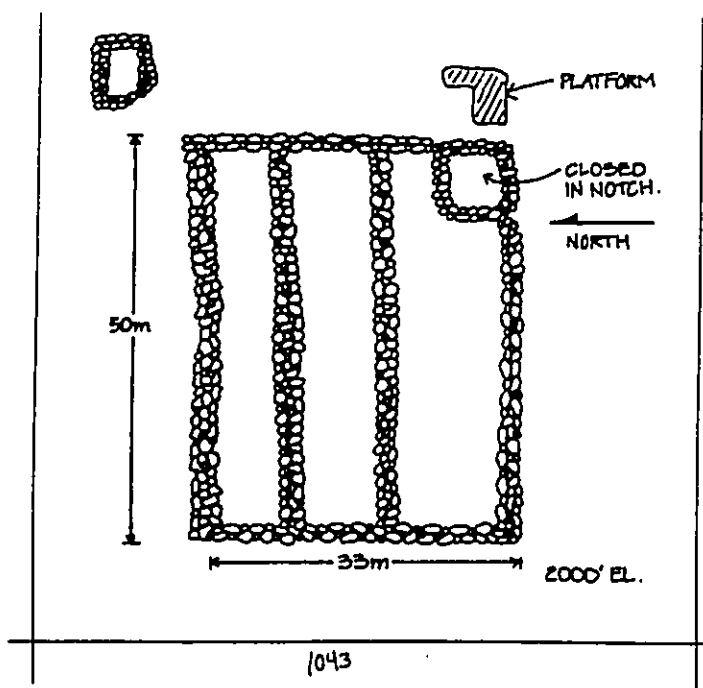


Figure 47 Plan View of Site 1043

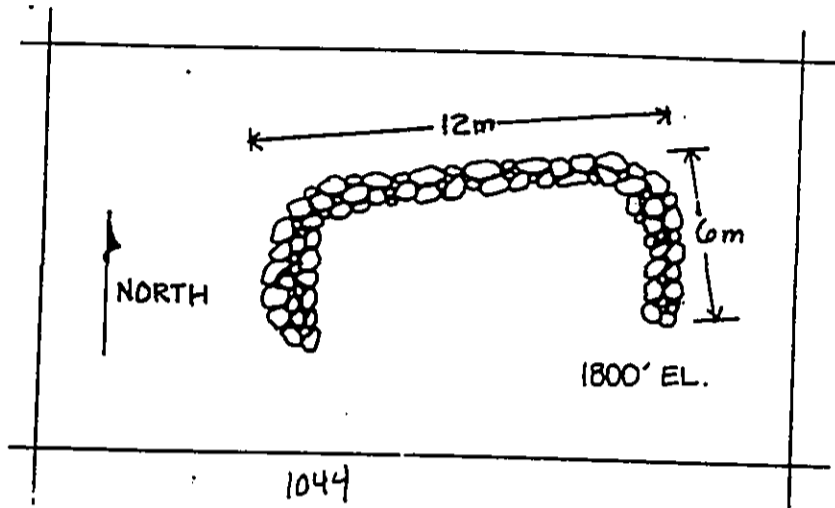


Figure 48 Plan View of Site 1044

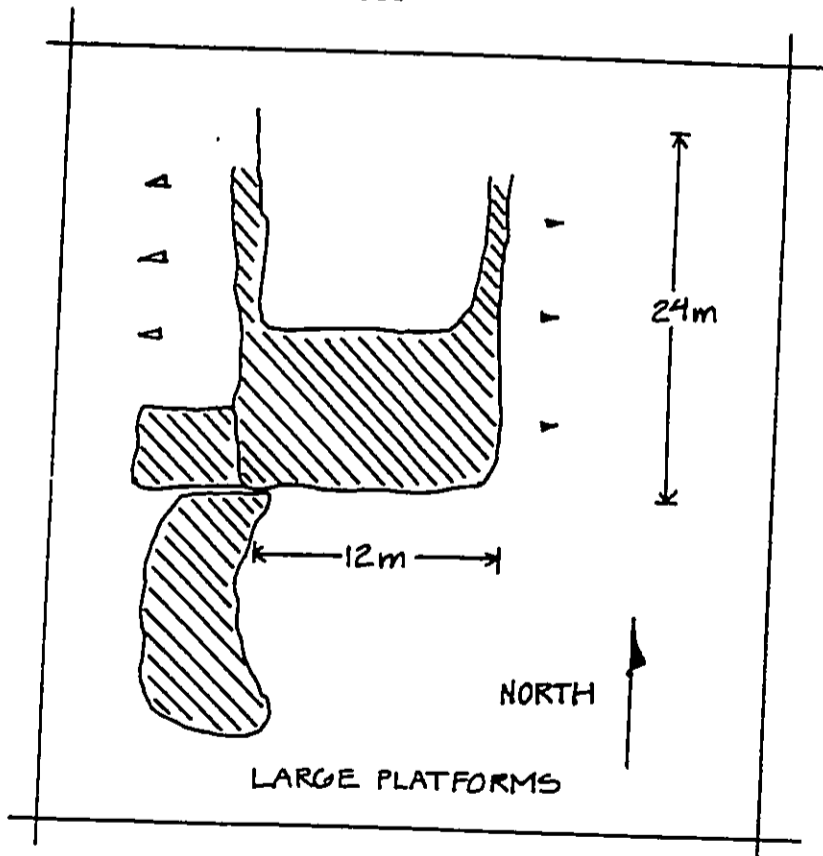


Figure 49 Plan View of Site 1045

Notes:

This is a major habitation site just 300' east of the *mauka*/makai pipeline. It measures 24 NS x 12 EW and is a complex of paved areas and walls built on a prominent bluff; Site 1043 is approx. 500'-600' west of Site 1045.

Survey Section Summaries

The above specific site and area information is summarized here in a general way to characterize the archaeological content or constraints of each of the survey sections (A-O) as presented on Figure 50 (being the same as Figure 7).

