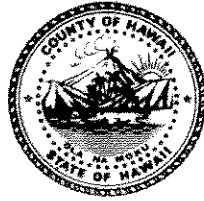


Harry Kim
Mayor



Christopher J. Yuen
Director

Brad Kurokawa, ASLA, LEED™ AP
Deputy Director

County of Hawaii

PLANNING DEPARTMENT

Aupuni Center • 101 Pauahi Street, Suite 3 • Hilo, Hawaii 96720
Phone (808) 961-8288 • Fax (808) 961-8742

February 3, 2006

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

Dear Ms. Salmonson:

Subject: Finding of No Significant Impact (FONSI)
Project: New Moon Foundation Contemplative Education Center in Bond Historic District
Tax Map Key: (3) 5-3-5: 5, 24, 39, 43, 45, 46 & 47 (pors.), North Kohala, Hawaii

The Hawaii County Planning Department has reviewed the comments received during the 30-day public comment period, which began on November 23, 2005 - OEQC Publication Date. The agency has determined that this project will not have significant environmental effects and has issued a FONSI. Please publish this notice in the February 23, 2006 OEQC Environmental Notice.

We have enclosed a completed OEQC Publication Form and four copies of the Final Environmental Assessment (FEA). If you have any questions, please call Jeff Darrow of this department at 961-8288 ext. 259.

Sincerely,

CHRISTOPHER J. YUEN
Planning Director

JWD:smn

P:\WPWIN60\CH343\2005\NewMoon-FEA-FONSI.doc

Encl. Final EA (4 copies)
Completed OEQC Publication Form
Project Summary (hard copy and on disk)

cc: Ron Terry, Geometrician Associates
Greg Mooers

OFFICE OF ENVIRONMENTAL
QUALITY CONTROL

06 FEB -7 P 3:30

RECEIVED

2006-02-23 HA FEA NEW MOON FOUNDATION CONTEMPLATIVE
EDUCATION CENTER IN BOND HISTORIC DISTRICT.

FEB 23 2006

FILE COPY

FINAL ENVIRONMENTAL ASSESSMENT

New Moon Foundation Contemplative Education Center in the Bond Historic District

TMK (3rd): 5-3-5:5, 24, 39, 43, 45, 46, & 47
'Iole, North Kohala, County of Hawai'i, State of Hawai'i

February 2006

Prepared for:

Hawai'i County Planning Department
101 Aupuni Street, Suite 3
Hilo, Hawai'i 96720

and the

Hawai'i State Department of Land and Natural Resources
State Historic Preservation Division
601 Kamokila Blvd., Rm. 555
Kapolei, Hawai'i 96707

OFFICE OF ENVIRONMENTAL
QUALITY CONTROL

06 FEB -7 P3:30

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2006 JAN 24 PM 1 20

PLANNING DEPARTMENT
COUNTY OF HAWAII



FINAL ENVIRONMENTAL ASSESSMENT
NEW MOON FOUNDATION
CONTEMPLATIVE EDUCATION CENTER IN THE
BOND HISTORIC DISTRICT

TMK (3rd) 5-3-5:5, 24, 39, 43, 45, 46, & 47
'Iole, North Kohala District, Island of Hawai'i, State of Hawai'i

APPLICANT:

New Moon Foundation
P.O. Box 1089
Kapa'au HI 96755

**APPROVING
AGENCY:**

Hawai'i County Planning Department
101 Aupuni Street, Suite 3
Hilo HI 96720

and

Hawai'i State Department of Land and Natural Resources
State Historic Preservation Division
601 Kamokila Blvd., Rm. 555
Kapolei, Hawai'i 96707

CONSULTANT:

Ron Terry Ph.D.
Geometrician Associates
HC 2 Box 9575
Keaau HI 96749

CLASS OF ACTION:

Action in State Historic District

This document is prepared pursuant to:
The Hawai'i Environmental Protection Act,
Chapter 343, Hawai'i Revised Statutes (HRS), and
Title 11, Chapter 200, Hawai'i Department of Health Administrative Rules (HAR).

TABLE OF CONTENTS

		ii
SUMMARY	PROJECT LOCATION, BACKGROUND AND DESCRIPTION	1
PART 1:	PROJECT LOCATION, BACKGROUND AND DESCRIPTION	1
1.1	Location, Land Ownership and Project Overview	1
1.2	Historical Background	3
1.3	Project Description	5
1.4	Related Activities on New Moon Property	6
1.5	Summary of Regulatory Requirements	7
1.6	Public Involvement and Agency Coordination	8
PART 2:	ALTERNATIVES	8
2.1	Proposed Project	8
2.2	No Action	9
PART 3:	ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION	9
3.1	Basic Geographic Setting	9
3.2	Physical Environment	9
3.2.1	Drainage, Floods and Hazards	9
3.2.2	Biology	11
3.2.3	Air Quality, Noise and Scenic Resources	11
3.2.4	Hazardous and Toxic Substances and Conditions	12
3.3	Socioeconomic and Cultural	12
3.3.1	Land Ownership and Land Use, Designations and Controls	12
3.3.2	Socioeconomic Characteristics	13
3.3.3	Archaeology, Historic Sites and Cultural Setting	27
3.4	Public Facilities	27
3.4.1	Traffic	31
3.4.1	Utilities and Public Facilities	32
3.5	Secondary and Cumulative Impacts	32
3.6	Required Permits and Approvals	32
3.7	Consistency With Government Plans and Policies	32
3.7.1	State Land Use Districts	34
3.7.2	Hawai'i County Zoning	35
3.7.2	Hawai'i County General Plan	40
PART 4:	DETERMINATION	40
PART 5:	FINDINGS AND REASONS	42
REFERENCES		
APPENDIX 1	FIGURES	
	1. U.S.G.S Map Showing Project Location	
	2. Tax Map	
	3a. Existing Site Photographs	
	3b. Aerial Photograph	
	4. Site Plan	
	5. Archaeological And Cultural Resources	
	6. Peak Hour Traffic Volumes And Traffic Assignments	
APPENDIX 2A	COMMENT LETTERS FROM AGENCIES AND ORGANIZATIONS	
	IN RESPONSE TO PRE-CONSULTATION	
APPENDIX 2B	COMMENT LETTERS TO DRAFT EA & RESPONSES (Final EA)	
APPENDIX 3	TRAFFIC IMPACT ASSESSMENT REPORT	
APPENDIX 4	ARCHAEOLOGICAL AND CULTURAL REPORT	
APPENDIX 5	BISHOP MUSEUM BIOLOGICAL SURVEY [PARTIAL]	

SUMMARY OF PROJECT, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Project Summary

The New Moon Foundation (NMF) proposes to use a portion of their property in and adjacent to the Bond Historic District in Kohala for a Contemplative Education Center (CEC). The CEC campus will involve adaptive re-use of the old Kohala Girls' School (KGS), built in 1874 by the missionary Elias Bond. The CEC will offer single- and multi-day programs, meeting and conference space, and special events focusing on healing encounters, leadership, land stewardship, and community needs for up to 80 residential and 20 day guests. Prior to acquisition by NMF, the KGS buildings had received little maintenance and were deteriorating rapidly. Since then, NMF has worked with architects and contractors, in consultation with the State Historic Preservation Division, to restore and renovate the various historic structures, spending over \$1,300,000 to stabilize the buildings. The educational heritage of the KGS provides an ideal match with NMF's mission of offering healing and educational programs. The CEC plans are in harmony with historic preservation efforts at KGS, as it is the exteriors of the KGS along with the interior of the Dining Hall that have been identified as the historically significant elements. Adaptation of the interiors of the other buildings, which had undergone a variety of substantial alterations prior to NMF's ownership, are no longer historically significant, is feasible and appropriate.

Short Term Impacts

Mitigation Measure: Construction activities will be limited to periods of low rainfall; cleared areas will be replanted or otherwise stabilized as soon as possible; and construction materials, petroleum products, wastes, debris, and landscaping substances (herbicides, pesticides, and fertilizers) will be prevented from blowing, falling, flowing, washing or leaching into drainages and streams.

Long Term Impacts

No sensitive biological, hydrological, or cultural gathering resources are present on the parcel. Impacts to historic sites are generally beneficial. Adverse impacts to archaeological sites can be mitigated through a data recovery and monitoring program proposed in the archaeological inventory survey.

PART 1: PROJECT LOCATION, BACKGROUND AND DESCRIPTION

1.1 Location, Land Ownership and Project Overview

The area under consideration in this EA consists of a total acreage of 13.649 acres and comprises portions of TMKs 5-3-05: 05, 24, 39, 43, 45, 46 & 47 (Figs. 1-2). The properties are owned by the New Moon Foundation (NMF), whose co-Executive Directors are Bennett Dorrance, Jr. and Thuy Fujimoto.

The proposed use of the property is for a Contemplative Education Center (CEC) that will offer single- and multi-day programs, meeting and conference space, and special events focusing on healing encounters, leadership, land stewardship, and community needs.

1.2 Historical Background

Reverend Elias Bond and his wife arrived in Hawai'i in 1841 with the ninth missionary company of the American Board of Commissioners for Foreign Missions (ABCFM). The Bonds were assigned the mission station of North Kohala, taking the place of Rev. Isaac Bliss and his family.

Bond undertook extensive construction at the mission station, which until this time consisted of just a main house, building a workshop and a number of outbuildings around the homestead compound. Meanwhile, Mrs. Bond began teaching classes for girls in her home in 1843.

At a September 1873 meeting of the three evangelical churches on the island of Hawai'i, Bond proposed the idea of raising funds to begin building the "necessary houses" to create a boarding school for the education of Native Hawaiian girls in "Christian living and housekeeping" (Bond 1875). In 1874 the carpenter D.F. Sanford from Waimea built the schoolhouse, designed by Bond, on land mauka of the Bond Homestead. The multi-purpose building served as classrooms, dining room and dormitory for the girls. The school opened in December 1874 with an initial enrollment of thirteen.

The Kohala Girls' School grew over the years as the Bonds added buildings to serve its expanded student body. In its heyday, the school had 60 students, with scholarships available for deserving girls. In 1926, it became a boarding school for girls of junior and senior high school age, with academic subjects taught at the public high school in Kohala. It was finally closed in 1955, although until recently the buildings continued to be used for various retreat and conference functions.

The Kohala Girl's School, the Bond Homestead, and Kalahikiola Church comprise a landscape with unique historical and architectural value (Figs. 3-4). Accordingly, the 50-acre site was listed on the Hawai'i Register of Historic Places in 1973 as the Father Elias

Bond District (Site 50-10-02-7100). In 1978, the historic district was nominated and subsequently accepted on the National Register of Historic Places.

In late 1998, New Moon LLC purchased about 48 acres of the Bond Historic District and 580 surrounding acres from the Bond family. The 1.58 acres containing Kalahikiola Church was not purchased, and would not be affected by the proposed action. The purchased area included 17 agriculture lots ranging between three and seven acres each. The area had been recently subdivided and was intended to be sold separately, with plans for a retreat center including numerous new buildings.

The purchase agreement with the Bond family established covenants specifying that real property located in the Bond Homestead is of historic significance and should be preserved and protected. The covenants further provided that personal property would be preserved and protected in accordance with the guidelines and recommendations of the National Trust for Historic Preservation, and that the personal property would not be removed from the Bond Homestead, with the exception that any property deemed of limited significance could be donated to the Mission House Museum, Lyman Museum or similar Hawai'i-based museums.

In August 2000, the properties were donated to the New Moon Foundation (NMF), a private non-profit operating foundation established to facilitate self empowerment and self sufficiency by offering healing and educational programs and grants; providing stewardship of its lands by honoring natural, historical and cultural essence; and promoting a mutually nurturing relationship between land and community.

Prior to acquisition by New Moon Foundation, the Kohala Girls' School buildings received little maintenance and were deteriorating rapidly. Since then, NMF has been working with its architects and contractors, in consultation with the State Historic Preservation Division (SHPD), to restore and renovate the various historic structures, spending over \$1,300,000 to stabilize the buildings. It is important to note that the structural historic preservation efforts, as substantial as they are, have been guided by consultation from SHPD and are exempt from the need for environmental assessment under Chapter 343, HRS.

The current focal point of NMF's efforts is to develop an adaptive re-use for the Kohala Girls' School (KGS) facilities as a Contemplative Education Center (CEC), as described below. The KGS, with its long history of functioning as an education center, provides an ideal match with NMF's mission of offering healing and educational programs. The CEC plans are in harmony with historic preservation efforts at KGS, as it is the exteriors of the KGS along with the interior of the Dining Hall that have been identified as the historically significant elements. Adaptation of the interiors of the other buildings, which have undergone a variety of substantial alterations in the last 30 years and are no longer historically significant, is feasible and appropriate. The proposed Contemplative Education Center will play an essential role in supporting New Moon Foundation's mission to serve its community and the world at large.

1.3 Project Description

The Contemplative Education Center (CEC) will focus on the following program areas:

- Healing encounter programs that increase participants' ability to authentically relate to others.
- Inspired leadership programs that increase participants' ability to wholeheartedly share their passion and gifts with others in a way that benefits all concerned.
- Land stewardship programs that increase participants' ability to relate in a more wholesome way to the earth and the lives that make up the natural landscape and to contribute to the self-sustainability of land-based communities.
- Programs that increase people's ability to understand history – the roots of the present - in order to more appropriately and authentically relate and respond to current events.

The CEC will offer single- and multi-day programs, meeting and conference space, and special events. It is anticipated that a maximum of approximately 60 residential guests can be accommodated at any time in the existing facilities, and 20 more residential guests in tents on wooden platforms in an area outside of the Historic District. There is classroom space for approximately 20 additional day guests, who would already live or have lodging elsewhere on the island.

The KGS facilities would also be available to accommodate up to approximately 200 people for special events such as guest lectures and fairs.

NMF estimates the need for approximately 8 to 22 full-time skilled positions at the CEC, some of which may be filled by interns receiving education in green-facility operations and management. This estimate varies considerably due to potentially supplementing officially paid positions with a work-study program as well as hiring part-time positions. This estimate does not include contracted work nor supplemental support from the offices of NMF, which already has onsite staff. The 22 positions are comprised of:

- 2 - Programs and Marketing
- 2 - Administration
- 18 - Operations (a combination of team leaders and their subordinates)

The CEC is proposed as a 24-hour facility hosting programs and guests overnight. Office hours for registration, check-in, check-out, and other administrative functions are currently expected to be from 7:30 am to 6:30 pm, although extended hours may be required. In general, gates to the CEC and parking areas will be closed after office hours and accessible only by staff unless there are evening events such as periodic, locally-based programs or lectures.

The adaptive re-use of the Kohala Girls' School requires that the buildings be altered in order to support the use as an educational center and to meet today's ADA and public use standards; this must be successfully accomplished while retaining the historic character of the KGS. To this end, the CEC will provide sleeping accommodations in the Carriage House, Infirmary, Carter Cottage,

and Dormitory (see Fig. 4). The Industrial Building will be used for dining facilities, classrooms, treatment rooms, computer support center, staff room and offices. A meditation hall, bookstore, and support offices will be established in the Chapel, while the Bake House will be used for support activities. An outdoor dining pavilion with open decking will be constructed adjacent to the Industrial Building. All proposed improvements will be coordinated with the SHPD.

In the surrounding Historic District land that will be the 14-acre campus of the CEC, a service road to the dining hall, a golf cart parking area, a rain shelter, an amphitheatre, walking paths, and fire hydrants will be built and provided. Also built will be various retaining walls, as well as a fountain and accompanying water features that will serve to supply water to plantings and agriculture in the KGS area.

The landscaping in the campus area will minimize the removal of trees and plants already present unless deemed invasive, such as banyan, guava, and African tulip. New plantings will include historically documented plants in the area, endemic and native species, as well as species that are used for healing and sustenance (such as an herb garden). The *lo'i* in the gulches will be restored in a historically and culturally sensitive manner, in consultation with cultural experts and the State Historic Preservation Division. Agricultural activities on land below the church pond down to the homestead area will be re-established to supply food for the CEC.

Still within the Historic District but beyond the CEC's campus, there will be a nursery and gardens below the church pond, and walking paths between the KGS and the Bond Homestead. The existing citrus orchard established by the Bond family will be retained and rehabilitated.

South and east of the Historic District, immediately across the access road, an approximately 10,000 square foot parking area, a Support Center (SC), a hydro-electric facility, a stone campfire pit that will be located near the SC (along with appropriate fire extinguishing facilities), a water storage/pool, and a Contemplative Hall will be built in order to support the CEC, its programs, and New Moon Foundation's operational and land stewarding needs.

On the north end of the parking lot, the Support Center will provide registration and administration offices, bathrooms, maintenance and grounds keeping areas, storage areas, and land management offices and meeting rooms. This facility will not only serve the CEC but will also support the existing and future administration, agricultural, and land management activities associated with NMF and its stewardship of the land.

The hydro-electric facility will be established south (mauka) of the parking area so that the water may then supply the agricultural needs in the CEC area. The 30 KW hydroelectric plant and a backup diesel generator will be installed in a small building along with the appropriate electrical controls. The water sources for the hydroelectric plant are existing shallow tunnels tapping perched groundwater that will be conveyed via pipe line to a central reservoir. A 10-inch penstock will convey the water under pressure to the power plant and also to fire hydrants located on the grounds of the KGS. The power system will be automatically controlled to shut the power plant down when the reservoir gets too low, at which time the diesel generator will start. It is intended that there will always be fireflow available. Water discharged from the plant will be restored to the water system

supplying the old Kohala Mill site for agricultural uses. The hydro facility may be supplemented by solar, photo/voltaic, propane, and/or wind-generated power. A pool area that functions for water collection will be located below the hydro-electric facility.

The Contemplative Hall will be built mauka of the CEC and the Historic District. It will provide a quiet location for more intensive programs as well as offer classrooms/meeting rooms accessible from the parking lot without a need to walk through the CEC campus. This can serve periodic, locally based programs.

Other physical changes include underground electricity/telephone utility lines from the existing lines on the access road to the KGS site, and any road improvements required as conditions to the Special Permit process, at the intersection of the access road and State Highway 270.

All historic buildings in the Bond Historic District, which include the Girl's School and associated buildings and the Homestead area, are to be preserved and restored as part of the plans. Only very limited construction will occur within the actual Historic District.

1.4 Related Activities on New Moon Property

It is important to emphasize that this Environmental Assessment applies to currently planned activities within the Bond Historic District that are part of the Contemplative Education Center (CEC). It also provides environmental documentation for activities in this and adjacent State Land Use Agricultural District land that will house or support the CEC and thus require a Special Use Permit from the County of Hawai'i. To ensure that environmental impacts of the project are provided a proper context in the framework of other foreseeable activities in adjacent land, it is useful to review New Moon Foundation's other plans. It should be noted, however, that these activities are not directly related to the proposed CEC activities at the Kohala Girls' School. None are currently subject to the need for a Chapter 343, HRS, Environmental Assessment or a Special Permit.

New Moon Foundation considers itself the land steward of its holdings and has numerous long-term projects in planning and/or in progress in order to fulfill this role. NMF has the mission to honor the entire 'Iole ahupua'a as a sanctuary for people, plants and animals. The holdings of NMF include over 600 acres that extend from below Highway 270 to as high as 1,800 feet above sea level. NMF lands outside of the Historic District have traditionally been used for agricultural and ranching activities, including sugar and macadamia nut cultivation. In light of this history, NMF is currently continuing the pre-existing cattle ranching leases and about 300 acres of macadamia nut. It is NMF's ultimate plan to diversify and increase its agricultural pursuits while entering into a land restoration program for the majority of its holdings. Activities include establishment of forests for watershed and wildlife habitat, reintroduction of native and/or endangered species, taro *lo'i* and gardens, community based diversified organic agriculture, ponds for

wetland habitats, trails for hiking and bicycling, and camping and outdoor educational activities.

NMF is currently maintaining the Bond Homestead buildings, last inhabited in the early 1920s, until the proper steps can be taken for long-term restoration. Proposed activities are limited to stabilization of the buildings and necessary repair and maintenance of the roof and exterior surfaces. All of the contents of the buildings have been inventoried and will be preserved and protected in accordance with the agreement with the Bond family. Access to the Bond Homestead is limited to educational and research activities on a case-by-case basis approved by NMF.

In the future, the vision for the Bond Homestead is to become something beyond a tourist attraction/standard museum. Not only are the buildings and their contents too sensitive for the ongoing impact of daily tours, but their unique nature creates a potential opportunity for a much more significant and meaningful experience of history and its relevance in today's world. It is therefore NMF's intention to create a community/cultural area that includes not only the Homestead and its missionary history, but other cultural histories as well with a focus on the Hawaiian/host culture. NMF will develop a board/organization with the knowledge and skills to care for the buildings and will work to involve the community and integrate the Bond Homestead into a mutually supportive environment centered around healing and educational experiences. Efforts will become more directed at the Bond Homestead upon completion of the CEC, and the CEC can serve as both an example of NMF's commitment as well as the staging area to generate interest and funding for this long-term project. Any required permits and/or approvals will be secured by the affiliated board/organization.

The NMF administrative offices are currently located in the Bond Homestead, formerly used by the Bonds for the same purpose. These offices will be relocated when NMF acquires a suitable location (the Support Center), and as the organizational entity that will focus on care for the Bond Homestead comes into being and requires offices in the Bond Homestead. Parking for the offices is currently in between the offices and the homestead's main buildings. The parking will most likely be relocated to an area that will not impact the visual aesthetic as the treatment of the Bond Homestead is decided upon.

1.5 Summary of Regulatory Requirements

This Environmental Assessment (EA) process is being conducted in accordance with Chapter 343 of the Hawai'i Revised Statutes (HRS). This law, along with its implementing regulations, Title 11, Chapter 200, of the Hawai'i Administrative Rules (HAR), is the basis for the environmental impact process in the State of Hawai'i. The EA is being prepared because of the adaptive re-use and modification to grounds and facilities within a designated Historic District, one of nine triggers in the EIS law. The EA is also serving as an environmental background report for the Special Permit, issued by the Hawai'i County Planning Commission.

By arrangement with the State Historic Preservation Division and by virtue of its experience with the EA process, the Hawai'i County Planning Department is serving as approving agency for the EA.

An EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria. Part 5 lists these criteria and the preliminary findings. The Hawai'i County Planning Department in consultation with the State Historic Preservation Division will make final findings, and if no impacts are considered significant, will issue a Finding of No Significant Impact (FONSI).

1.6 Public Involvement and Agency Coordination

The following agencies and organizations have been consulted during the Environmental Assessment Process:

County:

Planning Department	County Council
Department of Water Supply	Department of Public Works

State:

Department of Land and Natural Resources, Historic Preservation Division
Department of Land and Natural Resources, Division of Forestry & Wildlife

Private:

Sierra Club
Kūpuna of Kohala
Ka'ahumanu Society
Kohala Hawaiian Civic Club
Kohala Senior Citizens Organization

Copies of communications received during preconsultation are contained in Appendix 1A, and results of extensive community contacts and interviews are contained in Section 3.3.3.

A total of three written comments were received on the Draft EA. These comments and the responses to them are contained in Appendix 2B. Various places in the EA have been modified to reflect in the comment letters; additional or modified text is denoted by double underlines, as in this paragraph.

PART 2: ALTERNATIVES

2.1 Proposed Project

The proposed project is described in Section 1.1 above and illustrated in Figures 1-4. The applicant intends to begin the project as soon as the Special Permit and Building Permits are obtained. Uncertainties related to the duration of these permit processes preclude specification of an exact timetable, but it now appears that construction may begin as soon as Spring of 2006.

2.2 No Action

Under the No Action Alternative, the property would remain as-is, with the historic buildings unoccupied and unused. This EA considers the No Action Alternative as the baseline by which to compare environmental effects from the project.

No other Alternatives have been considered by the New Moon Foundation or are addressed in this EA.

PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

3.1 Basic Geographic Setting

The subject property is located at approximately 600 feet in elevation, mauka of Akoni Pule Highway (State Highway 270), about 4,000 feet southeast of the center of Kapa'au town (Fig. 1). The moderately sloped site was for decades a missionary and educational center, with outlying agricultural fields, as is evident in the current landscape of graceful old buildings, orchards and stately trees (see Fig. 2 for aerial and site photos). The surface geology is derived from the extinct Kohala volcano (Morris and Wolfe 1996), and, aside from the gulches, the area is blanketed with rich Ainakea silty clay loam soil (U.S. Soil Conservation Service 1973). Annual rainfall averages approximately 50 inches (U.H. Hilo-Geography 1998:57).

3.2 Physical Environment

3.2.1 Drainage, Flooding and Hazards

Environmental Setting

The project site is designated "X", defined as areas outside the 500-year floodplain, on the Flood Insurance Rate maps (FIRM).

The entire Big Island is subject to geologic hazards, especially lava flows and earthquakes. The project site is located in Lava Flow Hazard Zone 9 (on a scale of ascending risk 9 to 1). In this least hazardous zone of the Big Island, there is almost no risk of lava inundation over short time scales.

In terms of seismic risk, the entire Island of Hawai'i is rated Zone 4 Seismic Probability Rating (Uniform Building Code, Appendix Chapter 25, Section 2518). Zone 4 areas are at risk from major earthquake damage, especially to structures that are poorly designed or built.

Impacts and Mitigation Measures

In general, geologic and drainage conditions impose no substantial constraints on the project. All structures will conform to the Uniform Building Code. Although the project is located in an area exposed to a certain amount of hazard from earthquakes, the project presents no additional hazard to the public and is not imprudent for the landowner.

3.2.2 Biology

This area of Kohala probably sustained a mesic lowland forest prior to the arrival of Polynesians (Cuddihy and Stone 1990), whose dryland and *lo'i* taro patches, forest

resource procurement, and the introduction of alien trees, domesticated cultigens and animals substantially altered the environment (Tuggle and Tomonari-Tuggle 1980). The sugar plantations, ranching, tree harvesting, and orchards of the European and Asian peoples who arrived in the 19th and 20th century again modified the environment (Tomonari-Tuggle 1988).

Flora and Fauna

The site is now a managed landscape of old plantings and current agriculture, including typical weedy spots in waste areas. The entire Bond Historic District was inspected for biological resources by experts from the Bishop Museum in 1999. A portion of their report is attached as Appendix 5 and summarized below.

The two-day survey involved specialists in vertebrates, invertebrates (snails and insects), and plants. The goal of the survey was to get a reasonable picture of the taxa present in the 50 acres, and not 100 percent coverage, as the area has been intensely modified and is not particularly sensitive. Coverage was biased towards streamside areas where native species may have persisted.

The conclusions of the survey were that the Bond Historic District was found to be almost entirely dominated by alien species. Among the vertebrates recorded, only two species, the Hawaiian Hawk (*Buteo solitarius*, which sometimes perches in macadamia nut trees, according to caretakers) and the Black-crowned Night Heron (*Nycticorax nycticorax hoacii*) were native. The vertebrate survey did not record Hawaiian hoary bats (*Lasiurus cinereus semotus*), though they are known to frequent macadamia orchards. This species generally occurs in low numbers and is difficult to find. A large variety of alien birds are present. All the snails and slugs recorded were alien. More than 90 percent of insects were alien as well, with a few common natives. There were no native plant communities and very poor representation from native plants, with six indigenous species: palapalai fern (*Microlepia strigosa*), pakahakaha fern (*Lepisorus thunbergianus*), morning glory (*Ipoemoea indica*), popolo (*Solanum americanum*), a sedge (*Pycreus polystachyos*), and itchy crabgrass (*Digitaria setigera*). The vegetation is dominated by many escaped aliens and a number of fine ornamental specimens.

Follow-up walk-through surveys by Geometrician Associates in 2001 and 2004 indicated no substantial changes from the conditions documented in the Bishop Museum report.

The site does not appear to contain any valuable ecosystems, or to offer suitable habitat for or harbor any rare, threatened or endangered species. Aside from the Hawaiian Hawk, and possibly the Hawaiian hoary bat, which are both wide-ranging throughout the island of Hawai'i, no listed, candidate or proposed endangered animal or plant species were found or would be expected in the area. In terms of conservation value, no botanical or zoological resources requiring special protection are present.

Impacts and Mitigation Measures

Because of the lack of native ecosystems and threatened or endangered plant species, and the lack of plans to alter habitat, no adverse biological impacts would occur as a result of the proposed improvements and uses.

3.2.3 Air Quality, Noise, and Scenic Resources

Environmental Setting

Air pollution in windward North Kohala is minimal, and is mainly derived from volcanic emissions of sulfur dioxide, which convert into particulate sulfate and produce a volcanic haze (vog) that very occasionally may blanket the district. The persistent tradewinds keep this area relatively free of vog for most of the year.

Noise on the site is very low and is derived from natural sources, (e.g., wind in trees), agricultural activities on adjacent parcels, and occasional motor vehicles. The nearest sensitive noise receptors is the Kalahikiola Church, about 800 feet from the KGS. No residences or other sensitive uses are present in the area immediately near the proposed improvements.

The area shares the quality of scenic beauty with much of North Kohala. The Hawai'i County General Plan contains Goals, Policies and Standards intended to preserve areas of natural beauty and scenic vistas from encroachment. The Plan does not contain any specific references to this area.

Impacts and Mitigation Measures

The project would not affect air quality or noise levels, except for very minor and brief effects during construction. No substantial impact to scenery is expected because the improvements will basically preserve existing landscapes and uses.

3.2.4 Hazardous and Toxic Substances and Conditions

Based on onsite inspection and information on file, it appears that the site contains no hazardous or toxic substances and exhibits no other hazardous conditions. In order to ensure that construction-related damage is avoided or minimized, the following will be implemented:

Mitigation Measure: Construction activities will be limited to periods of low rainfall; cleared areas will be replanted or otherwise stabilized as soon as possible; and construction materials, petroleum products, wastes, debris, and landscaping substances (herbicides, pesticides, and fertilizers) will be prevented from blowing, falling, flowing, washing or leaching into drainages or streams.

3.3 Socioeconomic and Cultural

3.3.1 Land Ownership and Land Use, Designations and Controls

Existing Environment

The area under consideration in this EA consists of a total acreage of 13.649 acres comprising portions of TMKs 5-3-05: 05, 24, 39, 43, 45, 46 & 47, all owned by NMF (Figs. 1-2). Surrounding land is owned by NMF, New Moon LLC, and other private landowners. Other than historic preservation activities, the land use in this and surrounding properties is agriculture.

Zoning is Agricultural, 20-acre minimum lot size (A-20a). The State Land Use District is Agriculture. The Land Use Pattern Allocation Guide Maps identify the area, along with most of windward North Kohala, as Important Agricultural Lands. The site is not within the Special Management Area.

Because the proposed use includes uses that are not specifically permitted in the State Land Use Agricultural District, a Special Permit from the Hawai'i County Planning Commission will be required. The permit includes analysis that examines whether the proposed use will be compatible with surrounding agricultural uses and will not adversely affect agriculture (see Section 3.7.1 for detailed discussion). The Planning Commission may impose conditions to ensure that the use conforms with the provisions of Chapter 205, Hawai'i Revised Statutes. In the context of New Moon Foundation's existing activities, which support and promote sustainable agriculture and ongoing agricultural activity, the use appears compatible.

3.3.2 Socioeconomic Characteristics

Existing Environment: Social Characteristics

The project site is within the *ahupua'a* of 'Iole in the North Kohala District of the island of Hawai'i. After a period of declining population related to the demise of the sugar industry, the former economic mainstay of the area, population growth has been steady since 1980 in this rural area. Nearby towns include Kapa'au (pop. 1,159, according to the 2000 U.S. Census of Population) and Hawi (pop. 938). The socioeconomic characteristics are typical of the multi-ethnic island of Hawai'i.

Impacts and Mitigation Measures

No adverse socioeconomic effects would result. The project would produce a locally substantial number of jobs and training activities, and would provide a venue for local cultural events, leading to beneficial socioeconomic impacts. No mauka-makai access trails are present and no diminution of recreational resources or blocking of trail access, would occur.

3.3.3 Archaeology, Historic Sites and Cultural Setting

The project has been designed to specifically promote historic preservation by providing a vital adaptive re-use of historic structures and landscapes in order to sustain their presence into the future and provide the public the benefit of visiting and utilizing the areas. Although less obvious, there are other cultural and archaeological resources in and immediately adjacent to the Historic District. The discussion in this section first focuses on the architectural resources, then provides an extended historical discussion as a context for assessing other cultural and archaeological resources, and then provides a unified discussion of the project's impact to the Bond Historic District.

3.3.3.1 Architectural Resources

Existing Architectural Resources

The locations of the structures in the Bond Historic District are depicted of Figure 4, and selected structures are shown in photographs in Figure 2. Most of the buildings were constructed between 1874 and 1921.

Reverend Bond adapted construction techniques from his native New England to Hawai'i's novel environment and available materials. Although not formally trained in building, he was remarkably successful in Hawaiian and New England styles and figuring out his own methods to build not only structures but also furnishings. Major building events (i.e., construction or significant alteration of structures or features) associated with the Kohala Girls' School are summarized in Table 1, which includes only standing structures. Specific dates of construction or alteration are included when documented from primary sources otherwise general time ranges are given based on currently available information.

Table 1
Chronology of Major Building Events, Extant Resources Only

Structure or Feature	Building Event	Date
Bake house	constructed	?
Carriage house	constructed	1884
Carter cottage	constructed	1916
Girls' school house (old dormitory)	constructed	1874
Girls' school house (south & east wing additions)	remodeled	1890
Girls' school house (addition above kitchen)	remodeled	1891
Girls' school house (fire)	damaged	1894
Girls' school house (bathroom addition)	remodeled	Ca. 1900
Industrial building (dining hall)	constructed	1921
Infirmary	constructed	?
New school house (current chapel)	constructed	1878
New school house (two room addition)	remodeled	Pre-1907
New school house (chapel)	remodeled	1950?

Prior to New Moon's tenure on the property, modifications and alterations to building interiors and exteriors continued well into the 1980s when the last series of repairs and remodels were done. Between that time and 1998, when the property was acquired by New Moon, the Kohala Girls' School buildings received little maintenance and were deteriorating rapidly. Since then, NMF along with its architect Glenn Mason, AIA (1999 to present), Manoske Construction, LLC (1999-2000) and Kikiaola Construction Company (2002-present), have been working in consultation with the State Historic Preservation Division (SHPD) to restore and renovate the various historic structures, spending over \$1,300,000 to stabilize the buildings. This has included major roof repairs, foundation reinforcement, repainting all buildings, and replacement of rotting boards, beams and windows.

Impacts and Mitigation Measures to Cultural and Historic Resources: Architectural Resources

As discussed in Section 1, the stabilization and restoration activities at the Kohala Girls' School have been guided by consultation with the State Historic Preservation Division and are the type of activities that do not require an Environmental Assessment, i.e., exempt activities. Prior to these efforts, the buildings were barely being maintained and were continuously deteriorating. Water drainage was not being controlled by gutters or site topography, and rain water running off the roof and flowing through the site has been damaging building materials for many years. At the Old Dormitory building, problems with the siding allowed water to infiltrate and damage interior elements. Building renovations have included work to foundations, new roofing, flashing, gutters and downspouts, and the addition of vapor barriers into the exterior walls where needed to help control water infiltration. Building exterior work has generally be restorative. The goal has been to retain historic material, and when replacements were necessary, to replicate the original in shape, type, and material, in order to allow the structures to appear very much as they did in 1921.

The adaptive re-use of the KGS for the Contemplative Education Center will not involve any adverse effects to the architectural values of the structures. Interior work will retain original walls and materials wherever possible, and interior additions or renovations will not affect the exterior building appearance. However, the proposed reuse would increase pedestrian and vehicle traffic on the entire site. In order to ensure that vehicles do not overwhelm the site and detract from its character, off-site parking and a shuttle service will be provided, with only a drop-off area and limited parking at the KGS site itself.

The landscaping work described in Section 1, including orchards, ponds, and gardens, will help restore the landscape to the general feeling of the historic period. Such efforts will enhance, and not adversely affect, the values of the Historic District.

It is important to point out that without an entity such as New Moon stepping in to restore the property, it is likely that the buildings would have collapsed for want of repair and the grounds become completely overgrown. Adaptive reuse is a vehicle that will not only

allow New Moon Foundation to achieve its mission, but will also be a unique opportunity for the public to be able to enjoy one of the most historic Missionary Era sites in Hawai'i, which heretofore has been privately owned and only selectively shown in the past.

3.3.3.2 Archaeological and Cultural Resources

In addition to preserving the unique architectural heritage of the area, New Moon Foundation has pledged commitment to the broader cultural and historical heritage of the area. Accordingly, archaeological and cultural resources were the subject of a detailed integrated study, presented in full in Appendix 4. The study began with an archaeologist/cultural historian conducting a detailed review of documentary sources, including primary sources such books, letters, reports and maps from the 19th and early 20th centuries; secondary sources dealing with history and cultural matters; and various archaeological inventory surveys. Next, a community member with deep roots in Kohala consulted a long list of individuals with knowledge of the historic and cultural resources of the area. Finally, archaeologists conducted extensive fieldwork in and around the project area.

For the purposes of summarizing the findings for the EA, the documentary, interview and archaeological findings are discussed separately below, followed by an integrated summary of the resources, expected impacts to them, and proposed mitigation. In the interest of readability, many scholarly references contained in Appendix 4 have been eliminated from this discussion.

FINDINGS FROM DOCUMENTARY STUDY:

Early Settlement and Mythical Associations of Project Area

The project area is situated at moderate elevations several miles from the coast in 'Iole, an *ahupua'a* in the Kohala District. The perceived "classic" style of Hawaiian settlement, with the vast majority of people living on the shoreline, was not the standard for this part of Kohala. Perhaps because of the steep coastal *pali* that precluded easy access to and along the ocean, habitation appears to have been centered around the terraced taro *lo'i* in the uplands, a trait associated with Kohala windward coast.

Two legends, one regarding *aumakua* and another concerning warring rivals, provide some insights into the antiquity of occupation in 'Iole and the activities of its *ali'i* and common people. 'Iole is named for a legendary rat (Pukui, Elbert, and Mookini 1974:57), perhaps associated with the legend of Pikoi-a-ka-alala. This legendary figure was skilled in the shooting of rats with a bow and arrow, and was said to have shot "a rat lying asleep in Kohala across the channel" while standing at Kauiki in Maui (Beckwith 1970:425). Alternatively, the namesake for the *ahupua'a* is associated with a friendly rat that helped during a time of famine.

"Makali'i has hung up the vegetable food in a net attached to a cloud at Kaipaku, Hanalei, on

Kauai. Puluena comes from Kohala seeking food and puts the rat into the net. A division of land in Kohala district is called Iole after this friendly rat. The chant runs, *Hiu ai la Kaupaku Hanalei. I na mapuna wai a ka nalu*. 'Hung up on the ridgepole of Hanalei, to the water springs of the rain cloud' " (Emerson IN Beckwith 1970:434).

Another traditional tale of struggle between Pueo and 'Iole involves Rat getting the upper hand in the struggle until Owl:

"...went among those who were skillful in rat shooting but found no one who could destroy this upstart. Then he heard of a certain rat-shooting wizard on O'ahu named Piko'i, the son of 'Alalā the Crow; thereupon he went and made friends with him and told him about the thievery of 'Iole. It was Piko'i's amusement to destroy rats, so they both sailed for Hilo. Piko'i went to the top of Ka'uiki hill¹ and looked toward Kohala. He saw 'Iole and shot an arrow at him. As 'Iole the Rat lay tranquilly dreaming, never thinking of danger, he was struck by Piko'i's arrow and instantly killed. The place where he died was named 'Iole and retains that name to this day" (Pukui and Green 1995:52).

In one story the rat is friendly and saves the people from starvation, and in the other he steals from neighbor owl for his own benefit. Both stories attribute the rat with the naming of the Kohala *ahupua'a*, but the stealing stories take place in Kohala, while the starvation stories take place in South Point, Hawai'i and Kaua'i. Consequently, this rat of legend may have led a long and storied life, assisting people in need far from his home and getting what he could from his owl neighbor before ultimately losing it all.

This legend suite associates the land with early heroes including Hawai'i-loa, Makali'i, Piko'i, and *aumakua* 'Iole and Pueo. With this antiquity comes a greater claim to power. Waipio Valley was the principal seat of authority for much of the prehistory of the island (Cordy 2000; Fornander 1996). The legends of 'Iole and Pueo hint of ancient rivalries in the hinterlands of Waipio. The stories of the travels and battles of Kapunohu blend those into the history of human affairs.

The story of Kapunohu includes a chapter concerning family intrigue, shifting alliance, warfare, and political consolidation centering on the *ahupua'a* of 'Iole prior to the arrival and major changes brought from beyond Hawai'i by Pili and Pa'ao about seven centuries ago.

The windward side of Kohala was divided into two polities. The east side (also referred to as the "inside") was ruled by Niuli'i, and extended from Awini to Wainaia Gulch (in the project area). The west, or "outside", was ruled by Kukuipahu, and was from Wainaia Gulch to Kahua. Kapunohu was born in Kukuipahu, and his sister was married to the ruling chief named Kukuipahu. Through a series of events Kapunohu gained possession of Kanika'a's magic spear named Kanikawi. Kapunohu tested the spear by throwing it through 800 wiliwili trees in a row simultaneously.

¹ The reference to Hilo may be a typographical error, because Ka'uiki hill is in Hana, Maui.

Kapunohu became insulted by his brother-in-law, and was so angry that he left "outside" court and headed for the "inside" polity of Niuli'i. He stopped at Waio'opu in Halaula, and Puaiole in A'amakua for rendezvous with women, ultimately arriving at the court of Niulii. With Kapunohu and his magic spear in the lead, Niuli'i advanced against Kukuipahu initiating the fighting "...on their side (east) of the Wainaia gulch at a place called Piauwai" (Fornander 1918:218). The forces of Niuli'i moved the battle westwards:

"...over the Wainaia gulch and into 'Iole; then into Ainakea directly above Hinakahua at Kapaau, where Kukuipahu with the rest of his army was stationed. At this place the battle became very fierce and the spears went darting back and forth. It was at this place that Kapunohu threw his spear, Kanikawi (whereby the sugar-cane leaves rustled, the blades of grass grated, clouds of dust arose), and by its force killed 3,200 men and the slaughter was very great. Kapunohu took all the feather helmets and cloaks and Kukuipahu was killed together with a large number of his men; the rest of his army retreated to Lamakee in Kaauhuhu, where they were overtaken by Kapunohu and the battle was again resumed" [Fornander 1996: 218 and 220].

Five more battles were waged progressively further to the west, one involving an enemy champion with a huge magic club. Kapunohu prevailed against all, and won the entire windward lands for Niuli'i.

Although the story includes mythical guardians (*kapua*), magical weapons, and superhuman heroes, basic elements of the tale are likely representative of the political situation of the past. A rivalry between inside and outside Kohala rulers was likely brewing for some time. The boundary between the two was the Wainaia Gulch. When Kapunohu, probably an *ali'i* well trained in the art of war, was slighted and shifted his allegiance to from the outside to inside court, Niuli'i pressed his newfound advantage by attacking Kukuipahu and his army at the places named in the story. Details regarding the number of warriors killed and the taking of helmets and cloaks, and the fact that Kukuipahu's army were first met on Niuli'i territory, may or may not have survived from basic facts over the years of telling. The high numbers of dead, although probably an exaggeration, suggest that these rulers were powerful enough to enlist many if not all able-bodied citizens for warfare.

There were four *heiau* in the general vicinity, but none appear to be within the specific project area. All four have been destroyed and their precise locations have not since been located. Palapalaho'omau Heiau was situated in the lower elevations of Wainaia Gulch; two *heiau* were located on nearby Kauhola Point: Mulei'ula Heiau and Ohau Heiau; and about a half-mile east along the shoreline at Hapu'u Bay was a *heiau* associated with Kamehameha named Hale O Ka'ili.

Project Area in Early Historic Times

The connection of North Kohala to *ali'i nui*, including Kamehameha, who was born at Kokoiki near Mo'okini Heiau, is strong. Kalaniopu'u went to Hinakahua and nearby Kauhula and Hala'ula with his entourage after the death of Captain Cook to relax and

play (Kamakau 1992:106), enjoying dancing, maika, the kilu sexual game, and fighting (*mokomoko*). Kamehameha I spent time at Hapu'u and Kauhola with chiefly cohort (Ibid:126), and was trained in 'Āinakea by Kaukōkō in O'ahu fighting methods (Pukui, Elbert and Mookini 1974:7). Kamehameha also enjoyed surfing at several locations in Kohala, including Kauhola, today's "Lighthouse" (Schweitzer 2003:49). He is also associated with the cultivation of taro, as well as the improvement or creation of waterworks to supply the fields, at Wai'āpuka and 'Iole, which were said to contain his favorite lo'i. These lo'i were recognized as favorites of Kamehameha, and his name is associated with the 'auwai that supplied them with water.

After the death of Kamehameha I in 1819, the people continued to live in their dispersed villages situated around the lo'i. There is no information to address whether or how the lifestyle here was changed with the breaking of the *kapu* by Ka'ahumanu and Liliho soon thereafter. Reverend William Ellis, who traveled the area in 1823, noted that Kapa'au was an inland village with a low population, and that about a mile to the east at Halawa there were cultivated fields of "considerable size" that were kept "in good order" (Ellis 1969:384). Reverend Lorenzo Lyons was assigned as the permanent Protestant missionary to the Kohala district in 1832. The first census was conducted in 1835, and indicated that most Kohala residents lived on the leeward side. Less than 100 lived in each of the *ahupua'a* at and around 'Iole.

The missionaries were based in Waimea from 1823 through 1837. In the latter year, a permanent mission with Reverend Isaac Bliss and Mr. Edward Bailey and their wives was established in a thatched meeting house that is just *makai* of the current Bond Homestead main home.

At the request of Governor Kuakini, a Chinese immigrant named 'Aikō's established a sugar operation in 'Iole during in 1841 at a place that was "a little to the east" of the old meeting house (Morgan 1981:41). Three thatched or open-sided buildings comprised the place for making sugar and molasses.

The Arrival of Reverend Bond

Reverend Elias Bond and Mrs. Ellen Howell were sent in 1841 to relieve Mr. Bliss of his duties in 'Iole. The meeting house erected by Bliss was badly deteriorated when Bond arrived, but he repaired and used it through 1846. Bond then built a wood-frame church in 1846, which blew down in 1849 and had to be rebuilt. This is the church known as Kalahikiola, or, the Hawaiian Church, that stands today between the Bond homestead and the Kohala Girls' School (Morgan 1981:46-47).

Elias Bond's recollection of how the land appeared to him upon his arrival is the only significant description of the distribution of Hawaiian settlements in 'Iole for the early 1800s (Damon 1927: 72 IN Morgan 1981:41). Bond stated that the land *makai* of the current Highway 270 was sparsely occupied and used, with only two houses. A more populous gathering lived near the lo'i. Four or five houses were

situated along the trail and near the west side of the big taro patch called Hoimaihilo, and four more were situated along the other side. The 'Āiko sugar house, now run by a partner of 'Āiko's, was somewhat east of the church. Another set of homesteads was situated along the west side of the *lo'i* above 'Āiko's place. Chiefess Walawala, who was probably one of the *konohiki* in charge of this *ahupua'a*, lived in this group, which was likely the focal Hawaiian settlement in the *ahupua'a*. A trail led along a path that probably coincides with the current access road to the Girls' School. Two other residences were scattered in the uplands above the principal habitation and agricultural areas. One was about a half-mile further upland along the east side, and the other was just above the place where the Kohala Girls' School was eventually built. It is apparent that even at this late date, 'Iole *ahupua'a* was a thriving, productive Hawaiian dispersed village.