Survey Section A (Coverage: Some helicopter in the *makai* portion, Foot-transects in the *mauka* portions).

This section lies in the *makai* portion of Mahamenui between Palaha Gulch and the exclusion, which runs up Kamole Gulch. This section contains sites/areas 1001 which is an extensive agricultural and habitation complex covering most of the section between 700' elevation all the way to the *mauka* boundary of this section. This section also contains the ancient? foot-trail which runs from Manawainui Gulch to Kahikinui House. Below this foot-trail sites are still present to Pi'ilani Highway, but are generally thinly scattered. Site density is also lower toward the E and SE portions of this section. The central and *mauka* sections, particularly at the W end show major site concentrations, many of which were documented in foot transects, along the jeep road that forms the *mauka* boundary of this section.

Survey Section B (Coverage: Entirely done by helicopter transects, helicopter stopped to record each site).

Section B is the *makai* eastern boundary of the project area. It consists of smooth terrain, mantled with volcanic ash. Helicopter visibility here was excellent and the entire section was covered by helicopter. There are seven sites/areas recorded in this section. These are believed to be virtually all of the sites present here. In general terms, site density here is extremely low and sites are easily identified.

Survey Section C (Coverage: *Mauka* area covered by helicopter transects, helicopter stopped at most sites, *Makai* area below 1400' covered by foot-transects).

Section C comprises the central section of Mahamenui within the project area. Generally, site density is high at the *makai* end, particularly at the SW corner between the water tank and Site 1004. Site 1004 is a major site which would probably require preservation and there are other major sites, not specifically recorded above the water tank in the SW corner of this section. Site density decreases *mauka* and there are only isolated sites between the 1600' and 2000' elevation. It is believed that virtually all of the sites *mauka* of 2000' elevation have been recorded during helicopter transit.

Survey Section D (Coverage: *Makai* western area up to 2000' was covered by foot-transects, as well as the area up to Site 1008 at 2000'. The *mauka* areas were covered by helicopter transects).

Section D comprises the *makai* portion of Nakaaha in the project area, stretching from Kepuni Gulch westward to a *mauka*/makai jeep road. Major sites occur in this section. Sites 1005, 1006 and 1007 are fairly typical agricultural/habitation complexes. More *mauka*,

around 2000' Site 1008 and State Site 1056 are both major sites in this area, warranting preservation as probable *heiau*. In a large area *mauka* Site 1008 and including 1156 are major sites which have not specifically been recorded, many of these would probably warrant preservation.

Survey Section E (Coverage: *Mauka* area by helicopter, *makai* area below Site 1010 by foot-transects).

This survey section includes the western portion of Nakaaha with Kahikinui House at its SW corner. Site density is very high around Site 1010 which is a major HEIAU. Large sites occur just *makai* of Site 1010 becoming less dense below 1800' although some agricultural sites are present. Site density increases again, moving *makai* below 1600' in the area to the E and NE of Kahikinui House.

Survey Section F (Coverage: Helicopter transects only, no specific site recording)

This area which includes the *makai* area of Nakaahu and Kipapa is defined as the archaeological survey area for the 1960s Bishop Museum work done by Peter Chapman. Site density is high as documented in Chapman's settlement pattern map. Many habitation, agricultural, rock shelters and even *heiau* occur here between the *mauka* pipeline and Kahikinui House. Site density is high throughout this area.

Survey Section G (Coverage: Entirely covered by foot with brief helicopter flyover)

This survey area lies west of the Chapman section and generally has low site density. Scattered sites do occur in the SE Kipapa portion of this section with an excellent site complex occurring in a grove of wiliwili trees, approximately 600' east of the jeep road at approximately the 1700' elevation. This site was not recorded with a number. West of the jeep road and moving into the *mauka* sections there are few isolated agricultural and habitation features. And in the *mauka*-most portion sites are virtually absent.

Survey Section H (Coverage: Entirely covered by helicopter).

Survey Section H lies *mauka* of the Chapman survey area and extends to the 3200' elevation. Site density here is fairly low, with the only sites present occurring generally below the 2400' elevation. There are no sites recorded in the entire *mauka* portion of this survey section.

Survey Section I (Coverage: Entirely by helicopter)

Survey Section I lies west of a jeep trail and east of the rock wall *mauka* of the waterline. A single site was recorded in this project area at the *makai* end consisting of a habitation shelter. There is high confidence that the rest of the area is devoid of sites.

Survey Section J (Coverage: Entirely by helicopter)

Survey Section J comprises west of the stone wall and is completely defined on all other sides by jeep trails and extends *mauka* to 3200'. There is a single site recorded within this area consisting of a cave at the 2800' elevation. The survey crew did not land to examine this cave, so it is unknown if this is an archaeological site. There is high confidence that the rest of this survey section is devoid of sites.

Survey Section K (Coverage: Entirely by helicopter)

Survey Section K lies *mauka* of the waterline and water tank and is defined by jeep roads extending up to 3600' elevation. Site density is generally low in this section with the sites occurring at *makai* elevations below 2800'. There were only 3 sites recorded here; a platform, an enclosure and a rock shelter. Other recorded sites may be present in this area but there is confidence they are not plentiful.

Survey Section L (Coverage: Entirely by helicopter)

Section L is the SW corner of the project area as defined by jeep roads. Two sites were recorded in this project area. The terrain is fairly rocky. Other sites are most certainly present. Generally, site density is low and the sites consist of scattered habitation features with agricultural activities evident.

Survey Section M (Coverage: Entirely by helicopter)

Survey Area M comprises the area east and directly *mauka* of Luala'ilua Hills. It extends up to and slightly above the water line. Major sites and site complexes are present in this survey section. The largest site in the entire project area, Site 1043, lies in the *makai* of this portion east of Luala'ilua Hills. This area is densely concentrated with major sites, including another probable *heiau* just *mauka* of 1043 (Site 1042). This site complex extends eastward across the pipeline. Other major archaeological sites, including a large walled enclosure (Site 1038) and a site complex on an 'a'a bluff (Site 1035). These and other sites would clearly be appropriate for preservation. Because of the rockiness and rough terrain of this area it is certain that other sites occur in this section which were not recorded during the helicopter transect.