'Iole was claimed as Crown Lands in the Mahele. Elias Bond soon acquired all of 'Iole through grants and transactions with Kamehameha III and Kamehameha IV. The 1857 tax records list 21 taxpayers in 'Iole. In 1863 Bond approached Castle and Cooke to set up a sugar business, which became the Kohala Sugar Company. Bond built the Kohala Mill, at Hala'ula, just south of 'Iole, beyond the Bond Historic District. The business struggled at first, but began paying off in 1875. He donated much of his profit to ABCFM and other institutions (Morgan 1981:44). Education was an important aspect of the Bond lifestyle and mission, and Mr. and Mrs. Bond taught in their homes for many years (Ibid: 49). The family prospered, and several children were born and raised at the homestead.

Elias Bond said that his motive in establishing the Kohala Sugar Plantation was to provide wage work for local inhabitants. Ironically, the plantations flourished and expanded on such a scale that he and other planters were obliged to recruit laborers from around the world, especially China, Japan, Korea, the Philippines, Puerto Rico, and Portugal. The influx of immigrants with diverse backgrounds created a new cultural setting in Hawai'i manifest in the material remains, patterns of residence, language, and economic and political systems. This population in cross-cultural contact supplied the students, teachers, and laborers who attended, taught, and worked at the Kohala Girls' School.

The Bonds started building the first structure at the Kohala Girls' School in 1874. As the development of the Kohala Girls' School is described above in Section 1.2 and 3.3.3.1 of the EA, it will not be repeated here.

Aside from the Bond Homestead and the Kohala Girls' School, there were a few other interesting structures with historical relevance built in 'Iole. Elias Cornelias Bond (Rev. Bond's second son) built Achilles Hotel in late 1877 or early 1878 as a residence. The redwood building was two stories high. Cornelias left the islands in family dispute, and the Achilles family moved in after that and ran a hotel that serviced mostly businessmen.

The hotel was sold after World War II to a local rancher who tore it down in 1948 to use wood for another home elsewhere.

A poi factory situated near the center of the *lo'i* was run by Ah Tyam. The poi factory is in the location that is described for sugar mill that was previously run by, 'Āiko and it is very likely that Ah Tyam converted the mill into his factory in the early 1900s. The poi factory closed down soon after World War II.

The Kohala Ditch was built in 1906. This was the beginning of the reliance on irrigation and fluming techniques that increased productivity and efficiency of the sugar cultivation (Morgan 1981:81). Permanent flumes were built as main arteries for the movement of sugar downhill to the mill, including a trestle that crossed the Wainaiia Gulch. Smaller, portable flumes were used to move the cut sugar from their place of harvest to the main flumes.

Elias Bond passed away on July 24, 1896. Son Kenneth Bond worked for the Kohala Sugar Company. Another son, Dr. Benjamin Bond, lived and worked as a doctor in the Bond homestead for 40 years. Classes were terminated at the boarding school in 1926, because the public school system was deemed sufficient and appropriate for the education of the local youth (Morgan 1981:50). The old Kohala Girls' School buildings were subsequently used to board girls that had to travel far to Kohala High School. Boarding was discontinued in 1956. The buildings of the school have subsequently been used for retreats and residential rental units. Dr. Benjamin Bond closed his medical office at the Bond homestead in 1925. He left his residence there with his two sisters, and moved to Hilo, where he died in 1930. Since then there have been no Bond family members in full time residence on the 'Iole property.

Kenneth Bond leased 60 acres of 'Iole land in 1940 to develop a macadamia nut orchard (Morgan 1981:58). Castle & Cooke acquired full ownership of the Kohala Sugar Company in 1937, but could not make the business profitable, and by 1976 the operation had closed.

The 'Iole Development Corporation was created in 1967 to take the church to court to get the Kohala Girls' School back from the church that was not using it, but had retained the rights to it, contrary to the original Bond's deed (Morgan 1981:59). That effort was eventually successful, and the property came into the ownership of the corporation in 1980.

FINDINGS FROM CULTURAL CONSULTATION

Communication with knowledgeable and concerned local residents helps to provide insights into the broader concept of cultural practices and beliefs related to subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs. This section provides documentation of the consultation process

conducted to achieve an understanding of the types of cultural resources that might exist in the project area.

The interviews were organized and conducted by Ms. Lani Bowman, who was born in Kohala, and involved people from various professions, agencies, and backgrounds. Although the interviewees discussed a wide variety of topics, the focus of the consultation was the Kohala Girls School and the events and beliefs associated with the 'Iole area.

Groups and individuals approached included: descendants of people who once lived in and/or had some kind of relationship with the area; Hawaiian cultural practitioners; local and state historians and those knowledgeable in cultural practices; former Kohala Girls School attendees; people who had worked on the 'Iole; "old timers" from North Kohala; museum professionals; and members of the Hawaiian Civic Club, Na Kūpuna, and the Kohala Senior Citizens. Information release forms from many of the interviewees are on file with SCS and New Moon Foundation. While a variety of information was shared, only that relevant to cultural practices and places is summarized below. Unless indicated, those interviewed related no knowledge of any archaeological sites, traditional cultural practices, or gathering uses in the project area, the Kohala Girls School, or surrounding areas. Ms. Bowman consulted with the people identified below (some were interviewed by Tom Wolforth, archaeologist, as well).

Kohala Girls School Attendees

Eva Kealamakia attended KGS from 1939-1942. She provided photographs of the school from her period of enrollment. She also mentioned that her sister Ella Kimura, and another woman, Elizabeth Kimura, both Waimea residents, attended the school around that time.

Winnie Gonzalves was a student at the school in the late 1940s and early 1950s. She currently resides in Hawi.

Pua Tavares attended the school in the middle 1950s. She was one of the out-of-district children sent to the school as a Kohala High School student.

Garland Thoman is the son of the last school principal. He graduated from Kohala High School in 1953.

Community Groups

Members of the group *Na Kūpuna* were contacted: *Marie Solomon, Libby and Sonny Pa'alua, Armstrong Yamamoto, Kindy Sproat, and Dale Sproat*. Ms. Solomon shared concerns about the invasive trees in and around the project area, especially in the lowland *lo'i* just east of the Kohala Girls School. She also shared information on the history of 'Iole. Sonny Pa'alua provided information on former residents and people who might be familiar with *lo'i* in North Kohala.

Ka'ahumanu Society members were contacted: *Dora Lincoln, Miriam Reyes, and Mary Lee*.

The *Hawaiian Civic Club* was consulted with at their meetings. They provided information on the naming of the *ahupua'a 'Iole*. Member *Anthony Ako Anjo* expressed concerns over the project, and mentioned that some Hawaiians believe that the old Bond Estate used Hawaiian people for slaves, and that consequently there are many unsettled spirits on the property. He said that mainland visitors have seen apparitions and an unbalanced energy level causing them to leave the dormitory rooms prematurely.

Approximately 75 citizens attended the *Senior Citizen Meeting* and were asked to provide information on sites and practices in 'Iole. No information was provided at that time.

Other North Kohala Residents

Suse Soares' mother was a student at the school. She was born and raised in Honomakau.

Betty Trawick and *Betty Chang* are sisters who grew up in North Kohala.

Rose Maeda was born and resides in Niuli'i.

Alfonso Mitchell lived in Mahukona and Kokoiki. He worked with Ted Sparrow and Tom Fujii in the 1950s and 1960s at a piggery near the Bond wood lot.

James Tohara moved to North Kohala in 1947 and was a businessman in Hawi. He later worked for Mauna Kea Beach Hotel.

Hatsue Hayashi stayed with her uncle Herbert Waki at the old infirmary next to Kalahikiola Church when she was in elementary school in the 1940s. Mr. Waki helped plant the macadamia nut orchard for Kenneth Bond. Ms. Hayashi recalled being told by her uncle not to go to the Bond homestead, because it was haunted and the piano would play by itself. She related that on one rainy Sunday she accompanied her uncle to the homestead. While he was checking for leaks, she heard the piano play by itself.

Frank Perez was born and raised in Kohala. He worked for Kohala Sugar Company, then in 1950s worked with Lyman Bond as a caretaker of 'Iole. He recalled the Kohala Sugar Plantation bulldozing the eastern land in 1960s where the *lo'i* were in order to plant sugar cane. He also reported that in the early 1950s the land surrounding the Kohala Girls School was bulldozed by Arthur Lee to get rid of the Christmas berry and guava so the land could be used for pasture.

Ruth Rosimo lived in the old infirmary at the Kohala Girls School from 1962 to 1981. Ms. Rosimo did not experience visits from spirits during her stay there.

Daniel Winter was 'Iole Corporation Land Manager from 1978 to 1993. He noted that the entire area surrounding the Kohala Girls School was bulldozed in the 1980s to remove dense vegetation that was encroaching on the buildings. Mr. Winter participated in the restoration of the macadamia nut fields that had become covered with alien vegetation prior to his tenure on the land.

Florence (Treadwell) Hosbein is the daughter of Dr. Treadwell, a North Kohala physician from 1925 to 1941. She lived in Hawi at that time, and visited the Achilles Hotel.

Cultural Professionals

Kepā Maly, of Kumu Pono Associates, provided information on the relevant Māhele documents, including testimony and boundary details.

Stewart Ching, Curator at the Mission House Museum, was contacted regarding artifacts from the Bond Estate. The only items he mentioned are a *loulu* hat and two *mānele* that were used to carry Ms. Bond and her children.

Lynn Manuel, Curator at the Lyman House Museum provided a list of artifacts associated with the Bond Estate. There is no provenance connected to the Hawaiian artifacts on the list, suggesting that the items may have come from somewhere else and have been given to the Bond family. Ms. Manuel mentioned that the Peabody Museum in Connecticut might have other artifacts associated with the Bond family.

ARCHAEOLOGICAL FINDINGS

Prior to the current archaeological inventory survey, no archaeological work had been conducted within the Bond Historic District. The distribution and type of historical buildings and activities suggested that subsurface archaeological remains were very likely to be present within the project area (particularly in and around the Kohala Girls' School). Expected features were privies, cisterns and septic tanks, a network of pipes associated with the cisterns and septic tanks, stone and/or earthen walkways and driveways, postmolds from wood fences and light-duty structures, gardens, trash disposal areas, and builder's trenches alongside the foundation of walls. Also expected were scattered artifacts in non-feature contexts.

In areas outside the Historic District but still potentially affected by facilities of the proposed project, prehistoric and early historic features such as taro *lo'i* (perhaps covered by pasture or orchards), *'auwai*, and trails were expected. Also possible were some of the historic features listed above, and remnants of ditches, flumes, roads and paths, and some of the historic buildings such as the Achilles Hotel and the the 'Āiko sugar mill.

The field methods were designed to test for the presence of these kinds of resources. Surface survey of the entire project area was conducted to identify potential remains of prehistoric habitation and agriculture, and impacts to the land during the multiple uses during historic times. The project area was walked systematically at a maximum of 10-meter intervals, and multiple trips were made over much of the place. Consequently, the surface of the entire project area was thoroughly inspected. In addition, portions of the land beyond the project area were inspected to investigate how the shape of the different landscapes related to, and reflected, past activities in those places, and to learn how the broader network of activities in 'Iole were coordinated with those within the smaller project area. Also, subsurface tests were conducted at 20 locations within, and adjacent to, the project area, to investigate how the land was used and modified over time.

The reader is referred to Appendix 4 for a full discussion of sites, features, and their contribution to building understanding of the history of this area. These sites and features are shown in Figure 5, and Table 2 provides the archaeologist's assessment of significance and recommended treatment.

All features that are: 1) are within the 50-acre Bond Historic District, 2) newly identified in this project; and 3) pertain directly to the era of significance for the National Register of Historic Places (NRHP) District listing (1841 to 1926) are recommended as eligible for listing on the NRHP (Table 2, part 1). Whether these are to be actually added to the listing is beyond the scope of this report. As the project is listed on the NRHP, the *federal* criteria for evaluating significance include:

- A. It must be associated with events that have made a significant contribution to the broad patterns of our history, or be considered a traditional cultural property.
- B. It must be associated with the lives of persons significant in the past.
- C. It must embody distinctive characteristics of a type, period, or method of construction, or represent a significant and distinguishable entity whose components may lack individual distinction.
- D. It must have yielded or may be likely to yield, information important in prehistory or history.

Some other resources within the Bond Historic District do not contribute to the listing's era of significance but are significant for other reasons (Table 2, part 2). Since these are not part of the District, and this project is being reviewed under *State of Hawai'i* cultural resource management regulations, rather than *federal*, these resources are evaluated based upon State criteria of significance (Hawai'i Administrative Rules §13-275-6), which adds a fifth criterion:

- E. Have important value to native Hawaiian people or other ethnicities in the state, due to associations with cultural practices and traditional beliefs that were, or still are, carried out.

There are several resources immediately adjacent to the project area that could be effected by the undertaking (Table 2, part 3). These resources in this area are also evaluated under State criteria.

The activities associated with the proposed action may have an effect on some of the resources included in Table 2, parts 1, 2 and 3. The effects to the resources can be mitigated with the recommended treatments included in these tables and detailed in Appendix 4.

Two items partly within the project area are not significant cultural resources (Table 2, part 4).

**Table 2
Archaeological Resources**

Resource	Eligibility Criteria	Recommended Treatment
(1) Resources in Project Area Directly Related to Bond Historic District (BHD) NRHP Listing		
Water pipe (brick)	A, C and D	Data recovery explorations to connect water pipe system to the Upper Pali 'Akamoa 'Auwai. Monitor during construction to: 1) identify full extent of water pipe system, and 2) identify portions of system to preserve.
Old carriage road	A	Integrate preservation with active use as a foot path.
Privies	D	Preserve as is, or enhance preservation by rehabilitation.
Disposal areas	D	Data recovery excavations to collect material remains that may provide insights into changing patterns of status, ethnicity, function, technologies associated with the people that have lived and worked at the Kohala Girls' School.
Tunnel	A and D	Data recovery to examine tunnel technology and potential for prehistoric origin.
(2) Resources Within Project Area and Within the Bond Historic District NRHP Listing, Not related to BHD Era of Significance, But Eligible for Listing Independent of the BHD		
Lowland <i>lo'i</i>	A and D	Detailed mapping of the <i>lo'i</i> system. Investigate status of possible spring. Limited excavations to extract pollen and datable materials. Further excavations beyond the known <i>lo'i</i> limits to check for additional <i>lo'i</i> .
Upper Pali 'Akamoa 'Auwai	A and D	Data recovery excavations to collect pollen, macrobotanical, and datable materials. Further exploration and identification of the location of the 'auwai into the Kohala Girls' School, and perhaps to the lowland <i>lo'i</i> .
Achilles Hotel	D	No further work
(3) Resources Beyond Bond Historic District, Not Directly Related to Era of Significance		
Old quarry road	A and D	Data recovery excavation to inspect for possible buildings noted on old maps.
Quarry	A	Preserve as is. Preservation could be enhanced with rehabilitation by removing modern road and debris.
Agricultural terraced field with coral	A and D	Data recovery excavation to collect pollen, datable materials, and data on terrace morphology. Monitor installation of utility in vicinity of this area.
(4) Resources Within Project Area Not Eligible for Listing in BHD District or Otherwise		
Resource	Reason not eligible	
Frank's road	Less than 50 years old.	
Flume alignments	Not associated with the era of significance for BHD, and there is no physical remains (no integrity) of the flumes.	

It is important to note that no stone remains potentially associated with prehistoric habitation were identified during the 100% surface survey of the project area or in the random survey of the areas beyond the project area. No items that might indicate prehistoric habitation, such as subsistence debris or tools, were recovered from any of the exploratory tests. This information suggests that any habitation areas that once existed around the upland *lo'i* have been heavily disturbed by the ground altering activities associated with the Kohala Sugar Company sugar cultivation, and the ground shaping for, and planting of, the macadamia nut orchards.

Furthermore, field investigations could not identify habitation areas and trails, as the empirical evidence of their existence had been so highly altered or destroyed. Evidence of prehistoric habitation may remain beyond the project area in the location identified just north of the lowland *lo'i*.

The data collected during the field investigations, including the discussions with knowledgeable informants, clarified the fact that the post-contact landscape is intimately tied to the prehistoric landscape. The first missionaries set up their meeting house where one of the main *'auwai* reaches the uplands, and the Kohala Girls' School was built where another *'auwai* passed by. Bond tapped into the Wainai *'Auwai* to bring water to his homestead and to power his machinery. The early sugar mill and subsequent poi factory continued the age-old agricultural practices in 'Iole. The post-contact uses did not destroy the old technology. On the contrary, the post-contact occupations and agricultural thrived by using, and modifying, the ancient technology.

3.3.3.3 Summary of Impacts/Mitigation Measures

By its inclusion in the National and Hawai'i Historic Registers, the historical and cultural importance of well-inventoried collection of historic buildings within a unique 19th century landscape that comprises the Bond Historic District has already been recognized, documented and protected. The adaptive reuse of the KGS for a Contemplative Education Center has involved careful coordination among the New Moon Foundation, an architect specializing in historic buildings and districts, and the State Historic Preservation Division. The net effect is that this use will enhance, and not adversely effect, the architectural resources and the landscape in which they are found.

The integrated documentary, interview, and archaeological investigations of the project area conducted for this EA (Appendix 4) determined that further significant cultural resources were present, specifically archaeological resources shown in Figure 5 and listed in Tables 2-4. The program of data recovery and preservation proposed in the inventory survey will mitigate any adverse effect on these resources. It will also provide valuable information for interpreting land use patterns during traditional times, the missionary and sugar cane eras, and critical transition between these times.

The project area, as with all of windward Kohala, has special cultural associations with legend and historic features. There are references to 'Iole, Waianaia Stream and other

nearby locations in legends and oral historical accounts. The accounts involve a multitude of places in Kohala in a mostly general way, however. They do not appear to imbue any particular place in the specific project area with a special association that qualifies it as uniquely embodying the cultural association of such accounts. *Lo'i* said to be the favorite of Kamehameha, as well as the springs and *'auwai* that nourished them – have a special cultural association and reside in a specific place, and, were they intact, would have the potential to be traditional cultural properties. However, a century and a half of intensive use as a missionary outpost, sugar cane plantation, and macadamia nut orchard has left the land radically transformed. Few traces of these features exist, at least above the soil, except as undulating terrain in certain locations, particularly in the fields near Waianaia Stream. Interviewees with a wide knowledge of cultural resources in Kohala did not identify features on or near the project area that have ongoing Hawaiian cultural significance, or sites with ongoing Hawaiian cultural practices such as gathering, ceremonial activities, or spiritual practices. Most interviewees had no information concerning the presence of cultural features other than those associated with the missionary era. Many referred to the Girls' School and the role it played in people's lives, as well as the significant, if not always culturally welcome, part that the Bond family played in the history of North Kohala. In this sense, the project's actions in the Bond Historic District will perpetuate an important aspect of the multifaceted cultural history of the community.

In summary, no cultural resources or practices would be adversely affected by the proposed project, as supported by the information provided in this section.

3.4 Public Facilities

3.4.1 Traffic

A Traffic Impact Assessment Report (TIAR) was prepared for an earlier version of the project by Phillip Rowell and Associates in October 2005. The report is attached as Appendix 3 and is summarized below.

Existing Roadway and Traffic Conditions

A reconnaissance of the area was performed in order to identify the existing roadway conditions, cross-section, speed limits and right-of-way controls, as well as any other factors that might affect access to and egress for the proposed project.

The New Moon site is accessed from State Route (SR) 270, a two-lane, two-way State Highway, and a two-way paved roadway that is approximately 18 to 20 feet wide. The access road is located approximately 0.1 mile east of Milepost 24 on SR 270. The intersection of SR 270 at the project access road is a STOP sign-controlled T-intersection.

Existing morning and afternoon peak hour traffic volumes along SR 270 adjacent to the project access road were estimated using manual traffic counts conducted on Monday,

September 26, 2004 (Fig. 6). Existing AM peak-hour traffic consisted of about 300 vehicles, about 55% of it northbound. PM peak-hour traffic was also about 300 vehicles, fairly evenly distributed in both directions. Current traffic on the access road is light and is composed mainly of permanent and temporary workers at New Moon, as well as visitors to the Kalahikiola Church, as there are only three residences that take access from the road.

Project-Generated Traffic

The peak hour traffic that the project would generate along the adjacent street was estimated using standard trip generation procedures outlined in the *Trip Generation Handbook* (Institute of Transportation Engineers 1998: 7-12).

For the purposes of the TIAR, the traffic engineer distinguished four components to the project: residential guests, day students, special events and employees. A separate trip generation analysis was performed for each component. The readers is referred to Appendix 3 for details of the analysis, but the following list provides the assumptions that were used to calculate the generation of each component, the total of which is summarized in Table 3, below.

Residential Guests

- The maximum number of residential guests will be 80.
- Residential guests will be housed in units comparable to hotel rooms or tentalos.
- There will be two guests per unit.
- The traffic characteristics of the residential guests will be comparable to those of resort hotel guests. By definition, resort hotel guests tend to remain on-site and do not make a significant number of trips to and from the hotel site.

Day Students

- The maximum number of day students will be 20.
- 50% of students will arrive within one hour of the start of class.
- 50% of students will depart within one hour after end of class.
- Arrival and departure of day students will coincide with the peak commute hours along the adjacent roadway.
- The average vehicle occupancy is 2.0 persons per vehicle.
- There are no drop-offs and pick-ups.

Special Events

- Special events are understood to be guest lectures and fairs. These events may, or may not, last all day.
- The maximum capacity for a special event is 200 persons.

- 50% of attendees will arrive within one hour before the start of the event.
- 50% of attendees will depart the site within one hour after the end of the event.
- 50% of the attendees will arrive via automobile.
- The average vehicle occupancy of the automobiles will be 2.5 persons per vehicle.
- The remaining 50% of the attendees will arrive via van.
- The average vehicle occupancy of the vans is 6.0 persons per van.
- There will be no drop-offs or pick-ups.

Employees

- The maximum number of employees will be 22.
- Each employee will drive to and from work.
- All employees will live off-site.
- Employees will work from 8:30 AM to 5:00 PM. Thus, employee trips will coincide with the peak commute hours along the adjacent highway.

Table 3
Summary of Project Trip Generation Analysis

Time Period	Direction	Trips Generated By				Total #/%
		Residential Guests*	Day Students	Special Events	Employees	
AM Peak	Total	19	5	28	11	63
	#Inbound	12	5	28	10	87%
	#Outbound	7	0	0	1	13%
PM Peak	Total	24	5	28	10	67
	#Inbound	12	0	0	2	21%
	#Outbound	12	5	28	8	79%

Source: Appendix 3. *Includes tentalos

In summary, the proposed project will generate 55 inbound and 8 outbound trips during the morning peak hour. During the afternoon peak hour, the project will generate 14 inbound and 53 outbound trips. It should be noted that the peak hourly volumes shown above are the *maximum* number of trips that the project will generate. Since it was assumed that traffic associated with all the events coincide, including traffic associated with special events, the above trip generation analysis represents a *worst-case scenario*. The Institute of Transportation Engineers recommends that a traffic impact study should be performed if, in lieu of another locally preferred criterion, development generates an additional 100 vehicle trips in the peak direction (inbound or outbound) during the site's peak hour. Based on the criterion, a traffic impact study is not warranted.