Survey Section N (Coverage: Entirely by helicopter)

Survey Section N is an area defined by the rock wall on the east side and the pipeline on the west side and extends up to and slightly above the water line at its *mauka* end. Three sites were recorded. The only major site is 1045, which is the eastern portion of the extensive complex centering on the *heiau* 1043. Because of the well-defined nature of this survey section, there is high confidence that all sites were located.

Survey Section O (Coverage: Entirely by helicopter)

Survey Section O is defined as the entire *mauka* portion of the project area extending up to the forest reserve. In the afternoon there are clouds in the upper part, but helicopter transects were performed in the morning and there is high confidence that there are no archeological sites here, with the possible exception of the dissected terrain around Kepuni and Kamole Gulches in the lower elevations of this section.

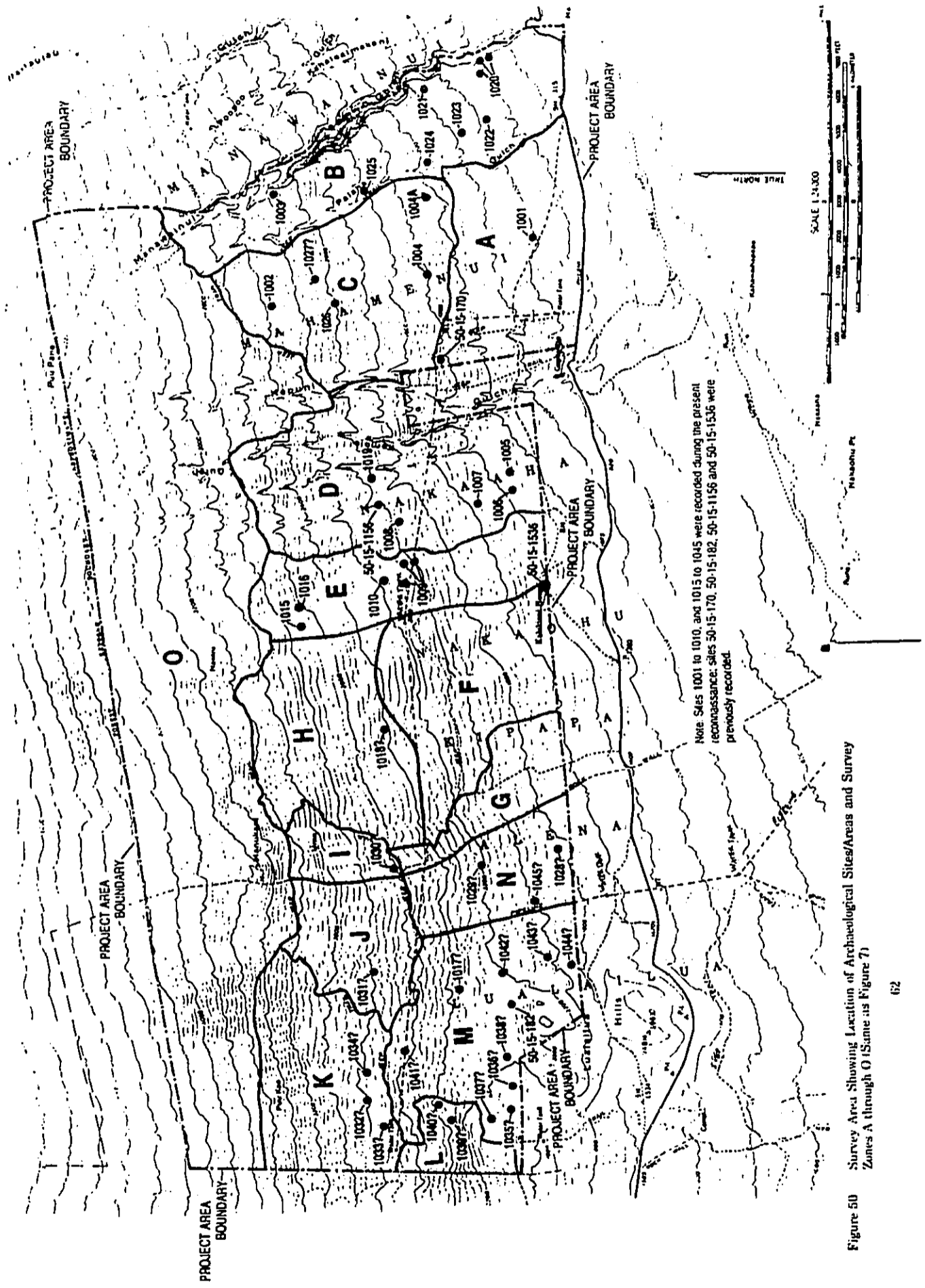


Figure 50 Survey Area Showing Location of Archaeological Sites/Areas and Survey Zones A through O (Same as Figure 7)

V. RECOMMENDATIONS

This reconnaissance project has attempted to define the areas of major site concentrations for the purposes of location of potential Homestead development in areas which would have the least possible archaeological impact. Clearly, other considerations such as drainage, water, accessibility, terrain must be considered, but from an archaeological perspective there appear to be some alternatives available. The following guidelines are presented in consideration of avoiding impact to the major archaeological sites present, as much as possible. Figure 51 shows areas of high site density designated by shading. Many areas not shaded on this map contain archaeological sites but density is comparatively lower and these sites generally consist of the more typical agricultural and habitation sites, rather than major structures such as *heiau*.