The next step in the analysis was to distribute and assign these trips assigned to the traffic movements at the intersection of SR 270 at the project's entrance. These assignments are shown in the second row of Figure 6, below.

Next, current background-plus-project traffic volumes were estimated by superimposing the peak hourly traffic generated by the proposed project on the 2005 background (without project) peak hour traffic volumes, as shown in the third row of Figure 6.

Impacts and Mitigation Measures

As mentioned above, based on criteria recommended by the Institute of Transportation Engineers, a traffic impact study is not warranted. However, a Level-of-Service (LOS) analysis was performed for future background-plus-project conditions in order to identify potential traffic operational deficiencies at the entrance to the project.

Level-of-Service is a qualitative measure of traffic operating conditions based on factors such as speed, travel time, traffic interruptions, freedom to maneuver and safety. Six levels-of-service, A through F, denote driving conditions from best to worst, respectively. In general, LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions. LOS D is typically considered acceptable for peak hour conditions in urban areas.

The Level-of-Service analysis was performed using the following assumptions:

- The existing lane configurations at the study intersections and driveways are unchanged.
- The peak hour of the project-generated traffic coincides with the peak hour of traffic along SR 270.

The results of the Level-of-Service analysis for both 2005 and 2007 conditions – after the project is in operation – are summarized in Table 4. Shown in the table are average vehicle delay and level-of-service of controlled movements.

**Table 4
Level of Service Analysis, Current and 2007 Conditions (Project Plus Background)**

Intersection and Movement	AM Peak Hour				PM Peak Hour			
	Existing (2005)		2007 Background Plus Project		Existing (2005)		2007 Background Plus Project	
	Delay ¹	LOS ²	Delay	LOS	Delay	LOS	Delay	LOS
SR 270 at Project Entrance Road								
Westbound Left & Thru	7.6	A	7.9	A	7.8	A	7.9	A
Northbound Left & Right	9.3	A	12.2	B	11.0	B	13.0	B

NOTES:

- (1) Delay is in seconds per vehicle.
 (2) Level-of-Service denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. For unsignalized intersections, the LOS is defined by the average vehicle delay.

Source: Appendix 3

Based on the results of the Level-of-Service analysis, traffic turning left into the project from SR 270 in 2007 will operate at Level-of-Service A during the morning and afternoon peak hours. Traffic exiting the project onto SR 270 will operate at Level-of-Service B during both peak hours. Because the levels-of-service are high, the traffic impacts of project-generated traffic are insignificant and no mitigation for impacts to Level-of-Service is recommended.

However, in terms of roadway safety, it was observed that the sight distance to the left of the project driveway may be restricted. Because of the speed and sight distances along SR 270 adjacent to the project, it is recommended that rumble strips of delineator buttons be installed along the approaches to the driveway to make drivers aware of the intersection. This should encourage drivers to slow down along this section of roadway.

3.4.2 Utilities and Public Services

Existing Facilities, Impacts and Mitigation Measures

Necessary utilities are or will be available to the CEC and related uses. The distribution of existing and proposed utility lines is illustrated in Figure 4 (Site Plan).

Potable water will be supplied from the Department of Water Supply (DWS) water system along the Hawi-Kapa'au Road. For fire protection, a 70,000-gallon water tank will be installed at the 900-foot elevation and connected to water from the Bond Tunnel. This will be run predominantly through existing 6-inch lines to three fire hydrants in strategic locations within the CEC campus. An access road to these hydrants will be provided. This non-potable water will also supply the water features (which will then supply the area's agriculture), as well as bottom floor non-potable water needs in the CEC buildings and various spigots for watering plants on campus.

In keeping with the commitment to self-sustainability, NMF is planning to supply power to the CEC using Bond Tunnel water to drive a hydro-electric plant; the water will then be available for agricultural use. This system will be supplemented by some combination of photo/voltaic, wind-power, and propane. The infrastructure for this will be sited in an unobtrusive location north of the access road on lands outside of the Historic District. All utility lines will be underground to minimize visual impact to the Historic District.

The CEC will modify existing or install new wastewater treatment systems in conformance with the requirements of the State Department of Health.

The requirements for additional police and fire services are minimal, as the proposed activities are similar to previous uses of the subject property, and the site is located close to police and fire stations in Kapaau. The visitors will not be full-time residents who would require educational support from the State, and the programs will provide substantial educational and recreational opportunities for the North Kohala community.

3.5 Secondary and Cumulative Impacts

The proposed project will not involve any secondary impacts, such as population changes or effects on public facilities.

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. No large-scale development projects are in progress or planned for the area. New Moon's plans for its adjacent lands discussed in Section 1.4 are centered on continuation and enhancement of agriculture, forestry and habitat restoration, and would not require special mitigation measures to counteract any small adverse cumulative effects on traffic.

3.6 Required Permits and Approvals

Construction of the project would require the following:

County of Hawai'i:

Special Permit
Building Permits
Grading Permit

State of Hawai'i

State Historic Preservation Division Concurrence

3.7 Consistency With Government Plans and Policies

3.7.1 State Land Use Districts

Because the project is located in the State Land Use Agricultural District, a Special Permit from the Hawai'i County Planning Commission will be required. It should be noted that since 1985, pursuant to State law, the Counties are allowed to process Special Permits if the land area is less than 15 acres. In this case the subject parcel consists of 13.649 acres so no Land Use Commission ratification is needed.

Title 15, Chapter 15 (Land Use Commission Rules), HAR establishes guidelines in determining whether a proposed use is "unusual and reasonable" so as to be permitted within the State Land Use Agricultural District under Section 205-6, HRS. Those guidelines are set forth in Section 15-15-95(b), as follows:

- The use shall not be contrary to the objectives sought to be accomplished by the Chapters 205 and 205A, HRS, and the rules of the Land Use Commission;

- The desired use would not adversely affect surrounding property;
- The use would not unreasonably burden public agencies to provide roads and streets, sewers, water drainage and school improvements, and police and fire protection;
- Unusual conditions, trends and needs have arisen since the district boundaries and rules were established; and
- The land upon which the proposed use is sought is unsuited for the uses permitted within the district.

Rule 6.3(5)(A) through (D) of the Planning Commission Rules of Practice and Procedure reiterate Section 15-15-95(b)(1) through (5), HAR, and further requires that a petition for a special permit include the following:

- (1) That the proposed use will not substantially alter or change the essential character of the land and the present use; and
- (2) The request will not be contrary to the General Plan and official Community Development Plan and other documents such as design plans.

Discussion: The proposed use of the site as a Contemplative Education Center is a continuation of educational uses, which have been undertaken on this site for over a century. The proposed use is consistent with the goals of both Chapters 205 and 205A. The programs of New Moon Foundation encourage agricultural uses of the property and teach good stewardship of the land. The surrounding property is utilized for active agricultural pursuits and the subject property and the proposed programs will enhance the agricultural uses and provide educational opportunities for visitors and residents that would not otherwise be available. The opportunity for university students to spend time at the CEC and observe up close the ecological relationships between all of the activities on the 'Iole lands is not otherwise possible.

In regard to 205A, the proposed uses will have no negative affect on coastal processes and will not inhibit the public's use of the shoreline or any of its resources. All historic features have been identified and are being preserved. Great care and expense have been taken to recognize, appreciate and preserve the important historic and cultural resources on the subject property. The restoration of these historically significant structures would not have been possible if not for the proposed adaptive reuse of the site.

The desired use would not adversely affect surrounding property. The proposed use has been consistent with the surrounding uses of the adjoining properties for over a century. The agricultural uses of the neighboring properties by New Moon and others have not and will not be affected by the CEC and its programs. The proposed programs and uses

promote the agricultural uses of the surrounding properties and actively support the stewardship of the subject property and surrounding properties.

The use would not unreasonably burden public agencies to provide roads and streets, sewers, water drainage and school improvements, and police and fire protection. All access for the project site currently exist, the drainage system and well-defined gulches have been and will remain adequate to address any drainage issues. The requirements for additional police and fire services are minimal, as the proposed activities closely approximate previous uses of the subject property, and the site is located close to the County's police and fire stations in Kapaau. The visitors will not be full-time residents who would require educational support from the State. In fact the guests will be using the site for educational purposes and there will be opportunities for the local community to participate in these programs as well, thus enhancing educational opportunities for the North Kohala community.

Unusual conditions, trends and needs have arisen since the district boundaries and rules were established. The proposed use of the site as an educational center was established over a century ago. Integrated agricultural and retreat educational centers have become increasingly popular in the last few decades. Guests are interested in understanding their relationship with the land and its natural processes. The fact that the Girls School was built here provides a unique opportunity to reestablish this educational function in the lands of 'Iole.

The land upon which the proposed use is sought is unsuited for the uses permitted within the district. The portion of the site within the Historic District cannot reasonably be used for most commercial agricultural pursuits as they would be out of keeping with the values of the Historic District. The portion adjacent to the Historic District will be used for support services for the CEC, and it will also house the support services for the agricultural uses of the surrounding NMF lands, which is a permitted use in the Agricultural District.

The proposed use will not substantially alter or change the essential character of the land and the present use. The proposed use requires very little construction and is in harmony with the character and current uses of the land. Great care has been and will continue to be taken to ensure the character of the area will be maintained as it is essential to the programs NMF proposes.

3.7.2 Hawai'i County Zoning

The property is zoned Agricultural-20 acre (A-20a) by the County of Hawai'i. Section 25-5-72 (c) of the County of Hawai'i Zoning Code identifies permitted uses in the Agricultural district with a Special Permit. Lodges (9) and meeting facilities (10) are permitted uses in this district. The zoning code clearly anticipated these types of uses and allows them.

3.7.3 Hawai'i County General Plan

The *General Plan* for the County of Hawai'i is the document expressing the broad goals and policies for the long-range development of the Island of Hawai'i. The plan was adopted by ordinance in 2005. The *General Plan* is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawai'i. Below are pertinent sections followed by a discussion of conformance.

ECONOMIC GOALS

Provide residents with opportunities to improve their quality of life through economic development that enhances the County's natural and social environments.

Economic development and improvement shall be in balance with the physical, social, and cultural environments of the island of Hawaii.

Strive for diversity and stability in the economic system.

Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County's cultural, natural and social environment.

Discussion: The proposed CEC is in balance with the natural, cultural and social environment of the County, and it would create both jobs and training in service, education and agriculture for local residents. It would also indirectly benefit the economy through construction industry purchases from local suppliers, as well as multiplier effects as employees spend their income for food, housing, and other living expenses in the retail sector of the economy. Such activities are in keeping with the overall economic development of the island.

ENVIRONMENTAL QUALITY GOALS

Define the most desirable use of land within the County that achieves an ecological balance providing residents and visitors the quality of life and an environment in which the natural resources of the island are viable and sustainable.

Maintain and, if feasible, improve the existing environmental quality of the island.

ENVIRONMENTAL QUALITY POLICIES

Take positive action to further maintain the quality of the environment.

ENVIRONMENTAL QUALITY STANDARDS

Pollution shall be prevented, abated, and controlled at levels that will protect and preserve the public health and well being, through the enforcement of appropriate Federal, State and County standards.

Incorporate environmental quality controls [are to be incorporated] either as standards in appropriate ordinances or as conditions of approval.

Discussion: The proposed CEC would not have an adverse effect on the environment and would not diminish the valuable natural resources of the region. Given the fact that the area has been in cultivation and in residential and educational use for the last century and a half, the proposed activities would essentially continue historical uses of the area. There would be little or no pollution and no effect on sensitive streams or coastal waters.

HISTORIC SITES GOALS

Protect, restore, and enhance the sites, buildings, and objects of significant historical and cultural importance to Hawaii.

Appropriate access to significant historic sites, buildings, and objects of public interest should be made available.

HISTORIC SITES POLICIES

Agencies and organizations, either public or private, pursuing knowledge about historic sites should keep the public apprised of projects.

Require both public and private developers of land to provide historical and archaeological surveys and cultural assessments, where appropriate, prior to the clearing or development of land when there are indications that the land under consideration has historical significance.

Public access to significant historic sites and objects shall be acquired, where appropriate.

Discussion: New Moon has already spent almost \$2 million on historic preservation efforts, and the CEC will promote further efforts. The adaptive reuse of the facility is highly consistent with the goal of not only preserving but also restoring and utilizing historic architecture, allowing both guests and the general public to enjoy a truly unique historic site in Hawai'i. Archaeological resources have been protected through inventory survey, which has pointed the way towards mitigation plans that will recover important data concerning the various eras of use. It is important to point out that New Moon's efforts at the Bond Estate have involved extensive coordination with the State Historic Preservation Division.

FLOOD CONTROL AND DRAINAGE GOALS

Conserve scenic and natural resources.

Protect human life.

Prevent damage to man-made improvements.

Control pollution.

Prevent damage from inundation.

Reduce surface water and sediment runoff

FLOOD CONTROL AND DRAINAGE POLICIES

Enact restrictive land use and building structure regulations in areas vulnerable to severe damage due to the impact of wave action. Only uses that cannot be located elsewhere due to public necessity and character, such as maritime activities and the necessary public facilities and utilities, shall be allowed in these areas.

Development-generated runoff shall be disposed of in a manner acceptable to the Department of Public Works in compliance with all State and Federal laws.

FLOOD CONTROL AND DRAINAGE STANDARDS

Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawaii County Code.

Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).

Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control" of the Hawaii County Code.

Applicable standards and regulations of the Natural Resources Conservation Service and the Soil and Water Conservation Districts.

Discussion: No proposed activity would affect a flood zone, and all construction activities will employ appropriate best management practices as part of their permits. Major grading and other construction activities will be subject to review by the Hawai'i County Department of Public Works to ensure that all relevant standards of Chapter 27 and Chapter 10 are addressed.

NATURAL BEAUTY GOALS

Protect, preserve and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.

Protect scenic vistas and view planes from becoming obstructed.

Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

NATURAL BEAUTY POLICIES

Increase public pedestrian access opportunities to scenic places and vistas.

Protect the views of areas endowed with natural beauty by carefully considering the effects of proposed construction during all land use reviews.

Do not allow incompatible construction in areas of natural beauty.

Discussion: The Bond Estate is not within an area identified in the County General Plan as having exceptional scenic beauty, but all of the current restoration efforts and proposed activities have been designed with maintaining and enhancing the scenic values of the winding road, orchards, graceful trees and gardens, and historic structures that comprise the Father Bond Historic District.

NATURAL RESOURCES AND SHORELINES GOALS

Protect and conserve the natural resources of the County of Hawaii from undue exploitation, encroachment and damage.

Provide opportunities for the public to fulfill recreational, economic, and educational needs without despoiling or endangering natural resources.

Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources.

Ensure that alterations to existing landforms and vegetation, except crops, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.

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Ensure that alterations to existing landforms and vegetation, except crops, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.

NATURAL RESOURCES AND SHORELINES POLICIES

The County of Hawaii should require users of natural resources to conduct their activities in a manner that avoids or minimizes adverse effects on the environment.

Encourage the use of native plants for screening and landscaping.

Discussion: The proposed project is not located on the shoreline, does not affect native plants or animals, as is being designed to minimize pollution and operate in a sustainable manner, in keeping with the New Moon Foundation's mission. Minimal land alteration activities will occur, and no hazardous areas are involved. Both guests and the general public will have enhanced opportunities to fulfill recreational, economic, and educational needs without despoiling or endangering the natural resources of Kohala.

LAND USE GOALS

Designate and allocate land uses in appropriate proportions and mix and in keeping with the social, cultural, and physical environments of the County.

LAND USE POLICIES

Allocate appropriate requested zoning in accordance with the existing or projected needs of neighborhood, community, region and County.

LAND USE, OPEN SPACE GOALS

Provide and protect open space for the social, environmental, and economic well-being of the County of Hawaii and its residents.

Protect designated natural areas.

LAND USE, OPEN SPACE POLICIES

Open space shall reflect and be in keeping with the goals, policies, and standards set forth in the other elements of the General Plan.

Discussion: The proposed CEC is highly compatible with the agricultural activities in surrounding land, which is owned by New Moon as well. Provision of facilities such as the CEC fulfill a need for a growing segment of the visitor industry while also promoting the use of the area for local-based activities.

PART 4: ANTICIPATED DETERMINATION

The Hawai'i County Planning Department, in consultation with the Hawai'i State Department of Land and Natural Resources, State Historic Preservation Division, is expected to determine that the proposed project will not significantly alter the environment, as impacts will be minimal, and that an Environmental Impact Statement will not be warranted. Therefore, it is expected that a Finding of No Significant Impact (FONSI) will be issued.

PART 5: FINDINGS AND REASONS

Chapter 11-200-12, Hawai'i Administrative Rules, outlines those factors agencies must consider when determining whether a project has significant effects:

1. *The proposed project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources.* No valuable natural or cultural resource would be involved, committed or lost. The proposed action involves adaptive reuse of a historic site that will promote its preservation and interpretation.
2. *The proposed project will not curtail the range of beneficial uses of the environment.* No restriction of beneficial uses would occur, and beneficial uses will be promoted.
3. *The proposed project will not conflict with the State's long-term environmental policies.* The State's long term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The project is minor and basically environmentally benign, and it is thus consistent with all elements of the State's long-term environmental policies.
4. *The proposed project will not substantially affect the economic or social welfare of the community or State.* The project will not have any substantial effect on the economic or social welfare of the Kohala community or State. Modest but locally substantial beneficial effects in terms of jobs and recreational/cultural opportunities will occur.
5. *The proposed project does not substantially affect public health in any detrimental way.* The project will not affect public health and safety in any way.
6. *The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities.* As the project is relatively minor, no secondary effects are expected.
7. *The proposed project will not involve a substantial degradation of environmental quality.* The project is minor and environmentally benign, and it would thus not contribute to environmental degradation.

8. *The proposed project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat. The site supports overwhelmingly alien vegetation. No rare, threatened or endangered species of flora or fauna are known to exist on the project site, and none would be affected by any project activities.*
9. *The proposed project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions. The project is not related to other activities in the region in such a way as to produce adverse cumulative effects or involve a commitment for larger actions. Most other planned activities on New Moon land in the area are related to sustainable agriculture and forestry and involve minimal traffic, water quality effects, or other adverse environmental impacts. If other types of activities are eventually planned, they would require further Special Permits from the Hawai'i County Planning Commission, which would consider their cumulative or secondary effects and impose conditions to mitigate for such.*
10. *The proposed project will not detrimentally affect air or water quality or ambient noise levels. No substantial effects to air, water, or ambient noise would occur. Brief, temporary effects would occur during construction and will be mitigated.*
11. *The project does not affect nor would it likely to be damaged as a result of being located in environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal area. The project is not located in an area exposed to flood, erosion, mass wasting or lava flow hazard. The area is not environmentally sensitive either hydrologically or geologically. It presents no additional hazard to the public and is not imprudent for the landowner. All construction will adhere to the Uniform Building Code and Chapter 27, Flood Control, of the Hawai'i County Code.*
12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies. No County or State plan, including the Hawai'i County General Plan, identifies important views in this area. The project will not impair views of or along the coastline.*
13. *The project will not require substantial energy consumption. Negligible amounts of energy input will be required for construction. Sustainable energy is part of project planning.*

For the reasons above, the proposed project will not have any significant effect in the context of Chapter 343, Hawai'i Revised Statutes and section 11-200-12 of the State Administrative Rules.

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ENVIRONMENTAL ASSESSMENT

**NEW MOON FOUNDATION
CONTEMPLATIVE EDUCATION CENTER IN THE
BOND HISTORIC DISTRICT**

APPENDIX 1A

COMMENT LETTERS

FROM AGENCIES AND ORGANIZATIONS

IN RESPONSE TO PRE-CONSULTATION

BENJAMIN J. CAYetano
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
HISTORIC PRESERVATION DIVISION
Kekuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawaii 96707

GILBERT S. COLOMA-AGARAN, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

DEPUTIES
JANET E. KAWELO
LINNELL NISHIOKA

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

June 8, 2001

Mr. Ron Terry, Ph.D.
GeoMetrician Associates
HC 2 Box 9575
Kea`au, Hawaii 96749

LOG NO: 27648
DOC NO: 0106tm04

Dear Mr. Terry:

**SUBJECT: Preconsultation for Environmental Assessment for
Proposed New Moon Foundation Retreat Center
Bond Historic District
TMK: 5-3-5:05 & 24, North Kohala, Island of Hawai'i**

As you are well aware, the Bond Estate is a significant historic site listed on the Hawaii and National Registers of Historic Places. We understand that the historic buildings will be preserved and rehabilitated. We would like to ensure that the historic integrity of the site is maintained following the Secretary of Interiors standards through continued consultation with the architects and New Moon Foundation.

You note that there are plans to construct a 1-acre parking lot on Parcel 5, which is located outside of the Historic District. The effect of the parking lot on cultural resources still needs to be evaluated. We would recommend archaeological testing of the proposed parking lot to determine the presence/absence of subsurface cultural deposits, unless it can be demonstrated that prior land use has destroyed any such possible deposits. It is our understanding that the New Moon Foundation is intending to acquire additional property, some of which may be developed in the future. If this is the case a plan should be developed to identify and treat any historic properties that might be affected by future development.

Continued consultation should include the review of the Environmental Assessment at which time we may be better able to ascertain the degree of further consultation necessary. Thank you for the opportunity to comment at an early stage. Should you have further questions regarding our archaeological concerns, please call Pat McCoy at (808)692-8029. If you have any questions regarding the architectural concerns, please call Carol Ogata or Tonia Moy at (808)692-8015.

Aloha,

Nathan Napaka

for DON HIBBARD, Administrator
State Historic Preservation Division

TM:jk

ENVIRONMENTAL ASSESSMENT

**NEW MOON FOUNDATION
CONTEMPLATIVE EDUCATION CENTER IN THE
BOND HISTORIC DISTRICT**

APPENDIX 1B

COMMENT LETTERS

IN RESPONSE TO DRAFT EA

AND RESPONSES

LINDA LINGLE
GOVERNOR OF HAWAII



GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

236 SOUTH BERETANA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4186
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

November 28, 2005

Christopher Yuen
Planning Department
101 Pauahi Street, #3
Hilo, Hawaii 96720

Attn: Jeff Darrow

Dear Mr. McClure:

Subject: Draft environmental assessment (EA), New Moon Contemplative Center

We have the following comments to offer:

Timeframe: What are the anticipated start and end dates of this project?

Fire pit; hydro-electric facility: In the final EA include an expanded description of these project elements.

Consultations: Besides the June 2001 written consultation from the State Historic Preservation Division, document your ongoing consultation with this agency, including meetings and telephone consultations. Did you receive correspondence from any other agencies during the pre-consultation phase? If so, enclose copies in the final EA.

Cultural impacts assessment: Your documentation of the history of the area and its cultural resources is very good, but section 3.3.3.3 needs to have a conclusion drawn from your findings, i.e. the *analysis or assessment* of the project's impacts on cultural practices. Include this in the final EA.

If you have any questions call Nancy Heinrich at 586-4185.

Sincerely,

Handwritten signature of Genevieve Salmonson in cursive.
GENEVIEVE SALMONSON
Director

c: Ron Terry

geometrician

ASSOCIATES, LLC

integrating geographic science and planning

phone: (808) 982-5831 fax: (808) 966-7593 HC 2 Box 9575 Kea'au Hawai'i 96749
ronterry@verizon.net

January 20, 2006

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

Dear Ms. Salmonson:

Subject: Comment Letter to Draft EA, New Moon Foundation Contemplative Education Center in Bond Historic District, North Kohala, TMK (3rd): 5-3-5:5, 24, 39, 43, 45, 46, & 47 (pors.)