1. Survey Areas B and C, and the eastern portion of Survey Area A all contain low site density. There is confidence that most of the areas in B and C have been observed during this present reconnaissance. None of these sites appear to be of preservation value, given the normal criteria applied to these decisions. Therefore this area provides definite potential for Homestead development.
2. Survey Areas G and N, as well as the eastern portions of M and virtually all the lands comprised in Sections H, I, J, & K are either devoid of sites or have low site density. This provides another definite potential area for Homestead development. It is surrounded on the *makai* sides by major complexes to the east of Luala'ilua and in the Chapman survey area (Section F). However, large tracts of land containing low site density are available. Most of the sites recorded in these sections, with the exception of Site 1045 in the western portion of Section N would not be appropriate for preservation given the general standards applied to these decisions.
3. The entire *mauka* portion of the project area is devoid of archaeological sites. Homestead development could take place here if feasible by other considerations, with no impact to archaeological resources.

Whichever alternative is selected, it is recommended that Homestead development be preceded by more intensive archaeological investigation when the specific area is chosen. This investigation could range from archaeological walk-through to confirm absence of sites to complete inventory survey in areas where sites are known to be present. It is hoped that the reconnaissance results presented here will be useful in planning the use of this vast area and provides information which can assist in the design of future archaeological study. During the performance of this study we have learned that Kahikinui is the place of one of the major archaeological resources of the island of Maui and the State of Hawaii. Because of its long stable history of use as ranch lands archaeological sites have been preserved relatively intact, compared to many other areas of the islands.

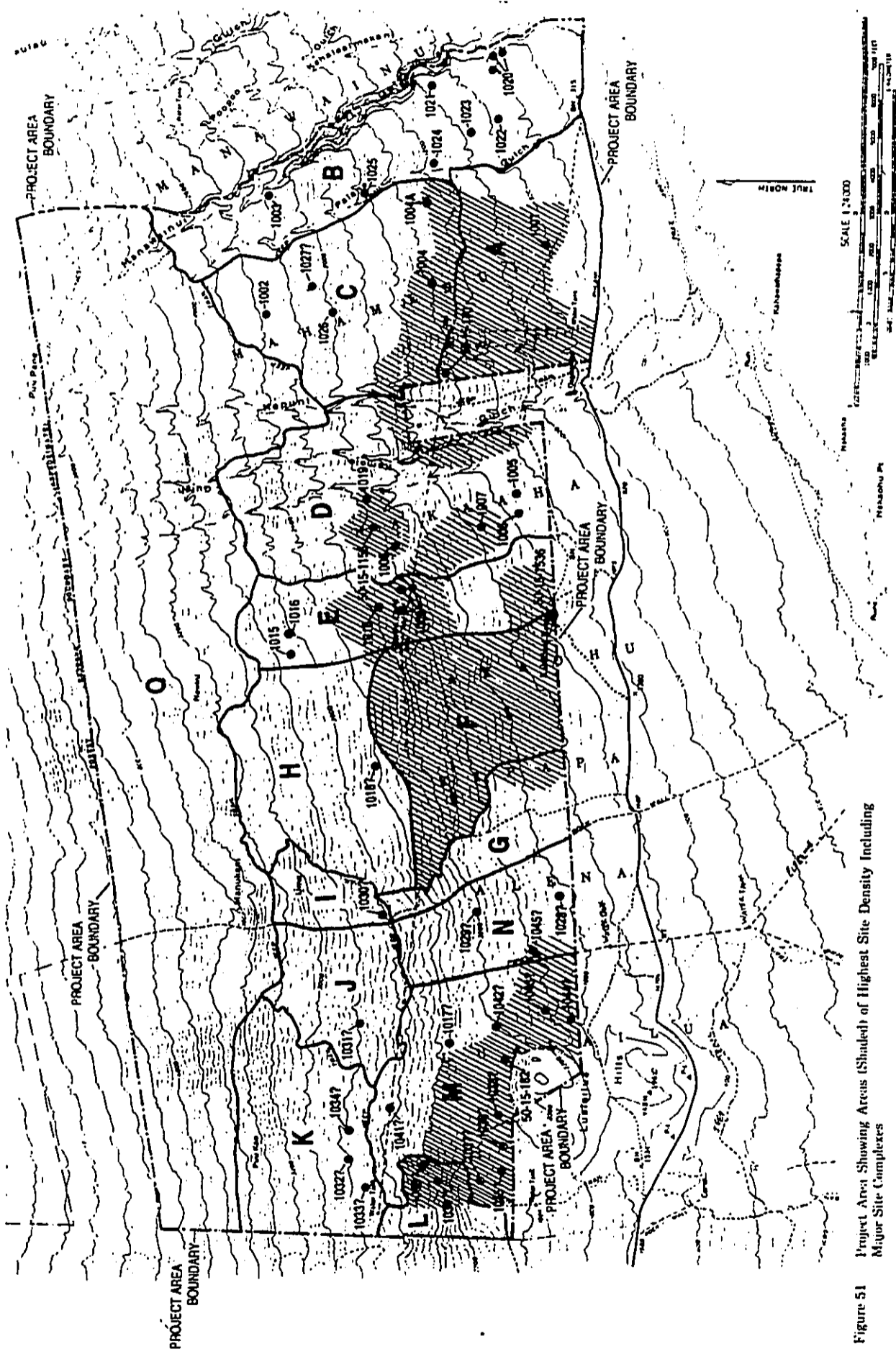


Figure 51 Project Area Showing Areas (Shaded) of Highest Site Density Including Major Site Complexes

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PHOTO APPENDIX

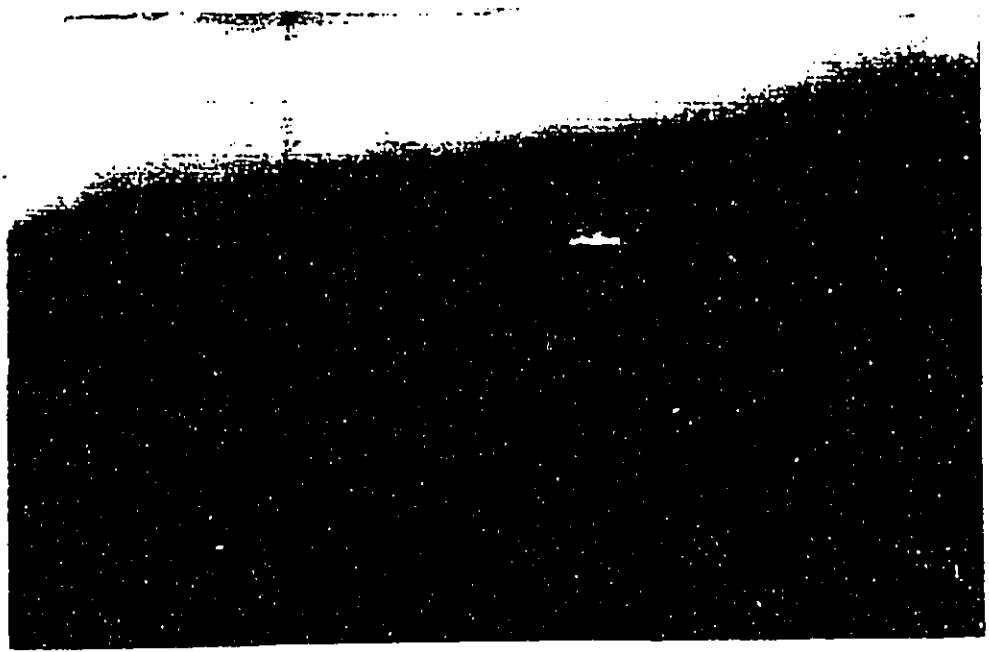


Figure 52 Dr. Michael Kolb and Pilot Duke Baldwin at a Site, Area 1001, Survey Section A



Figure 53 Site 1003 in Survey Section B

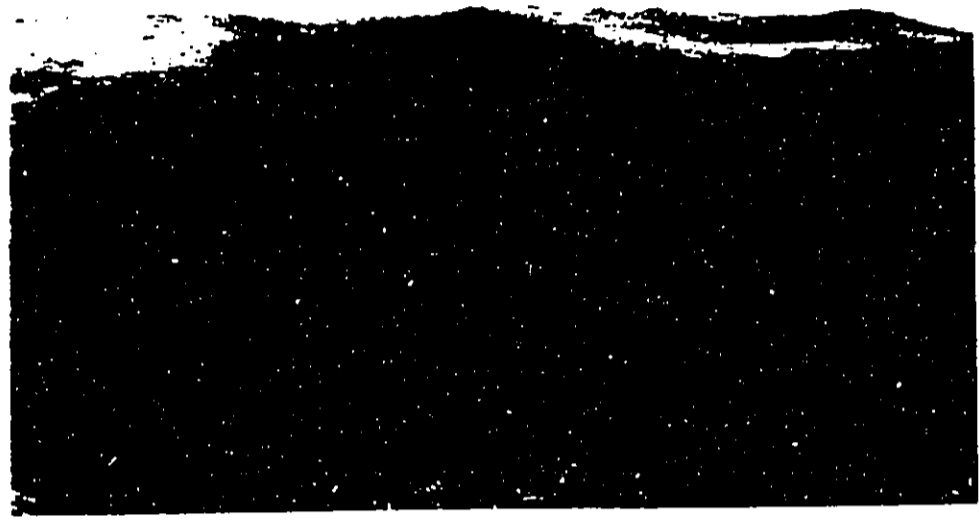


Figure 54 Site 1004, Survey Section C, *Mauka* Enclosure, View *Mauka*



Figure 55 Burial Mound (unnumbered site) at 1400' elevation in Survey Area C, East Transect Between 1004 and 1004A

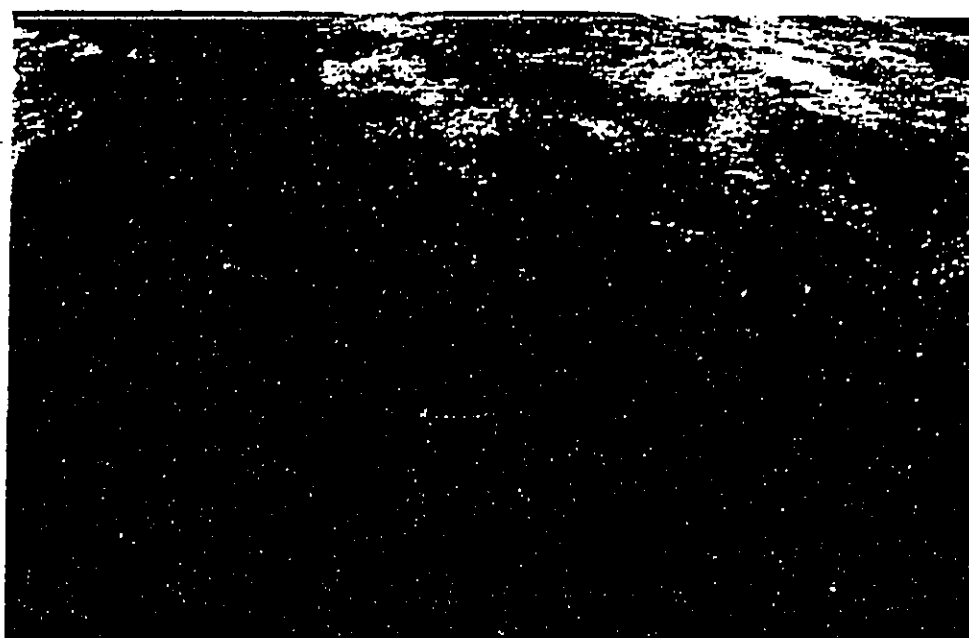


Figure 56 Notched *Heiau*. Nakaaha *Heiau*, State Site 1156, Site 1008, Survey Section D