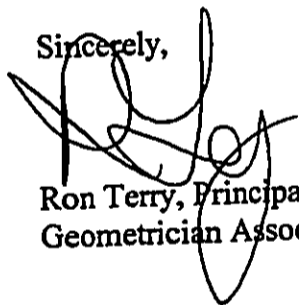
Thank you for your comment letter dated November 28, 2005, on the Draft EA. In answer to your specific comments:

1. **Timeframe.** The applicant intends to begin the project as soon as the Special Permit and Building Permits are obtained. Uncertainties related to the duration of these permit processes preclude specification of an exact timetable, but it now appears that construction may begin as soon as Spring of 2006. This information has been added to Section 2.1 of the Final EA
2. **Firepit and hydroelectric facility.** The Final EA now contains the following expanded descriptions of these facilities. The 30 KW hydroelectric plant and a backup diesel generator will be installed in a small building along with the appropriate electrical controls. The water sources for the hydroelectric plant are existing shallow tunnels tapping perched groundwater that is conveyed via pipe line to a central reservoir. A 10-inch penstock will convey the water under pressure to the power plant and also to fire hydrants located on the grounds of the facility. The power system will be automatically controlled to shut the power plant down when the reservoir gets too low, at which time the diesel generator will start. It is intended that there will always be fireflow available when needed. Water discharged from the plant will be restored to the water system supplying the old Kohala Mill site for agricultural uses. The fire pit is simply a campfire area that will be lined with cement or stones and will be located near enough the support services building that a hose can be used to douse the fires. A fire hydrant is also expected to be available nearby.

3. *Consultations.* After unsuccessful attempts to obtain return phone calls or e-mails from the SHPD office in early 2005, our archaeologist spoke by telephone with the Assistant Hawai'i Island Archaeologist on several occasions in 2005, seeking: a) review of the archaeological report we had submitted and for which we had paid review fees, and b) verification of the EA acceptance procedure that we had worked out in a meeting then-Hawai'i Island Archaeologist Pat McCoy during a site visit in June, 2001. Our architectural consultant also spoke by telephone and met in person with staff from SHPD in Honolulu in late 2005 an attempt to obtain a written determination of the acceptability of the EA acceptance procedure. As none of these consultation attempts bore fruit, we did not document them in the Draft EA. As for other agencies, none responded to our preconsultation letters. I would note that our cultural consultants engaged in a very extensive in-person consultation process with dozens of individuals and groups in North Kohala, as documented in the archaeological and cultural report.
4. *Cultural impacts assessment.* The Final EA now contains the conclusion that no cultural resources or practices would be adversely affected by the proposed project, as supported by the information provided in this section.

Again, thank you for your comment. If you have any questions about the EA, please contact me at 982-5831. For information or questions about the project, please contact Greg Mooers at 880-1455.

Sincerely,



Ron Terry, Principal
Geometrician Associates

Harry Kim
Mayor



Lawrence K. Mahuna
Police Chief

Harry S. Kubojiri
Deputy Police Chief

County of Hawaii

POLICE DEPARTMENT
349 Kapiolani Street • Hilo, Hawaii 96720-3998
(808) 935-3311 • Fax (808) 961-2389

December 19, 2005

Mr. Ron Terry
Geometrician Associates
HC 2 Box 9575
Keaau, Hawaii 96749

Reference: New Moon Foundation Contemplative Education Center in Bond
Historic District, North Kohala

Dear Mr. Terry:

This is in response to your request received by the Hawaii Police Department on November 23, 2005, concerning the New Moon Foundation Contemplative Education Center in Bond Historic District, North Kohala project, Draft Environmental Assessment for the property described by tax map key (3) 5-3-5:5, 24, 39, 43, 45, 46 and 47 (pors.).

Staff has reviewed your request and has no comments to offer at this time.

Sincerely,

A handwritten signature in black ink, appearing to read "Lawrence K. Mahuna", written over a circular stamp.

LAWRENCE K. MAHUNA
POLICE CHIEF

LB:jaj

geometrician

ASSOCIATES, LLC

integrating geographic science and planning

phone: (808) 982-5831 fax: (808) 966-7593 HC 2 Box 9575 Kea'au Hawai'i 96749
ronterry@verizon.net

January 20, 2006

Lawrence Mahuna, Chief
Hawaii County Police Department
349 Kapiolani Street
Hilo, Hawaii 96720

Dear Chief Mahuna:

Subject: Comment Letter to Draft EA, New Moon Foundation Contemplative Education Center in Bond Historic District, North Kohala, TMK (3rd): 5-3-5:5, 24, 39, 43, 45, 46, & 47 (pors.)

Thank you for your comment letter dated December 19, 2005, in which you stated that you had no comments on the Draft EA. If at any time you do have questions about the EA, please contact me at 982-5831. For information or questions about the project, please contact Greg Mooers at 880-1455. Please note that we will be preparing a Special Permit for the Hawai'i County Planning Commission for certain aspects of the project, and may be seeking further input from your office. Again, thank you for your review.

Sincerely,



Ron Terry, Principal
Geometrician Associates

PHONE (808) 594-1888

FAX (808) 594-1885



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

HRD05/2140

December 19, 2005

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

RE: Draft Environmental Assessment for the Proposed New Moon Contemplative Education Center in Bond Historic District, North Kohala, Hawai'i Island, TMK (3) 5-3-5: 5, 24, 39, 43, 45, 46 & 47 (pors.).

Dear Mr. Terry,

The Office of Hawaiian Affairs (OHA) is in receipt of your November 23, 2005 request for comment on the above listed proposed project, TMK (3) 5-3-5: 5, 24, 39, 43, 45, 46 & 47 (pors.). OHA offers the following comments:

Our office has two recommendations for the proposed re-development of the Kohala Girls' School. Both recommendations address issues of cultural and environmental sensitivity. They are: 1) an archaeological monitor should be present during all ground altering activities within the proposed project area, and, 2) all grubbed areas should be replanted with native flora to promote a native ecosystem in the 'Iole region.

OHA further requests your assurances that if the project goes forward, should iwi or Native Hawaiian cultural or traditional deposits be found during ground disturbance, work will cease, and the appropriate agencies will be contacted pursuant to applicable law. Thank you for the opportunity to comment. If you have further questions or concerns, please contact Jesse Yorck at (808) 594-0239 or jessey@oha.org.

'O wau iho nō,

A handwritten signature in black ink, appearing to read "Clyde W. Nāmu'o".

Clyde W. Nāmu'o
Administrator

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

Norman Hayashi
Hawaii County Planning Department
101 Aupuni Street, Suite 3
Hilo, HI 06720

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ronterry@verizon.net

January 20, 2006

Clyde W. Namu'o, Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd., Suite 1250
Honolulu HI 96813

Dear Mr. Namu'o:

Subject: Comment Letter to Draft EA, New Moon Foundation Contemplative Education Center in Bond Historic District, North Kohala, TMK (3rd): 5-3-5:5, 24, 39, 43, 45, 46, & 47 (pors.)

Thank you for your comment letter dated December 19, 2005, on the Draft EA. In answer to your specific recommendations:

1. *Archaeological monitor.* An extensive program of archaeological monitoring, data recovery and continuing research has been proposed as part of the archaeological inventory survey, which the New Moon Foundation intends to undertake diligently.
2. *Planting with native vegetation.* New Moon will continue gardening and landscaping with a mixture of natives, Polynesian cultivated species and period vegetation throughout the property. Please note that New Moon plans to keep grubbing and grading to a minimum, and that certain areas that are to be grubbed and graded will be parts of structures, roads, orchards and lawns.

Again, thank you for your comment. If you have any questions about the EA, please contact me at 982-5831. For information or questions about the project, please contact Greg Mooers at 880-1455.

Sincerely,



Ron Terry, Principal
Geometrician Associates

ENVIRONMENTAL ASSESSMENT

**NEW MOON FOUNDATION
CONTEMPLATIVE EDUCATION CENTER IN THE
BOND HISTORIC DISTRICT**

APPENDIX 2

FIGURES

Figure 1
USGS Map

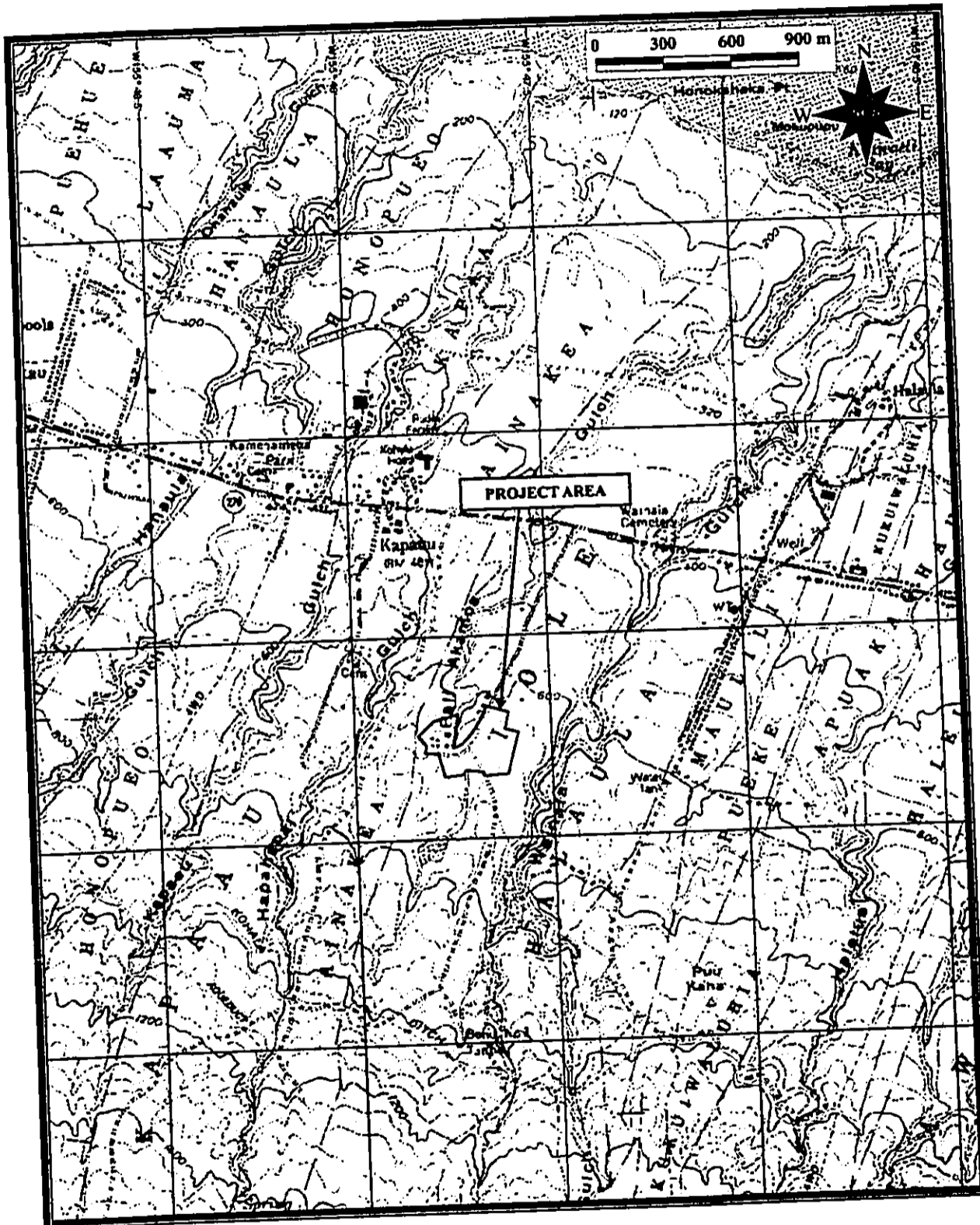


Figure 2
Tax Map

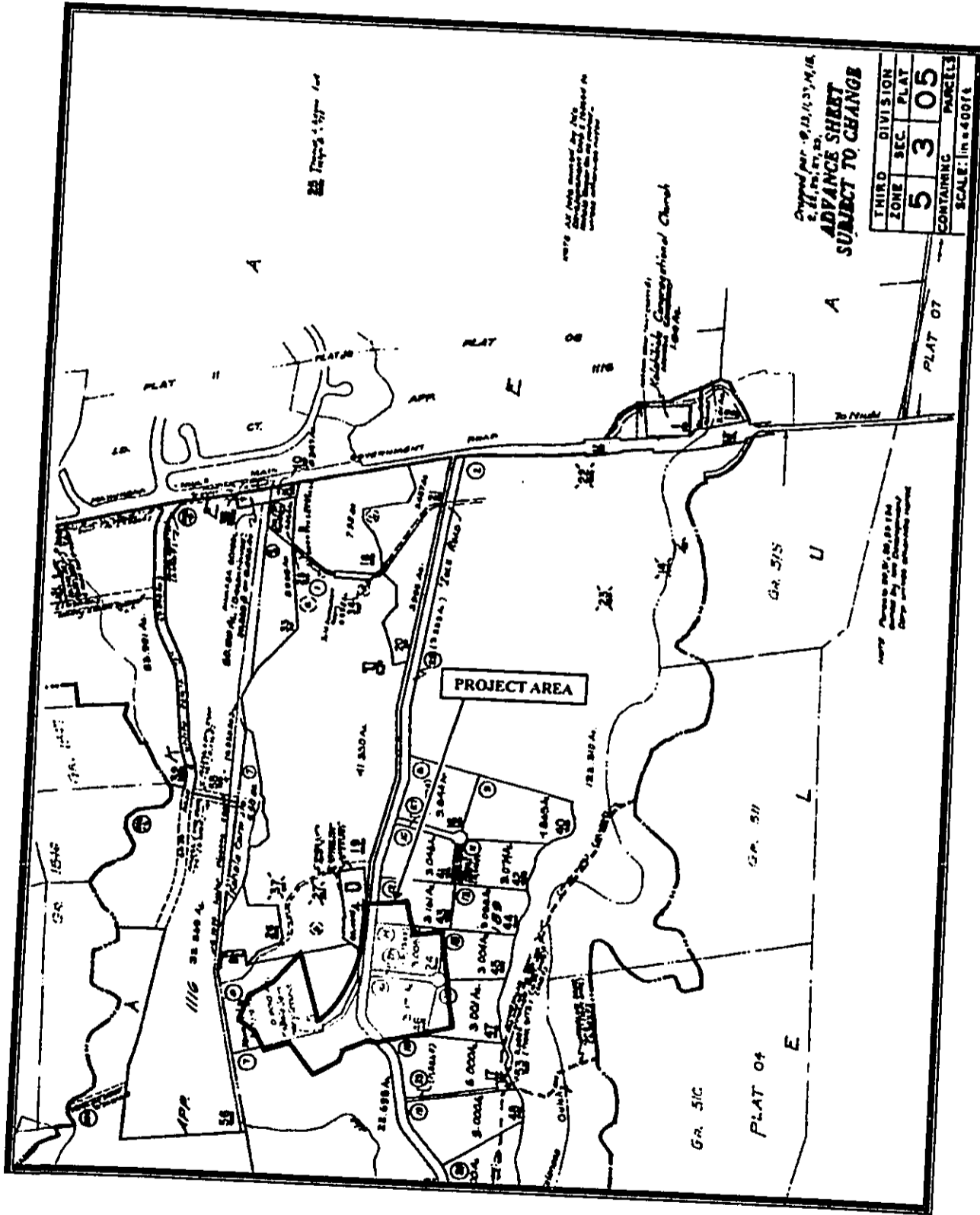
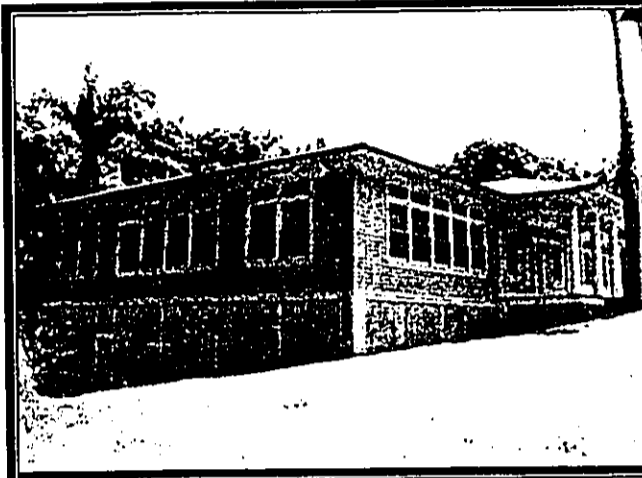
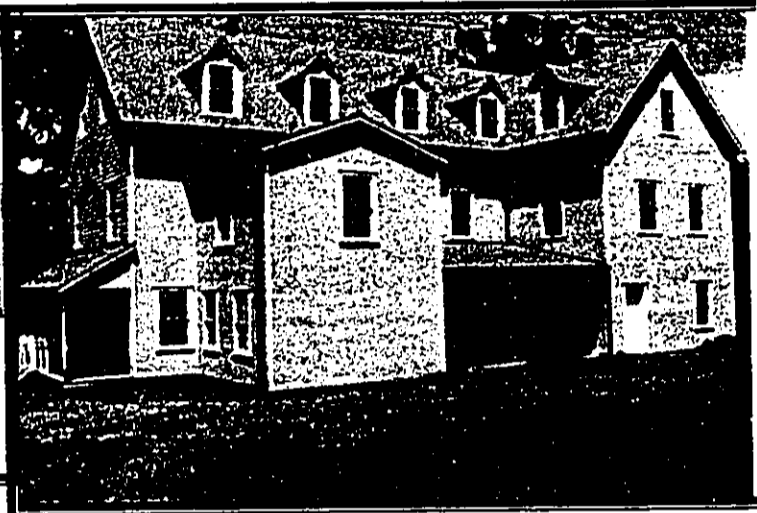