Figure 57 Site 1035. Complex in Western Portion of Survey Section M

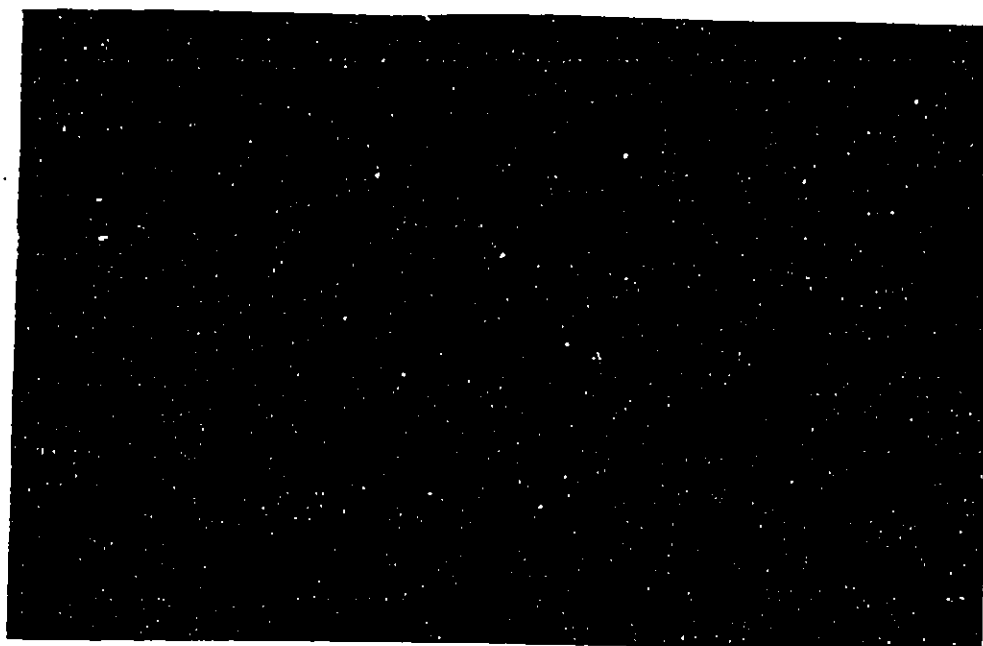


Figure 58 Notched *Heiau*?, Site 1043, Survey Section M, East of Luala'ilua Hills, View *Makai*