Figure 3a Project Site Photographs

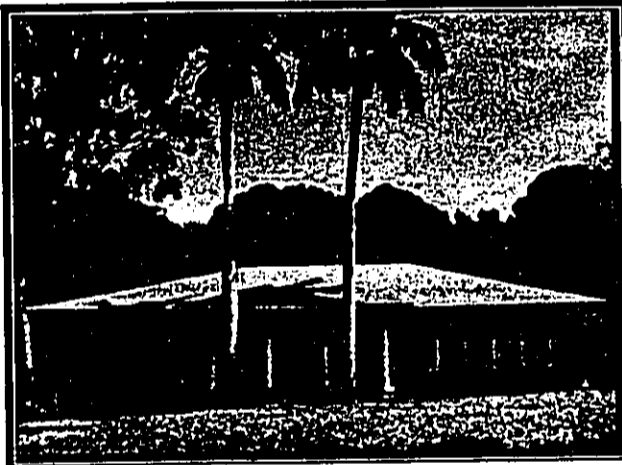


Dining Hall



Dormitory

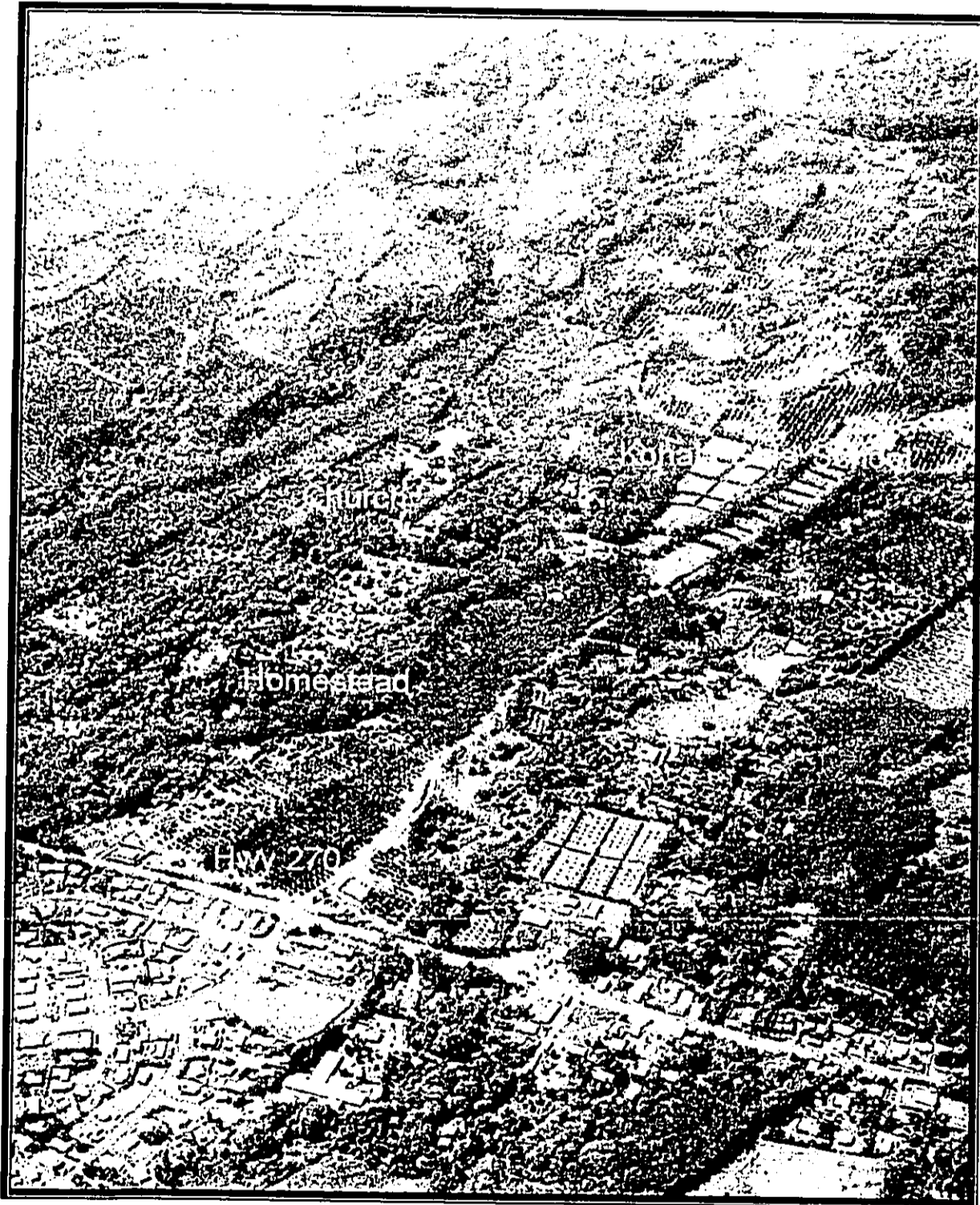
Dining Hall



Outbuilding



Figure 3b Aerial Photograph



**Figure 4
Site Plan**

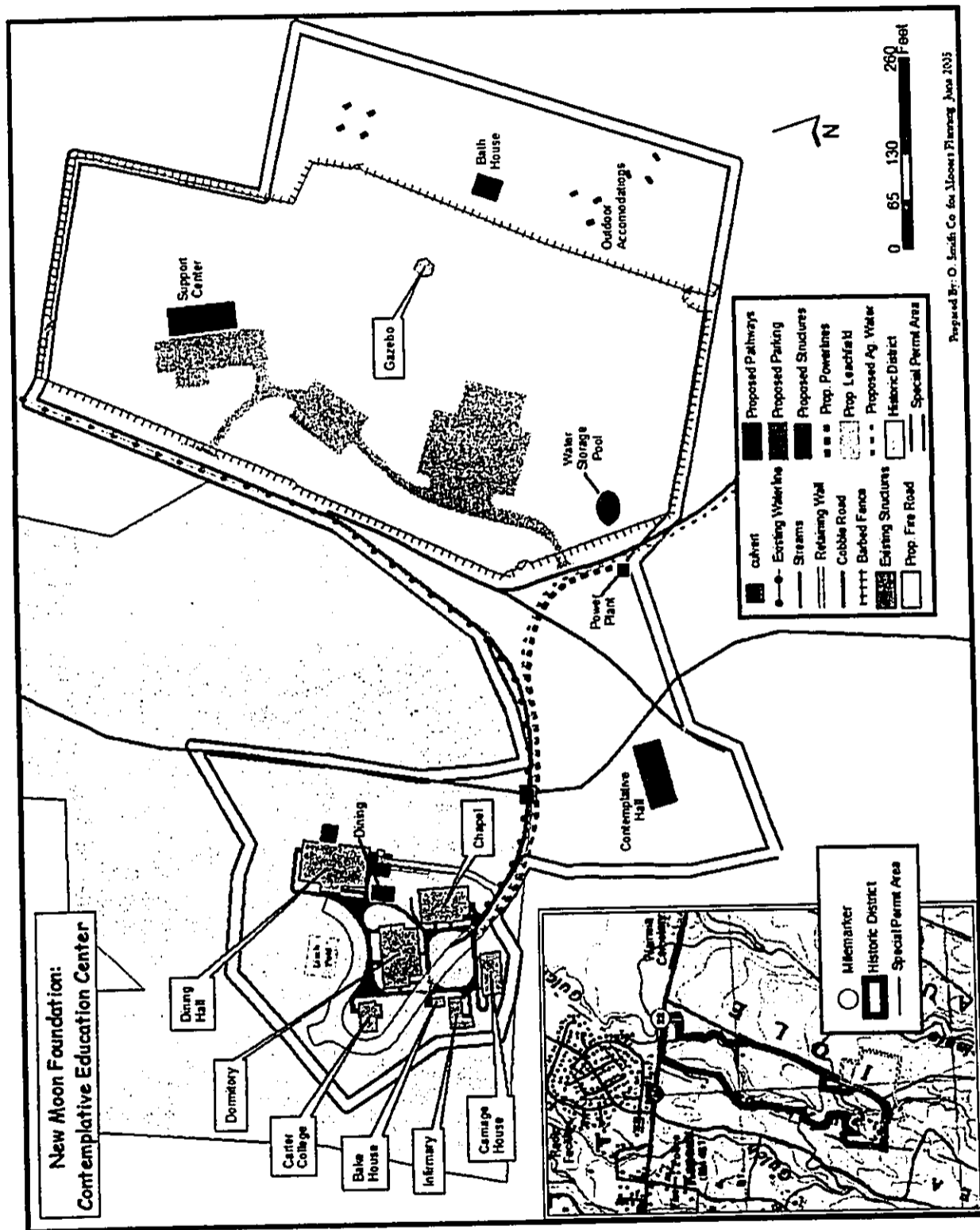


Figure 5
Archaeological and Cultural Resources

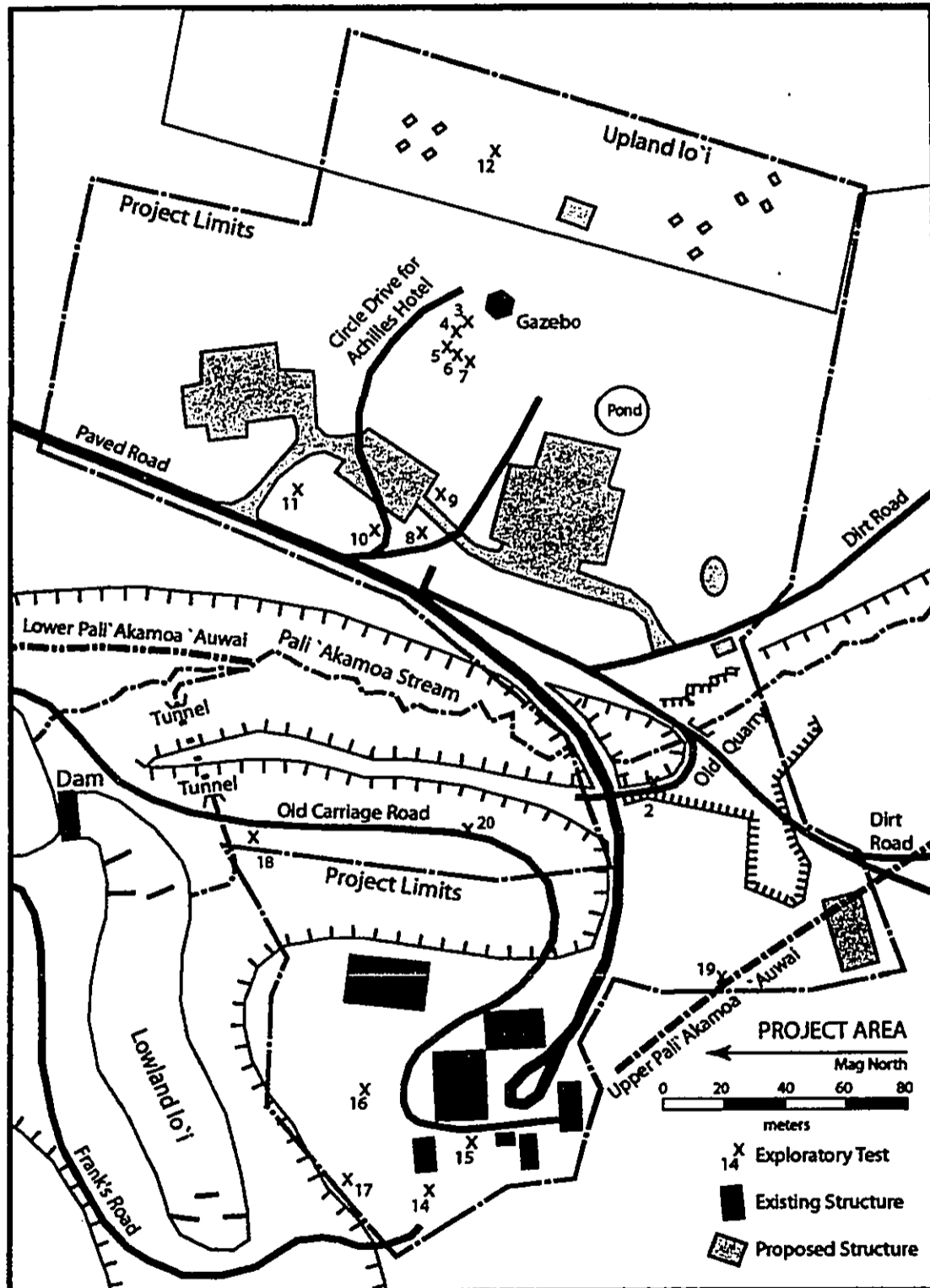
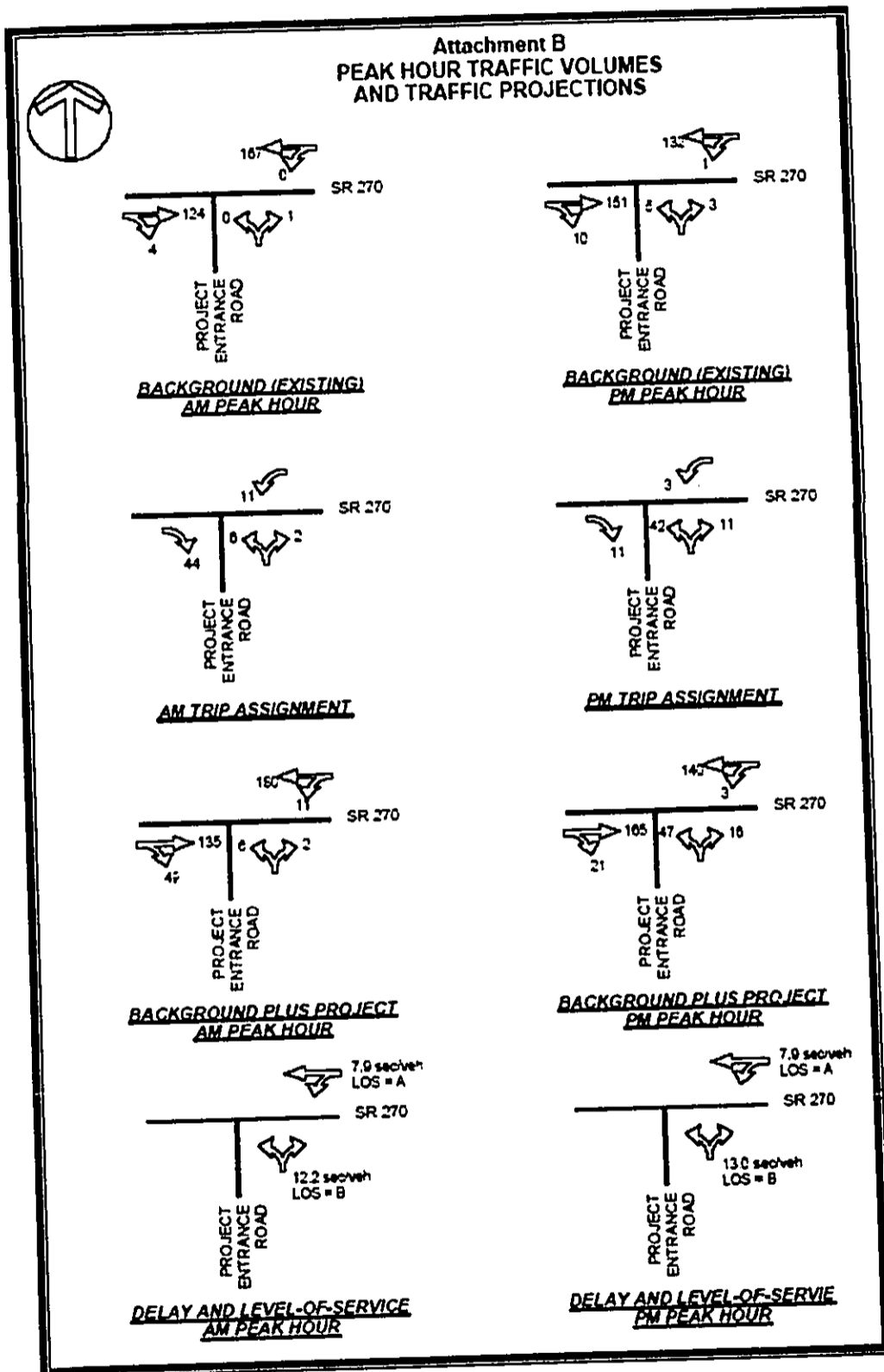


Figure 6



Source: Appendix 3

ENVIRONMENTAL ASSESSMENT

**NEW MOON FOUNDATION
CONTEMPLATIVE EDUCATION CENTER IN THE
BOND HISTORIC DISTRICT**

APPENDIX 3

TRAFFIC IMPACT ASSESSMENT REPORT

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October 5, 2005

Mr. Bennett Dorrance
c/o Mooers Enterprises, LLC
PO Box 1101
Kamuela, HI 96743

Attn: Mr. Greg Mooers

Re: **Traffic Impact Assessment**
Proposed New Moon Contemplative Education Center
North Kohala, Hawaii
TMK5-3-5:5 & 24

Dear Mr. Dorrance:

Phillip Rowell and Associates have prepared the following Traffic Impact Assessment Report for the proposed New Moon Contemplative Education Center in the North Kohala area of the Island of Hawaii. The purpose of this traffic assessment is to identify and assess the traffic impacts of the proposed project.

Project Location and Description

The project is located mauka of SR 270 in the North Kohala area of the Island of Hawaii. The site is the old Kohala Girl's School on the Bond Estate. The project access road is a two-way paved roadway that is approximately 18 to 20 feet wide. The access road is located approximately 0.1 mile east of Milepost 24. The approximate location of the project is shown on Attachment A.

The proposed project is a Contemplative Education Center "for various programs of an historic, agricultural, environmental, educational, or healing nature." Table 1 is a summary of the anticipated users of the CEC.

Table 1 Summary of Proposed Project

A.	Residential Guests on Site	Maximum of 60 guests
B.	Residential Guests in Tentalo	Maximum of 20 guests
C.	Day Guests	Maximum of 20 guests
D.	Special Events	Maximum of 200 attendees
E.	Employees	Maximum of 22 employees

Purpose and Objective of Study

1. Identify existing and potential deficiencies in the roadway network adjacent to the proposed project.
2. Determine if a Traffic Impact Analysis Report for the proposed project is warranted.
3. Identify potential deficiencies that will impact traffic operations in the vicinity of the proposed project.

Methodology

The following is a summary of the methodology and tasks performed to complete this study:

1. A reconnaissance of the area was performed. The purpose of the reconnaissance was to identify the existing roadway conditions, cross-section, speed limits and right-of-way controls and any other factors that may affect access to and egress for the proposed project.
2. Existing traffic data for SR 270 adjacent to the project was collected. This data was obtained from manual traffic counts conducted on Monday, September 26, 2005, at the intersection of SR 270 at the project's entrance roadway.
3. The peak hour traffic that the project will generate was estimated. This was done using standard trip generation procedures outlined in the *Trip Generation Handbook*¹. These trips were then distributed and assigned based on the available approach and departure routes.
4. Background plus project traffic projections were estimated. This was done by increasing the existing traffic volumes along SR 270 by an appropriate growth factor and then superimposing project generated traffic.
5. Anticipated traffic operating conditions were estimated for the intersection of SR 270 at the project access road. This analysis was performed using the methodology described in the *Highway Capacity Manual*². Generally, this methodology determines with level-of-service of a study intersection based on the average vehicle delay of vehicles using the controlled movements of the intersection during the peak hour.

Description of Existing Streets and Intersection Controls

Access to and egress from the project will be via a driveway along south (mauka) side of SR 270. This roadway is a two-way roadway. SR 270 is a two-lane, two-way State Highway. The intersection of SR 270 at the project access road is a STOP sign controlled T-intersection.

Existing Peak Hour Traffic Volumes

Existing morning and afternoon peak hour traffic volumes along SR 270 adjacent to the project access road are shown in Attachment B. These traffic volumes were obtained from manual traffic counts performed on Monday, September 26, 2005.

Level-of-Service Concept

"Level-of-Service" is a term which denotes any of an infinite number of combinations of traffic operating conditions that may occur on a given lane or roadway when it is subjected to various traffic volumes. Level-of-service (LOS) is a qualitative measure of the effect of a number of factors which include space, speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience.

There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. The characteristics of traffic operations for each level-of-service are summarized in Table 2. In general, LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions.

¹ Institute of Transportation Engineers, *Trip Generation Handbook*, Washington, D.C., 1998

² Transportation Research Board, *Highway Capacity Manual*, Washington, D.C., 2000

Capacity is defined as the maximum number of vehicles that can be accommodated by the roadway during a specified period of time. The capacity of a particular roadway is dependent upon its physical characteristics such as the number of lanes, the operational characteristics of the roadway (one-way, two-way, turn prohibitions, bus stops, etc.), the type of traffic using the roadway (trucks, buses, etc.) and turning movements.

Table 2 Level-of-Service Definitions for Unsignalized Intersections⁽¹⁾

Level-of-Service	Expected Delay to Minor Street Traffic	Delay (Seconds)
A	Little or no delay	<10
B	Short traffic delays	10.1 to 15.0
C	Average traffic delays	15.1 to 25.0
D	Long traffic delays	25.1 to 35.0
E	Very long traffic delays	35.1 to 50.0
F	See note (2) below	>50.1

Notes:
(1) Source: *Highway Capacity Manual*, 2000.
(2) When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement of the intersection.

Project Trip Generation

Future traffic volumes generated by the project were estimated using the procedures described in the *Trip Generation Handbook*,³ published by the Institute of Transportation Engineers. This method typically uses trip generation rates to estimate the number of trips that a proposed project will generate during the peak hours of the project and along the adjacent street.

There are four components to the project. These components are residential guests on-site, residential guests in tentalos, day guests, special events attendees and employees. A separate trip generation analysis was performed for each component and is discussed in the following paragraphs.

Residential Guests On Site

The trip generation analysis for the residential guests was performed using the following assumptions:

1. The maximum number of residential guest will be 60.
2. Residential guest will be housed in units comparable to hotel rooms.
3. There will be two guests per unit.
4. The traffic characteristics of the residential guests will be comparable to those of resort hotel guest. By definition, resort hotel guests tend to remain on-site and do not make a significant number of trips to and from the hotel site.
5. 100% of the units will be occupied.

³ Institute of Transportation Engineers, *Trip Generation Handbook*, Washington, D.C., 1998, p. 7-12

The trip rates and the estimated number of peak hour trips that the residential guests will generate are shown in Table 3. Trips generated during the morning and afternoon peak hour of generator are shown.

Table 3 Trip Generation Calculations for Residential Guests

Time Period	Direction	Rate or Factor ⁽¹⁾	Units	Peak Hour Trips
AM Peak Hour	Total	0.47	30	14
	% Inbound	63%		9
	% Outbound	37%		5
PM Peak Hour	Total	0.59	30	18
	% Inbound	50%		9
	% Outbound	50%		9

NOTES:
 (1) Institute of Transportation Engineers, *Trip Generation*, 7th Edition, 2003.

Residential Guest in Tentelos

1. The maximum number of residential guest will be 20.
2. Residential guest will be housed in units comparable to hotel rooms.
3. There will be two guests per unit.
4. The traffic characteristics of the residential guests will be comparable to those of resort hotel guest. By definition, resort hotel guests tend to remain on-site and do not make a significant number of trips to and from the hotel site.
5. 100% of the tentalo units will be occupied.

The trip rates and the estimated number of peak hour trips that the residential guests in tentalos will generate are shown in Table 4. Trips generated during the morning and afternoon peak hour of generator are shown.

Table 4 Trip Generation Calculations for Residential Guests in Tentalos

Time Period	Direction	Rate or Factor ⁽¹⁾	Units	Peak Hour Trips
AM Peak Hour	Total	0.47	10	5
	% Inbound	63%		3
	% Outbound	37%		2
PM Peak Hour	Total	0.59	10	6
	% Inbound	50%		3
	% Outbound	50%		3

NOTES:
 (1) Institute of Transportation Engineers, *Trip Generation*, 7th Edition, 2003.

Day Guests

The trip generation analysis for the day guests was performed using the following assumptions

1. The maximum number of day guests will be 20.
2. 50% of the day guests will arrive within one hour before the start of class.
3. 50% of the day guests will depart within one hour after the end of class.
4. Arrival and departure of day guests will coincide with the peak commute hours along the adjacent roadway.
5. The average vehicle occupancy is 2.0 persons per vehicle.
6. There are no drop-offs and pick-ups.

Based on these assumptions, there will be 5 inbound trips during the morning peak hour and 5 outbound trips during the afternoon peak hour.

Special Events

Special events are understood to be guest lectures and fairs. These events may, or may not, last all day. The assumptions used to estimate traffic associated with special events are:

1. The maximum capacity for a special event is 200 persons.
2. 50% of the attendees will arrive within one hour before the start of the event.
3. 50% of the attendees will depart within one hour after the end of the event.
4. 50% of the attendees will arrive via automobile.
5. The average vehicle occupancy of the automobiles will be 2.5 persons per vehicle.
6. The remaining 50% of the attendees will arrive via van.
7. The average vehicle occupancy of the vans is 6.0 persons per van.
8. There will be no drop-offs or pick-ups.

Based on these assumptions, there will be 28 inbound trips during the morning peak hour and 28 outbound trips during the afternoon peak hour.

Employees

The trip generation analysis for the employees was performed using the following assumptions

1. The maximum number of employees will be 22.
2. Each employee will drive to and from work.
3. All employees will live off-site.

4. Employees will work from 8:30 AM to 5:00 PM. Thus, employee trips will coincide with the peak commute hours along the adjacent highway.
5. Employees will have trips rates and inbound/outbound distributions comparable to typical office employees.

The estimated trips generated by the project's employees is summarized in Table 5.

Table 5 Trip Generation Calculations for Employees

Time Period	Direction	Rate or Factor ⁽¹⁾	Employees	Trips
AM Peak Hour	Total	0.48	22	11
	% Inbound	88%		10
	% Outbound	12%		1
PM Peak Hour	Total	0.46	22	10
	% Inbound	17%		2
	% Outbound	83%		8

NOTES:

(1) Institute of Transportation Engineers, Trip Generation, 7th Edition, 2003.

Project Summary

Table 6 is a summary of the total trips generated by the project.

Table 6 Summary of Project Trip Generation Analysis

Time Period	Direction	Trips Generated By:					Total
		Residential Guests On Site	Residential Guests on Tentalo	Day Students	Special Events	Employees	
AM Peak Hour	Total	14	5	5	28	11	63
	Inbound	9	3	5	28	10	55
	Outbound	5	2	0	0	1	8
PM Peak Hour	Total	18	6	5	28	10	67
	Inbound	9	3	0	0	2	14
	Outbound	9	3	5	28	8	53

The proposed project will generate a maximum of 55 inbound and 8 outbound trips during the morning peak hour. During the afternoon peak hour, the project will generate a maximum of 14 inbound and 53 outbound trips. It should be noted that the peak hourly volumes shown above are the maximum number of trips that the project will generate. Since it was assumed that traffic associated with all the events coincide, including traffic associated with special events, the above trip generation analysis represents a worse-case scenario.

The Institute of Transportation Engineers recommends that a traffic impact study should be performed if, in lieu of another locally preferred criterion, development generates an additional 100 vehicle trips in the peak

direction (inbound or outbound) during the site's peak hour.⁴ Based on the criterion, a traffic impact study is not warranted.

The project generated traffic was distributed and assigned to the traffic movements at the intersection of SR 270 at the project's entrance. These assignments are shown on Attachment B.

2007 background plus project traffic volumes with the project were estimated by expanding the existing through traffic along SR 270 by 4% per year for two years and then superimposing the peak hourly traffic generated by the proposed project. The Traffic Projection Worksheet is provided as Attachment B and the resulting 2007 background plus project peak hour traffic volumes are shown in Attachment C.

Level-of-Service Analysis of 2007 Conditions

Based on criteria recommended by the Institute of Transportation Engineers, a traffic impact study is not warranted. However, a level-of-service was performed for future background plus project conditions to identify potential traffic operational deficiencies at the entrance to the project.

The Level-of-Service analysis was performed using the following assumptions:

1. The existing lane configurations at the study intersections and driveways are unchanged.
2. The peak hour of the project generated traffic coincides with the peak hour of traffic along SR 270.

The results of the Level-of-Service analysis for 2007 conditions are summarized in Table 7. Shown in the table are average vehicle delay and level-of-service of controlled movements.

Table 7 Level-of-Service Analysis for 2007 Peak Hour Conditions

Intersection and Movement	AM Peak Hour				PM Peak Hour			
	Existing (2005)		2007 Background Plus Project		Existing (2005)		2007 Background Plus Project	
	Delay ¹	LOS ²	Delay	LOS	Delay	LOS	Delay	LOS
SR 270 at Project Entrance Road								
Westbound Left & Thru	7.6	A	7.9	A	7.8	A	7.9	A
Northbound Left & Right	9.3	A	12.2	B	11.0	B	13.0	B

NOTES:

- (1) Delay is in seconds per vehicle.
- (2) Level-of-Service denotes Level-of-Service calculated using the operations method described in *Highway Capacity Manual*. For unsignalized intersections, the LOS is defined by the average vehicle delay.

Based on the results of the Level-of-Service analysis, traffic turning left into the project from SR 270 will operate at Level-of-Service A during the morning and afternoon peak hours. Traffic exiting the project onto SR 270 will operate at Level-of-Service B during both peak hours. Levels-of-Service A and B imply that traffic operating conditions at the study intersection will be good and that delays will be minimal. Level-of-Service C is considered an acceptable level-of-service for rural highway conditions.