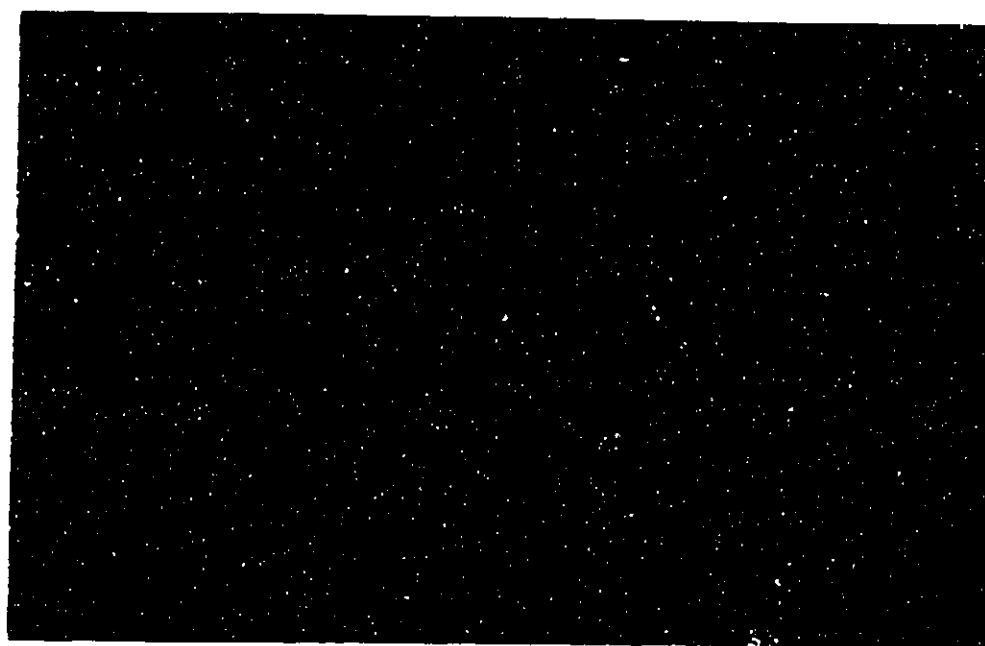


Figure 59 Site 1045, Survey Section N, View *Makai*

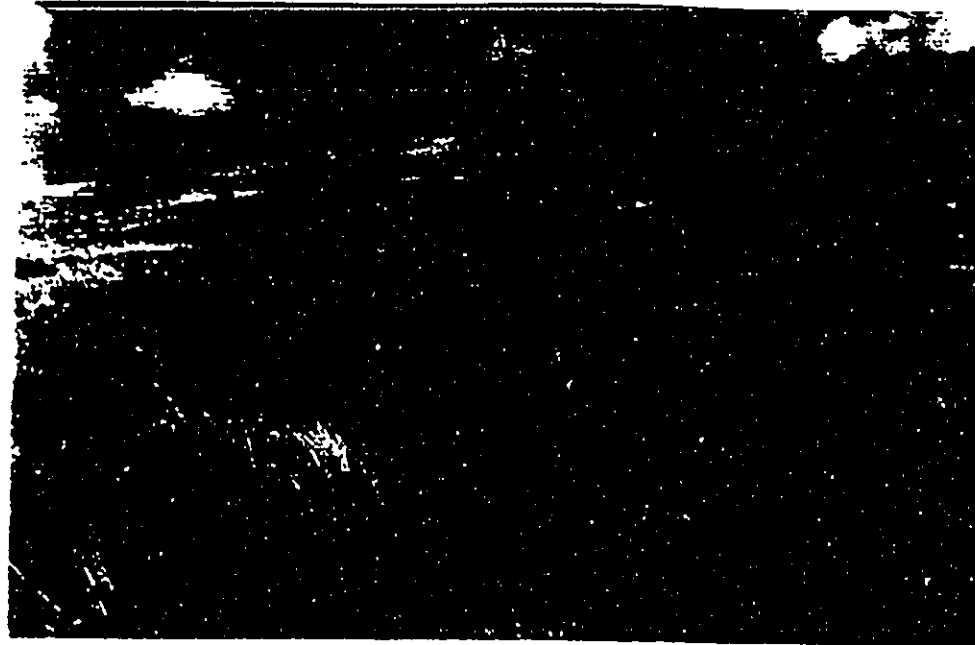


Figure 60 Sites in 1006-1007 Complex, Survey Section D

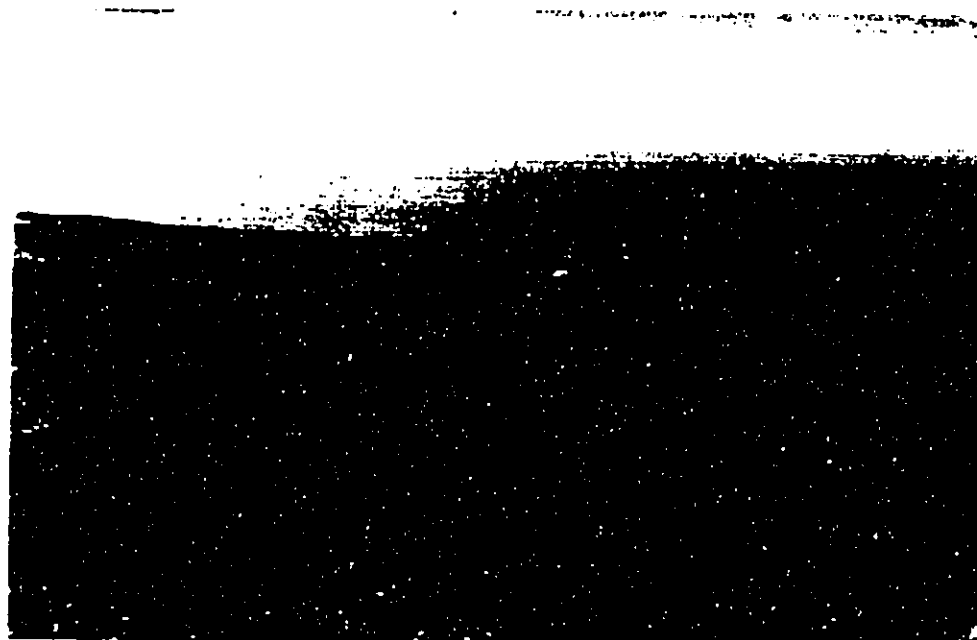


Figure 61 Site 1010, Notched *Heiau* in Survey Section E, Showing Notch, View to SE from *Mauka* Wall