⁴ Institute of Transportation, *Traffic Access and Impact Studies for Site Development, A Recommended Practice*, 1991, page 5.

Mr. Bennett Dorrance
October 5, 2005
Page 8

Mitigation

Because the levels-of-service are high, the traffic impacts of project generated traffic are insignificant and no mitigation is recommended.

The need for separate left turn storage lanes was assessed using two criteria. The first is based on traffic volumes at the subject intersection and is described in NCHRP Report 457⁵. The warrant provided in this reference is reproduced as Attachment D. As shown, a separate left turn lane is not warranted for either morning peak hour or afternoon peak hour.

Summary and Conclusions

The conclusions of the traffic impact analysis for 2007 background plus project conditions are:

1. The proposed project will generate 55 inbound and 8 outbound trips during the morning peak hour. During the afternoon peak hour, the project will generate 14 inbound and 53 outbound trips. It should be noted that the peak hourly volumes shown above are the maximum number of trips that the project will generate. Since it was assumed that traffic associated with all the events coincide, including traffic associated with special events, the above trip generation analysis represents a worse-case scenario.
2. Based on the results of the Level-of-Service analysis, traffic turning left into the project from SR 270 will operate at Level-of-Service A during the morning and afternoon peak hours. Traffic exiting the project onto SR 270 will operate at Level-of-Service B during the morning and afternoon peak hours. Because the levels-of-service are high, the traffic impacts of project generated traffic are insignificant and no mitigation is recommended.
3. A separate left turn lane from SR 270 into the project is not required based on guidelines described by the Transportation Research Board.
4. During the field reconnaissance, it was observed that the sight distance to the left of the project driveway may be restricted. It is recommended that adequate sight distance be confirmed by the project's civil engineer.
5. Because of the speed and sight distances along SR 270 adjacent to the project, it is recommended that rumble strips of delineator buttons be installed along the approaches to the driveway to make drivers aware of the intersection. This should encourage drivers to slow down along this section of roadway.

Respectfully submitted,
PHILLIP ROWELL AND ASSOCIATES



Phillip J. Rowell, P.E.
Principal

⁵ Transportation Research Board, National Academy of Sciences, *NCHRP 457, Evaluating Intersection Improvements: An Engineering Study Guide*, 2001, Washington, D.C., p.22.

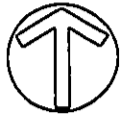
List of Attachments

Attachment A Project Location Map

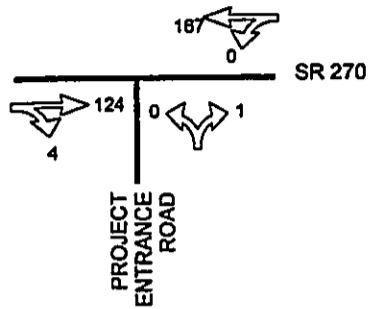
Attachment B Peak Hour Traffic Volumes and Traffic Projections

Attachment C Traffic Projection Worksheet

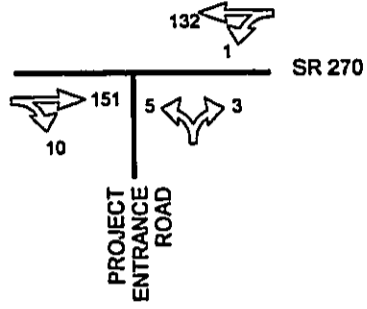
Attachment D Guidelines for Determining the Need for a Separate Left Turn Lane



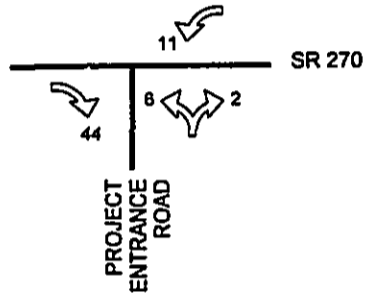
**Attachment B
PEAK HOUR TRAFFIC VOLUMES
AND TRAFFIC PROJECTIONS**



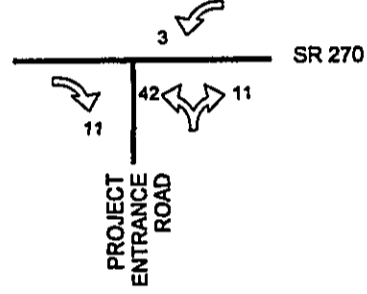
**BACKGROUND (EXISTING)
AM PEAK HOUR**



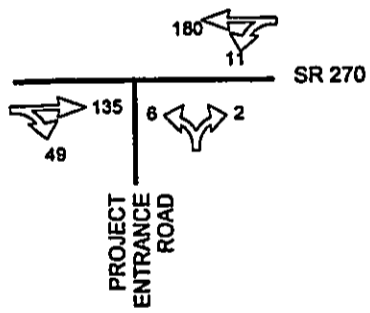
**BACKGROUND (EXISTING)
PM PEAK HOUR**



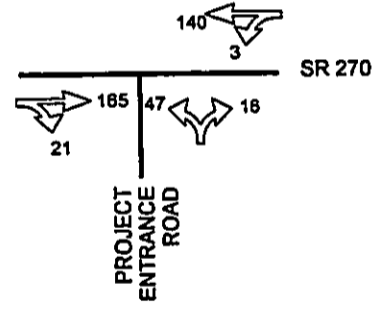
AM TRIP ASSIGNMENT



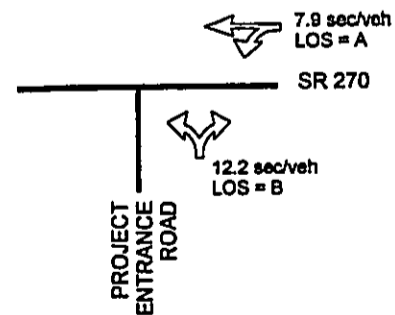
PM TRIP ASSIGNMENT



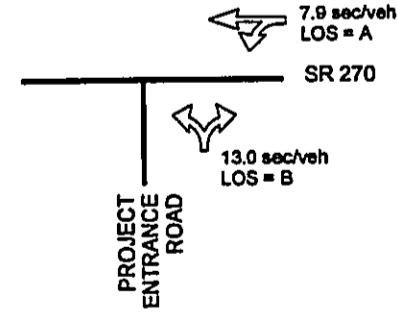
**BACKGROUND PLUS PROJECT
AM PEAK HOUR**



**BACKGROUND PLUS PROJECT
PM PEAK HOUR**



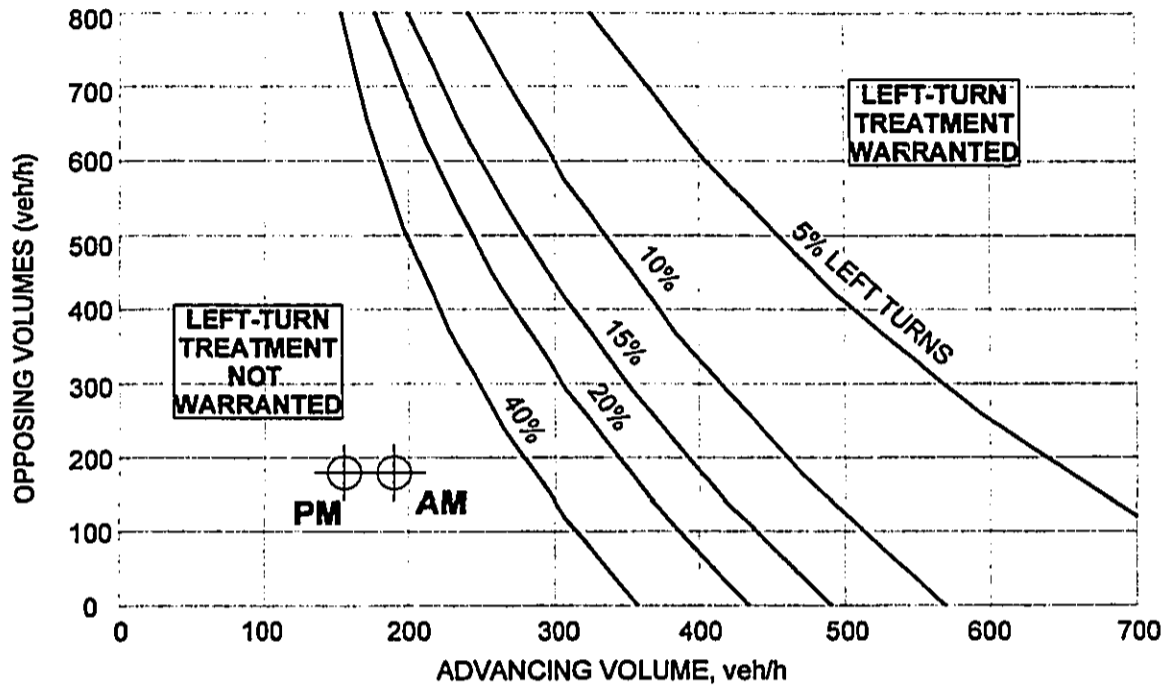
**DELAY AND LEVEL-OF-SERVICE
AM PEAK HOUR**



**DELAY AND LEVEL-OF-SERVIE
PM PEAK HOUR**

Attachment C
Traffic Projection Worksheet

Approach & Movement		Existing (2005)		2007 Background		Project Trip Distribution		Project Trips		2007 Background Plus Project Trips	
		AM	PM	AM	PM	% In	% Out	AM	PM	AM	PM
East	Thru	167	132	180	140					180	140
	Lt	0	1	0	0	20%		11	3	11	3
South	Rt	1	3	0	5		20%	2	11	2	16
	Lt	0	5	0	5		80%	6	42	6	47
West	Rt	4	10	5	10	80%		44	11	49	21
	Th	124	151	135	165					135	165



Source: NCHRP Report 457
Evaluating Intersection Improvements: An Engineering Study Guide
2001, page 22

Attachment D

GUIDELINES FOR DETERMINING THE NEED FOR A MAJOR ROAD LEFT-TURN BAY AT A TWO-WAY STOP CONTROLLED INTERSECTION

TWO-LANE ROAD - 60 km/hr (40 mph)

ENVIRONMENTAL ASSESSMENT

**NEW MOON FOUNDATION
CONTEMPLATIVE EDUCATION CENTER IN THE
BOND HISTORIC DISTRICT**

APPENDIX 4

ARCHAEOLOGICAL AND CULTURAL REPORT

SCS Report 409-2

**An Archaeological Inventory Survey for the
Proposed New Moon Contemplative Education Center
in 'Iole, North Kohala, Hawai'i**

**Investigations into the Changing Patterns of Water Control
in the Uplands of 'Iole**

Portions of TMK: 5-3-005:5, 24, 39, 43, 45, 46, and 47

**by Thomas R. Wolforth, M.S.
Scientific Consultant Services, Inc.**

August, 2005

**Prepared for:
New Moon Foundation
P.O. Box 1089
Kapa'au, Hawai'i 96755**

ABSTRACT

The New Moon Foundation proposes to build a retreat center within portions of the Bond Historic District, a National Register of Historic Places property (Site 50-10-02-7100). Although extensive background research and architectural investigations have been conducted previously, there had been no archaeological investigations for this area. Archaeological Inventory Survey was performed within and adjacent to the Bond Historic District focusing on the areas at and around the Kohala Girls' School for the New Moon Foundation by Scientific Consultant Services, Inc. Archaeological remains of prehistoric agricultural practices, and historical development were observed on the surface and below the surface of the project area.

The project area is partly within and partly beyond the Bond Historic District. The newly reported historical features identified within the District (brick "Water Pipe", privies, disposal areas, tunnel, and an old carriage road) are significant for their contribution to the era of significance for the District. The prehistoric features within the District (the Lowland *Lo'i*, and the Upper Pali 'Akamoa 'Auwai) are significant, but not as a contributing element to the District.

In addition, there are two resources (Quarry and Old Quarry Road) immediately beyond the project area that are significant for their contribution to the era of significance for the District, and one resource that is significant as a prehistoric resource (Terraced Field).

TABLE OF CONTENTS

ABSTRACT	ii
TABLE OF CONTENTS	iii
LIST OF FIGURES	iv
LIST OF TABLES	iv
INTRODUCTION	1
THE HAWAIIAN CHRONOLOGY	6
THE LATTER DAYS OF HAWAIIAN RULE: 1750-1819	6
HAWAIIAN STYLE IN 'IOLE	14
EARLY TIMES	14
THE POST-CONTACT CHRONOLOGY	18
BEFORE BOND: 1819-1841	18
THE ARRIVAL OF BOND: 1841-1874	19
THE KOHALA GIRLS' SCHOOL: 1874-1926	20
AFTER BOND: 1926-TODAY	22
THE BOND HISTORIC DISTRICT	22
POTENTIAL SUBSURFACE HISTORICAL RESOURCES	23
FIELD ACTIVITY AND RESULTS	23
THE COMMUNITY RESOURCES	23
FIELD METHODS	26
THE PREHISTORIC RESOURCES	30
THE BOND-ERA RESOURCES	47
DISCUSSION	61
PATTERNS OF 'IOLE PAST	61
SIGNIFICANCE ASSESSMENT	63
CULTURAL IMPACT ASSESSMENT	66
RECOMMENDED TREATMENTS	66
ACKNOWLEDGEMENTS	68
REFERENCES CITED	69

LIST OF FIGURES

Figure 1. Project location.....	2
Figure 2. Project TMK.....	3
Figure 3. Bond Historic District.....	4
Figure 4. Project area.....	5
Figure 6. Alternative reconstruction of historic resources.....	9
Figure 7. Blueprint of Kohala Sugar Company Lands (date unknown).....	11
Figure 8. 'Auwai in Wainai Gulch profile.....	12
Figure 9. 1949 TMK with selected features: lowland <i>lo'i</i> , Achilles Hotel, permanent flumes.....	13
Figure 10. The principal buildings currently standing at the Kohala Girls' School.....	21
Figure 11. Project Environs with Some of the Exploratory Tests.....	28
Figure 12. 1949 TMK with selected features: XT 12 in "taro patches", XT 13 in terraced field, and "ditches".....	31
Figure 13. XT 12 profile.....	32
Figure 14. XT 8 and 10 profiles.....	33
Figure 15. XT 13 profile.....	33
Figure 16. XT 16 profile.....	34
Figure 17. 1949 TMK with selected features: poi factory 'auwai, Bond's new 'auwai, Pali 'Akamoa "ditch".....	37
Figure 18. Upper Pali 'Akamoa 'Auwai profile.....	39
Figure 19. XT 19 profile.....	40
Figure 20. XT 19 profile, view to northwest.....	41
Figure 21. Cultural Resources Identified in this Inventory Survey.....	43
Figure 22. Old map (date unknown, from Schweitzer 2003:74).....	45
Figure 23. 1910 map.....	46
Figure 24. XT 2 profile.....	48
Figure 25. Topographic map of the Kohala Girls' School (1971).....	52
Figure 27. Photograph of Brick "Water Pipe".....	55
Figure 28. XT 18 profile.....	57
Figure 29. 1949 TMK of Achilles Parcel.....	58
Figure 30. XT 3 and XT 5 profiles.....	59

LIST OF TABLES

Table 1. Inventory of Buildings at the Kohala Girls' School (from Slocumb et al. 1999:3-36).....	20
Table 2. Inventory of Exploratory Tests.....	27
Table 3. Resources within the project area that are directly related to the Bond Historic District NRHP Listing.....	64
Table 4. Resources within the project area and within the Bond Historic District NRHP Listing, that are not related to the BHD era of significance, but are eligible for listing independent of the BHD.....	65
Table 5. Resources beyond the Bond Historic District NRHP Listing, but that are directly related to the era of significance.....	65
Table 6. Resources within the project area that not eligible for listing in the Bond Historic District NRHP Listing, or otherwise.....	65

INTRODUCTION

The New Moon Foundation proposes to use portions of the Bond Historic District to create a retreat center within a roughly 15 acre portion (TMK: 5-3-005:5, 24, 39, 43, 45, 46, and 47) of their property previously known as the Bond Estate. The proposed developments are partly within and partly beyond the Bond Historic District, a National Register of Historic Places (NRHP) property. The Bond Historic District is referred to as Site 50-10-02-7100 on the Hawai'i Register of Historic Places. The retreat center is designed to facilitate the New Moon Foundation mission to provide opportunities for healing and other beneficial relationships between and amongst people and the land. The New Moon Foundation has initiated consultation with the State Historic Preservation Division of the Department of Land and Natural Resources (SHPD) Architecture Division, and received SHPD input on how best to proceed with cultural resource management issues (SHPD letter dated June 8, 2001, Log No. 27648).

The project is in *ahupua'a* of 'Iole, on the windward side of Kohala (Figure 1). Lava flows here originated from the Kohala mountain chain, and stopped flowing over 120,000 years ago (Morris and Wolfe 1996). Thick Kohala Series soils cover the lava, and there are few outcrops of lava (Sato et al. 1972:31). Roughly 50 inches of rain falls annually (Giambelluca et al. 1986). This geography probably sustained mesic forest habitat prior to influx of Polynesian immigrants. Mesic forests may have been the "richest of all forests in terms of numbers of tree species and unique plants" (Rich 1913 IN Cuddihy and Stone 1990:13). Native Hawaiian subsistence practices and habitation altered this environment with dryland and *lo'i* agricultural, forest resource procurement, and the introduction of alien trees, domesticated cultigens and animals (Tuggle and Tomonari-Tuggle 1980). This environment was subsequently modified after the arrival of European and Asian peoples to Hawai'i by sugar plantations, ranching, tree harvesting, and orchard planting (Tomonari-Tuggle 1988). The current vegetation can be characterized as being manicured lawn with alien trees around the Kohala Girls' School.

The activities that are directly associated with this cultural resource management assessment are referred to in this report as the "project area" (Figure 2). Some of the project elements are within the Bond Historic District (BHD) (Figure 3), and others are beyond it. A roughly 15 acre area encompasses most of the project elements (Figure 4). One aspect of the larger suite of development at the New Moon Foundation is currently underway. The buildings in the Kohala Girls' School are being remodeled. Potential impacts to the structural resources are being mitigated through consultation with the SHPD Architectural Division.

The project development centers on adaptive re-use for the Kohala Girls School (KGS) facilities as a Contemplative Education Center (CEC). Rehabilitation of the KGS has been conducted in full compliance with state regulations, and in consultation with SHPD. Those buildings will be an integral part of the CEC, which will offer single- and multi-day programs, meeting and conference space, and special events. It is anticipated that a maximum of approximately 60 residential guests can be accommodated at any time in the existing facilities and 20 more residential guests in a tentalo area outside of the historic district. There is classroom space for an approximate number of 20 additional day guests (who live on island or arrange for alternative lodging).

The adaptive re-use of the Kohala Girls School requires that the buildings be altered in order to support the new use as an educational center and to meet today's ADA and public use standards; this must be successfully accomplished while retaining the historic character of the KGS. To this end, the CEC will provide sleeping accommodations in the Carriage House,

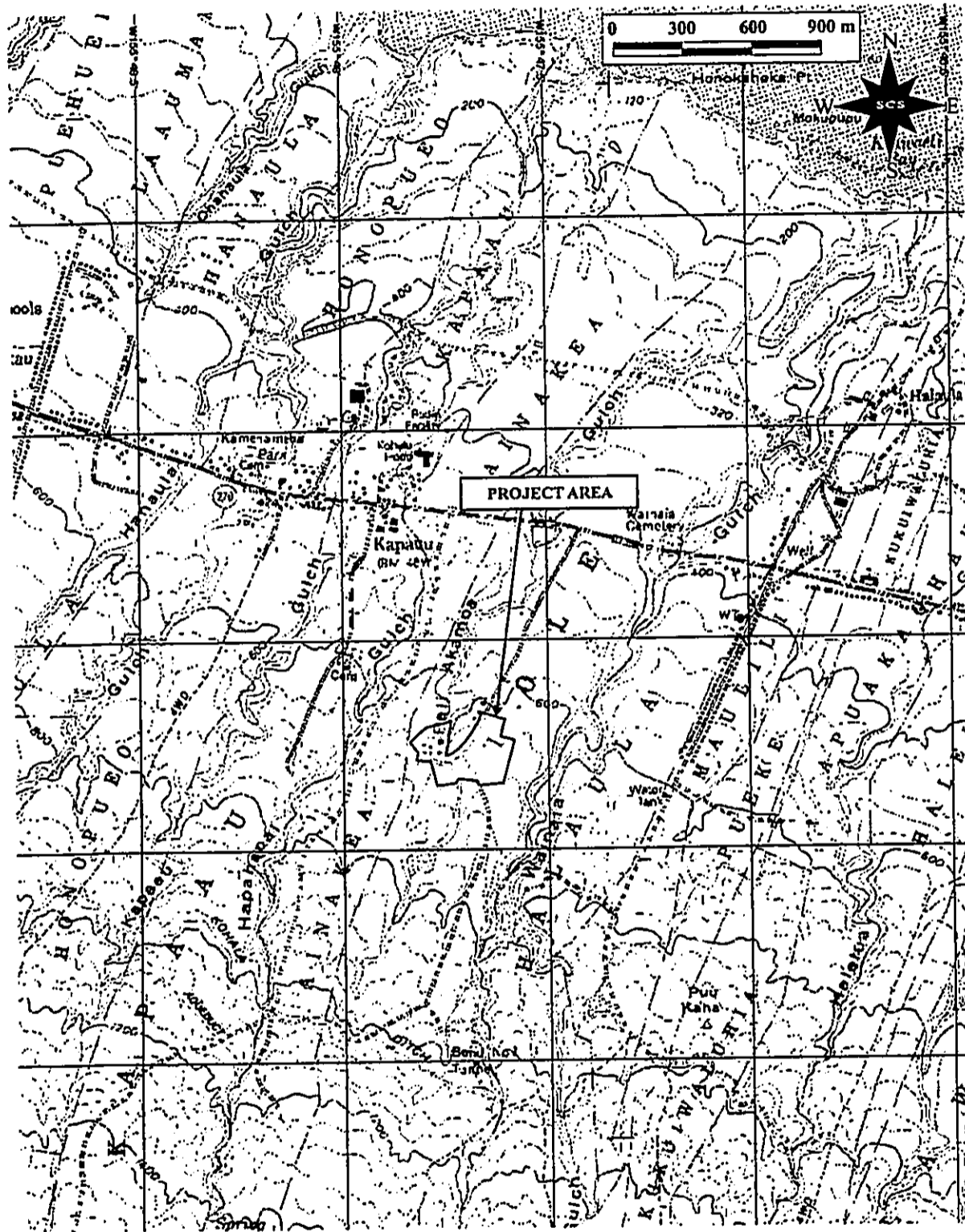


Figure 1. Project location.