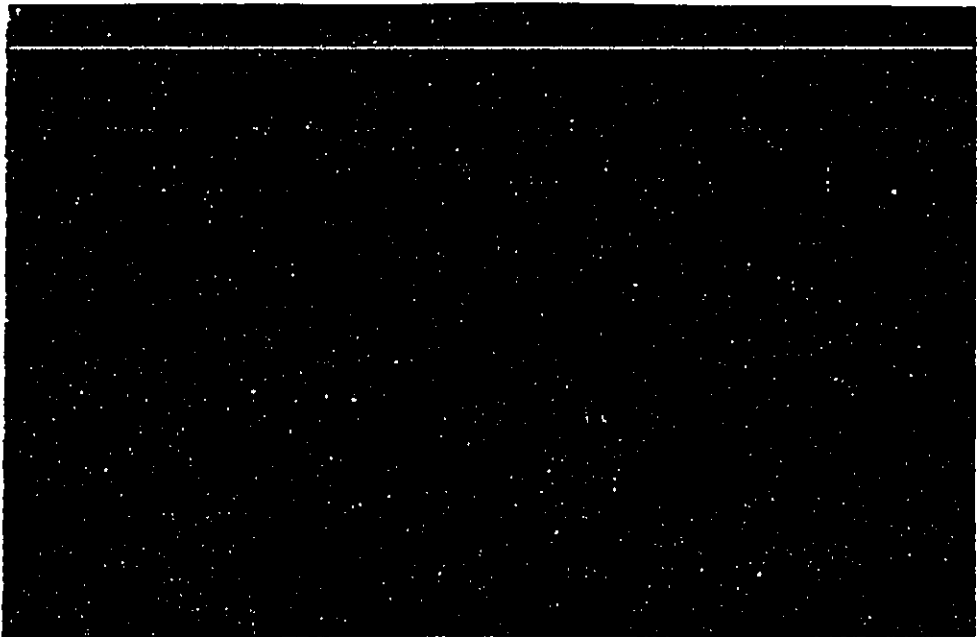


Figure 62 Double Notched *Heiau* in Northwest Portion of Survey Section F

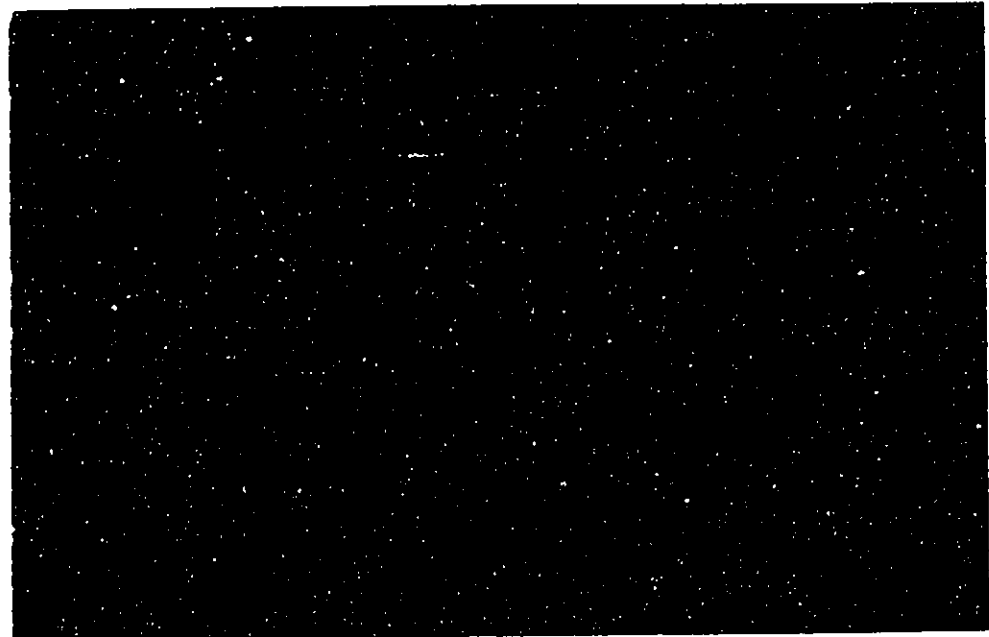


Figure 63 Site 1020 Complex, Survey Section B, Near Manawainui Gulch

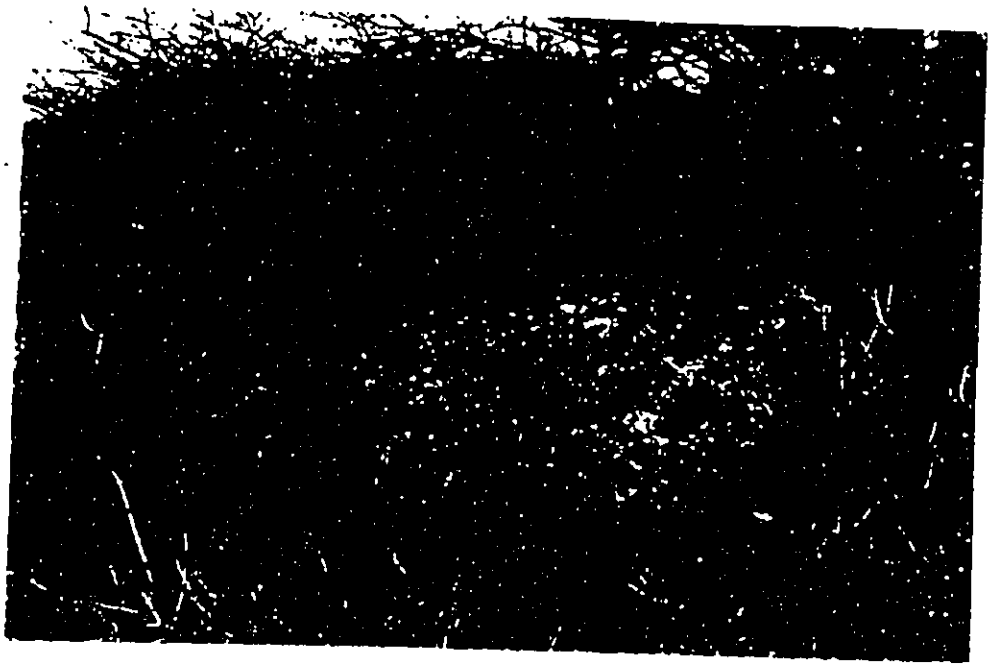


Figure 64 Platform Site (unnumbered) in SE Corner of Survey Section G

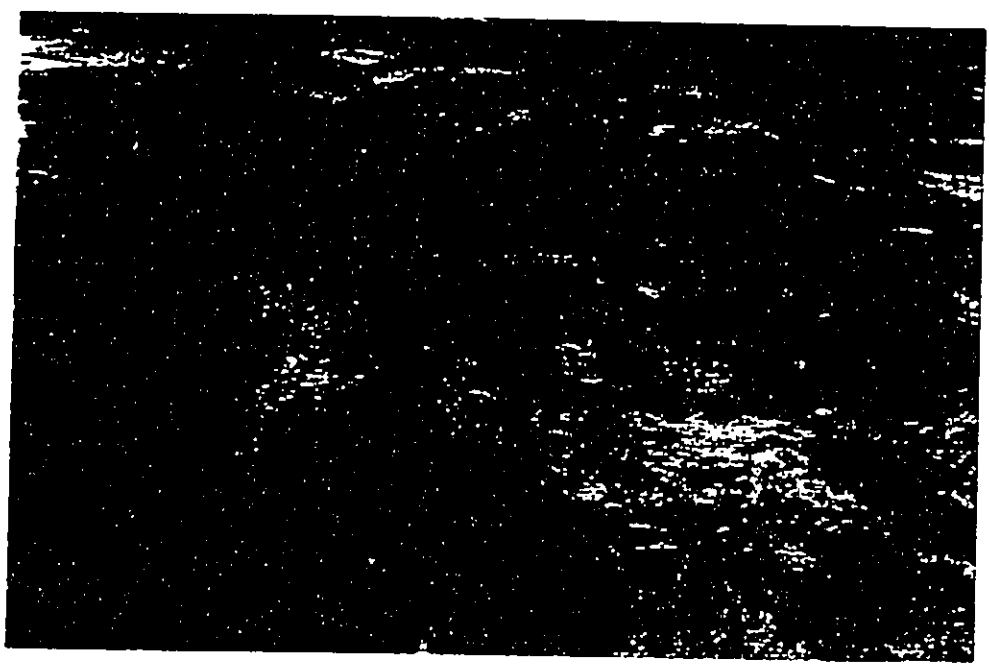


Figure 65 Unnumbered Sites in Western Portion of Survey Section A. Near Pūilani Highway. View Makai



Figure 66 Site 1038. Large Enclosure with Interior Sites in Survey Section M on the *Mauka* Site of Luala'ilua Hills, View *Makai*



Figure 67 Site 1033 at 2640' Elevation, Survey Section K, View SW