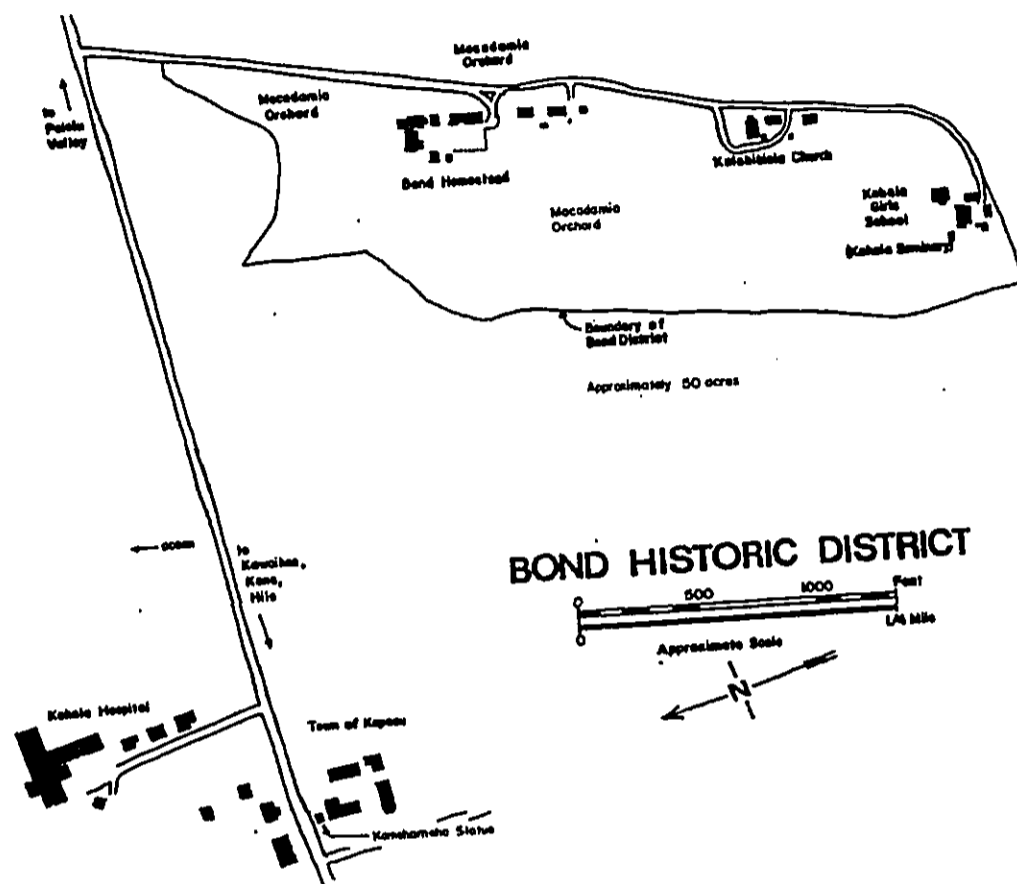


Figure 3. Bond Historic District.

Infirmary, Carter Cottage, and Dormitory. The Industrial Building will be used for dining facilities, class rooms, treatment rooms, computer support center, staff room and offices. A meditation hall, book store, and support offices will be established in the Chapel; while the Bake house will be used for support activities. An outdoor dining structure will be constructed adjacent to the Industrial Building.

In the surrounding historic land that is the 14 acre campus of the CEC, a service road to the dining hall, a golf cart parking area, a rain shelter, an amphitheatre, walking paths, and fire hydrants will be built and provided. There will be the necessary construction of some retaining walls as well as a fountain and accompanying water features which will serve to supply water to plantings and agriculture in the KGS area.

The landscaping in the campus area will minimize the removal of trees and plants already present unless deemed invasive such as banyan, guava, and African tulip. New plantings will include historically documented plants in the area, endemic and native species, as well as species that are used for healing and sustenance (such as an herb garden). The *lo'i* in the gulches will be restored in a historically and culturally sensitive manner and the agricultural activities on land below the church pond down to the homestead area will be re-established to supply food for the CEC.

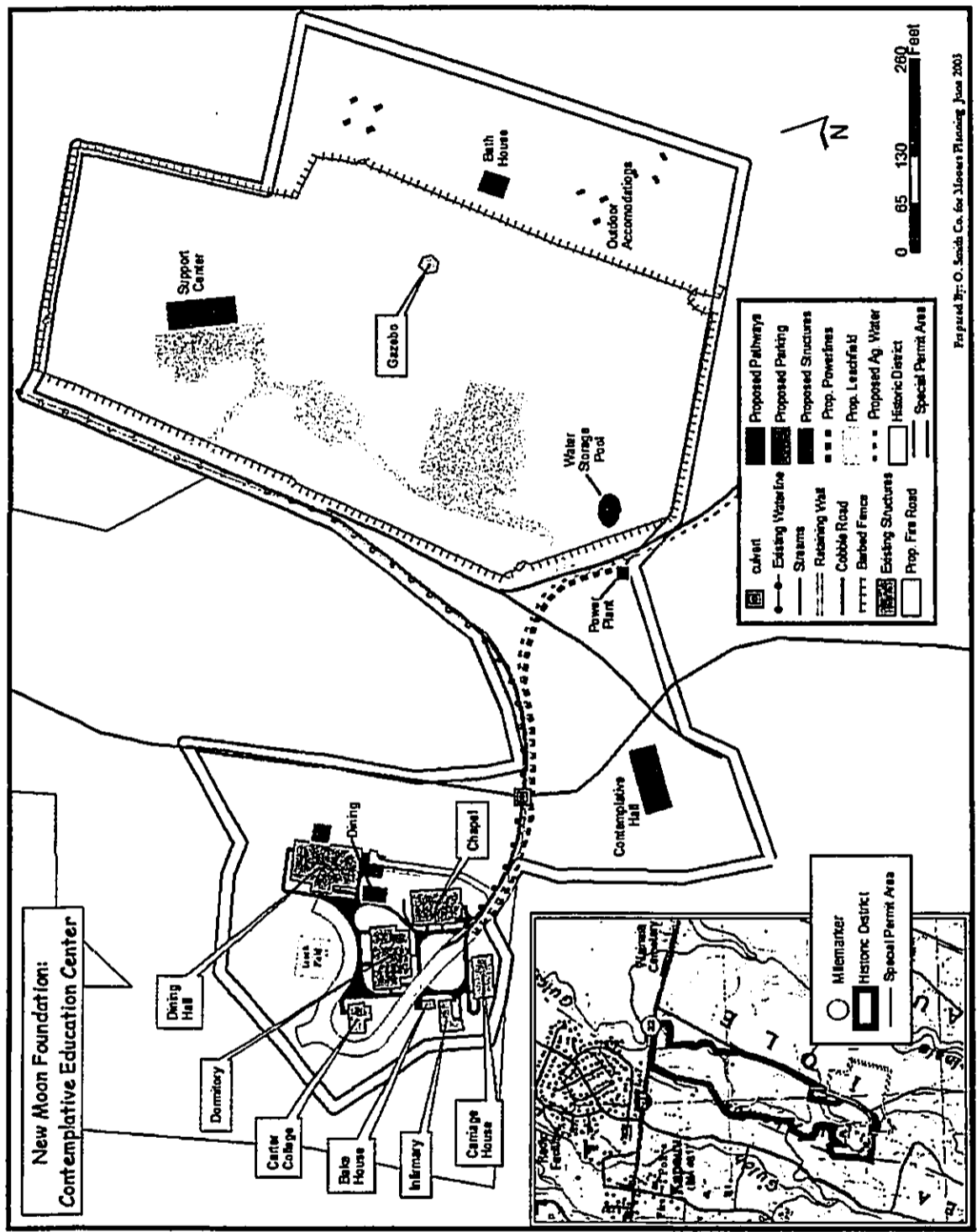


Figure 4. Project area.

South and East of the Historic District, immediately across the access road, an approximately 10,000 square foot parking area, a Support Center (SC), a hydro electric facility, a fire pit, a water storage/pool, and a Contemplative Hall will be built in order to support the CEC, its programs, and New Moon Foundation's operational and land stewarding needs.

On the north end of the parking lot, the Support Center will provide registration and administration offices, bathrooms, maintenance and grounds keeping areas, storage areas, and land management offices and meeting rooms. This facility will not only serve the CEC but support the existing and future administration, agricultural, and land management activities associated with NMF and its stewardship of the land.

The hydro-electric facility will be established south (*mauka*) of the parking area so that the water may then supply the agricultural needs in the CEC area. It may be supplemented by solar, photo/voltaic, and/or wind generated power. A pool area that functions for water collection will be located below the hydro-electic facility.

The Contemplative Hall will be built *mauka* of the CEC and the historic district but within the special permit area. It will provide a quiet location for more intensive programs as well as offer classrooms/meeting rooms accessible from the parking lot without a need to walk through the CEC campus. This can serve periodic, locally based programs.

THE HAWAIIAN CHRONOLOGY

This chronology is developed as a tool to organize the information that has been gathered to date on the history and prehistory of the area in and around the Bond Estate. This chronology is not meant as an alternative to existing chronologies of the area (i.e. Tomonari-Tuggle 1988). Rather it is developed to facilitate 1) discussion of the available data, and 2) creation of research topics to guide this and future investigations at the project area. Imbedded within the chronology is the description of the Hawaiian and historical settlement patterns, and the expectations for what kinds of material and cultural remains may be encountered during the inventory survey field and analysis.

A typical chronology of events begins with the beginning and works its way to the present. Based on the kinds of data that are available, doing so here would be confusing, because there is so little data on the prehistory of the area. The bulk of the data comes in oral histories set down in the 1800s. Principal among these are the reminiscences of Reverend Elias Bond. The information that is provided in his and other's chronicles provides the basis for inferring Hawaiian settlement patterns into antiquity.

Given this situation, the discussion of Hawaiian landuse patterns in 'Iole is presented in three sections beginning with the most recent, and working towards the ancient times. This forms the basis for understanding the area prior to beginning the field work. Results of the field work and analysis are used to refine the chronology, and those are presented in chronological order in the end of the report.

THE LATTER DAYS OF HAWAIIAN RULE: 1750-1819

There is one significant description of the distribution of Hawaiian settlements in 'Iole for the early 1800s. That description is cited in full below, with an elaboration and illustration of those agricultural and residential elements pertaining to the Hawaiian pattern. Although that

pattern is described as representing the early 1800s, based on the kinds of investment of labor needed to create those elements, it is clearly representative of activities dating well into prehistory.

The paragraph cited below has been interpreted once previously (Morgan 1981) with the purpose of trying to understand how Hawaiians settled and cultivated the land 'Iole. That interpretation (Figure 5) differs from the interpretation that I present below. Consequently, I provide a discussion of how I have arrived at my interpretation.

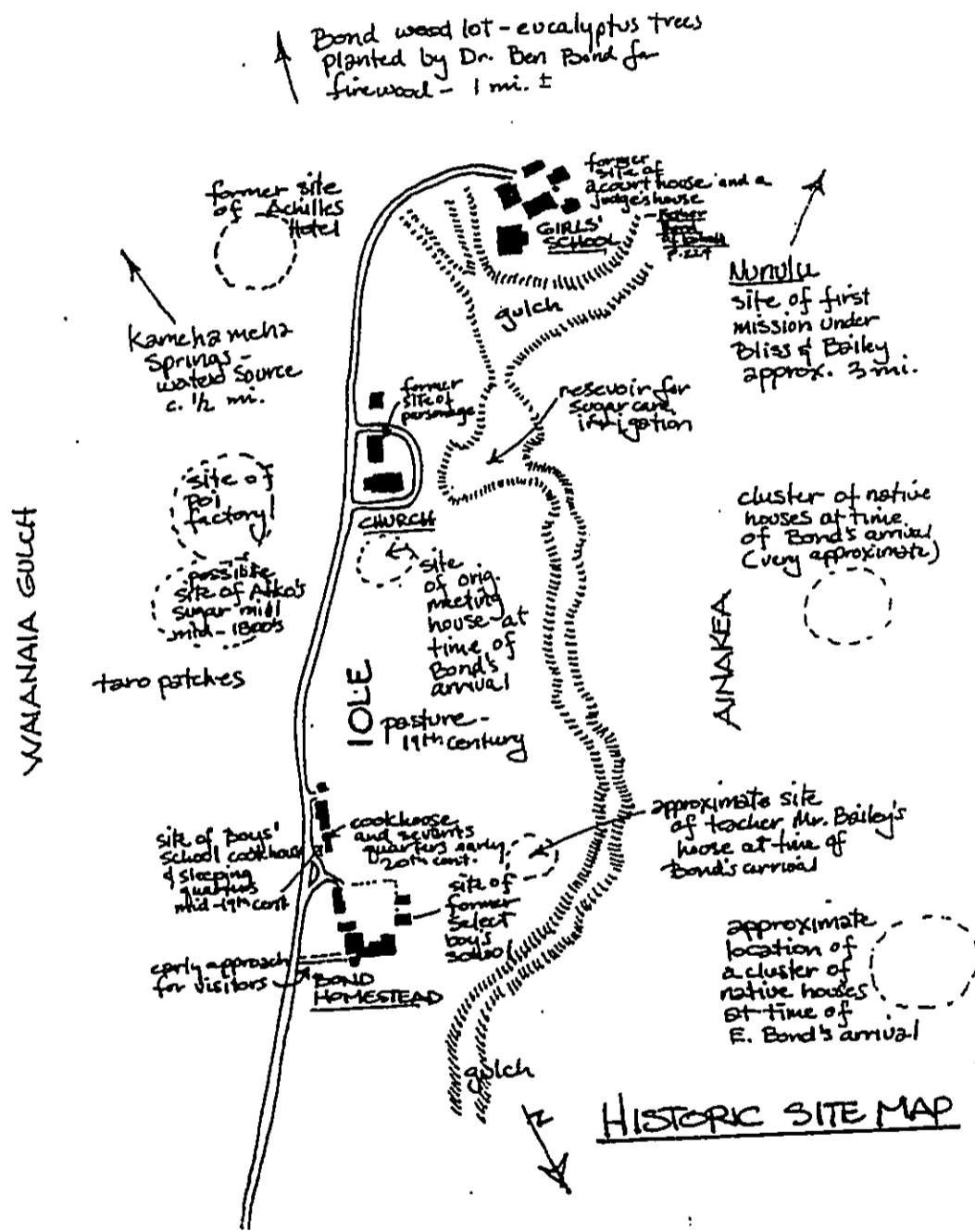


Figure 5. Reconstruction of historic resources by Morgan (1981:36).

Just as the missionaries arrived and began settling in 'Iole, this *ahupua'a* was a thriving, productive Hawaiian dispersed village. Elias Bond's recollection of how the land appeared to him upon his arrival reveals a prosperous and flourishing land and peoples.

On Iole, about fifty rods or so makai of the present government road, near the present Plantation road running North and South stood one grass house only, with a little hamlet at the shore. Up this way near the present West end of Hoimaihilo (the big taro patch) was a row of four or five houses on the path running seawards. Then on the other side of the Lois, (taro patches) stood four houses of which Keliiholoho's was the last to be removed. The cattle pen as it is now is with a short distance above and below was occupied with Aiko's sugar establishment just built, and then running up on the West side of the Lois lived the old chiefess, Walawala, and her people. Mauka of that there was only one house about a half a mile up, on the Eastern side of the land. Just above the Seminary buildings (built later above the church) there was one house more. That was all. The old tumble-down meeting house stood just *makai* of the present Meeting House near the mauka wall and Aiko's sugar house was a little to the East. Then a house near the present gateway, leading to Ah Lo's and Kekuewa's. That was all save the Teacher's House (Mr. Bailey's) in what is now our garden near the present bed of pineapples (Damon 1927: 72 IN Morgan 1981:41).

An alternative to Morgan's (1981) interpretation of this data-filled paragraph is outlined below (Figure 6). The land makai of the government road (at the approximate location of current Highway 270), and at the intersection of the "Plantation road running North and South" (the current drive into the Bond Historical District) was sparsely occupied and used. At approximately 50 rods north of that intersection there was only one grass house. The occupant also had a little hamlet at the shore.

A more populous gathering lived near the *lo'i*. Four or five houses were situated along the trail and near the west side of the big taro patch, called Hoimaihilo, and four more were situated along the other side. This area was "up this way" referring to some proximity to Bond's places of activity during this recollection, the church and homestead. Although the larger of the two *lo'i* appears to be the *mauka* one (based on historical maps illustrated elsewhere in this report), Bond's narrative seems to be working its way from *makai* to *mauka*, which would indicate that the first Hawaiian homesteads were on the lower of the two *lo'i*. The narrative also places the *lo'i* and Hawaiian homesteads in reference to the "Aiko sugar establishment".

The 'Aiko sugar house was "a little to the east" of the church, and the church is securely located on the landscape. The first Hawaiian homesteads appear to be just below 'Aiko's place, and on both sides of the *lo'i*. The precise location of the old trail referred to in this anecdote is not known (lacking notice on old maps and evidence on the ground surface), but is most likely the pathway now paved and used as the main road up into the Bond Historical District.

Another set of homesteads was situated along the west side of the *lo'i* above 'Aiko's place. Chiefess Walawala lived in this group. Walawala was probably one of the *konohiki* in charge of this *ahupua'a*, although there is no mention of this name in *Ruling Chiefs of Hawai'i* (Kamakau 1992). The word *walawala* means to tilt or tip backwards, and is also the name of a type of rain (Pukui and Elbert 1986: 381). Based on the presence of the chiefess, this location is likely the focal Hawaiian settlement in the *ahupua'a*.

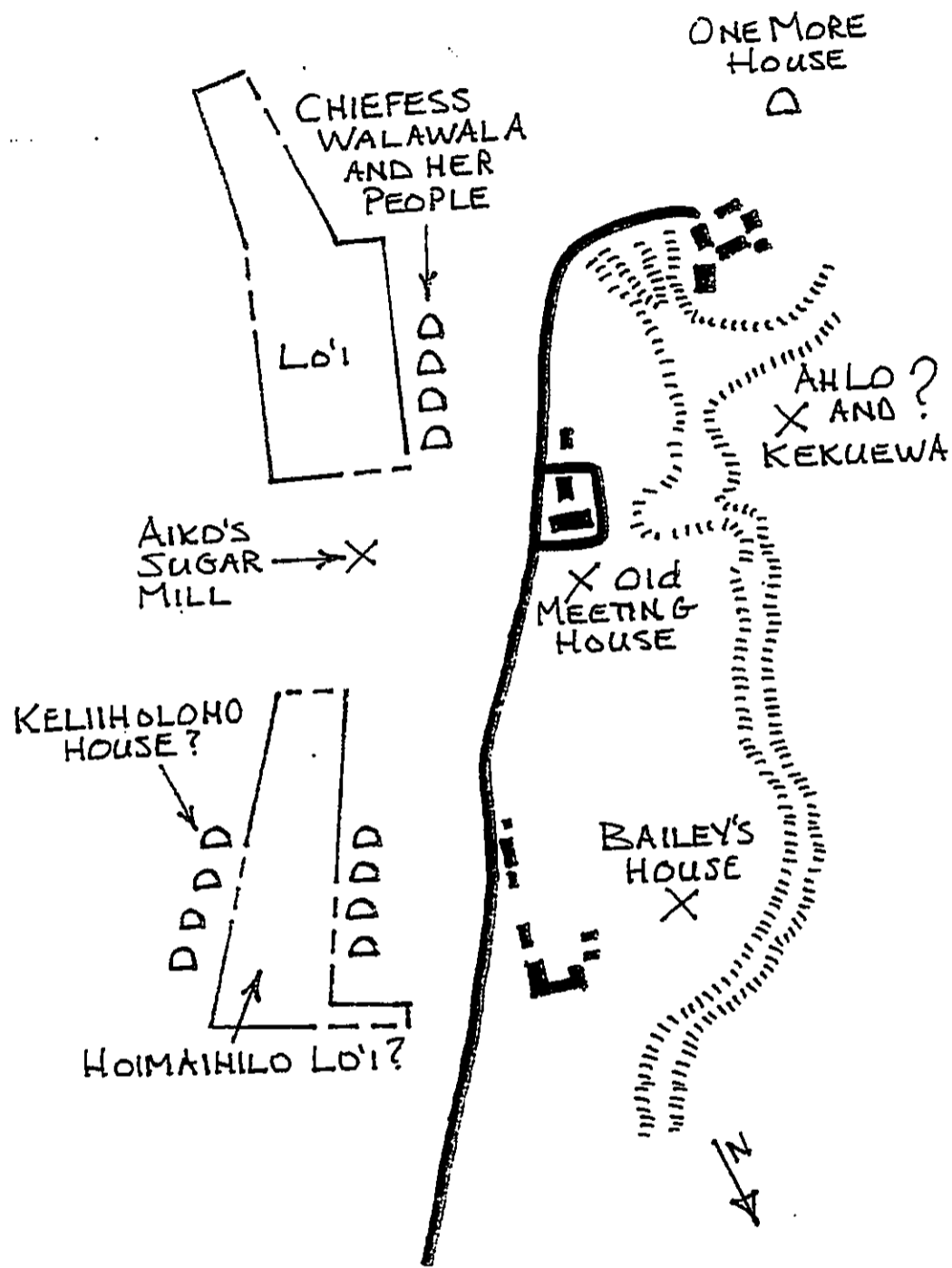


Figure 6. Alternative reconstruction of historic resources.

Two other residences were scattered in the uplands above the principal habitation and agricultural areas. One was about a half mile further upland along the east side, and the other was just above the place where the Kohala Girls' School (Seminary buildings) was eventually built.

The picture painted by Bond of a moderate density of population with *ali'i* connections is commensurate with other perspectives of the area during the early 1800s. An earlier written account of the area is from 1823 indicating that Kapa'au was an inland village with a low population, and that about 3 kilometers to the east at Halawa there were cultivated fields of "considerable size" that were kept "in good order" (Ellis 1969:384). Artemus Bishop passed through the area in 1825, and Rev. Lorenzo Lyons eventually was assigned as the permanent Protestant missionary to the Kohala district in 1832. The first census was conducted in 1835, and indicated that most Kohala residents lived on the leeward side. Less than 100 lived in each of the *ahupua'a* at and around 'Iole.

There were four *heiau* in the vicinity. All four have been destroyed and their precise locations have not since been located (Erkelens and Athens 1994:21). Palapalaho'omau Heiau was situated in the lower elevations of Wainaia Gulch (Stokes and Dye 1992:173). Two *heiau* were located on nearby Kauhola Point: Mulei'ula Heiau and Ohau Heiau (Stokes and Dye 1992:173). Further east along the shoreline, approximately one kilometer along the coast, a *heiau* associated with Kamehameha named Hale O Ka'ili was situated at Hapu'u Bay (Stokes and Dye 1992:181).

The connection of this place to Kamehameha and earlier *ali'i nui* is strong. The area was used for recreation and farming in the late 1700s and early 1800s. Kalaniopu'u went to Hinakahua and nearby Kauhola and Hala'ula with his entourage after the death of Captain Cook to relax and play (Kamakau 1992:106), enjoying dancing, maika, the kilu sexual game, and fighting (*mokomoko*). Kamehameha I spent time at Hapu'u and Kauhola with chiefly cohort (Kamakau 1992:126), and was trained in 'Ainakea by Kaukōkō in O'ahu fighting methods (Pukui, Elbert and Mookini 1974:7). 'Iole was claimed as Crown Lands in the Mahele.

The lo'i

There are three known sets of *lo'i* in the vicinity (Figure 7). Two are in the fertile uplands between the Wainaia and Pali 'Akamoa Gulches (see Figure 1). The other is in the Pali 'Akamoa Gulch lowlands. These *lo'i* were recognized as favorites of Kamehameha, and his name is associated with the *'auwai* that supplied them with water.

"Certain it is that the old water course of Kamehameha the Great had been carefully and skillfully constructed to water the taro patches for as much as a mile down the Iole land. In the old days each taro patch had its own name. Beautiful they still are today, terraced up the hill to the outlet of the watercourse. This runs along up the side of the steep, wooded Wainaia gulch. In Kamehameha's time it was a shallow ditch carrying off little more than surface flow, in itself abundant, from a number of springs... With the removal of forests in the mauka (upland) lands these springs have greatly diminished. The forest used to come much further down" (Damon 1927:266 IN Morgan 1981:34).

There is *'auwai* that hangs on the west bank of the Wainaia Gulch (Figure 8) dropping downward at a gradient slightly less than the gulch stream itself. There is a spring along this *'auwai* where the 680 foot elevation crosses the gulch on the USGS topographic map (see Figure

1). The spring issues from the west bank of the gulch at approximately 720 feet above sea level. As a result, the 'auwai is able to bring water "up" to the uplands by dropping from approximately

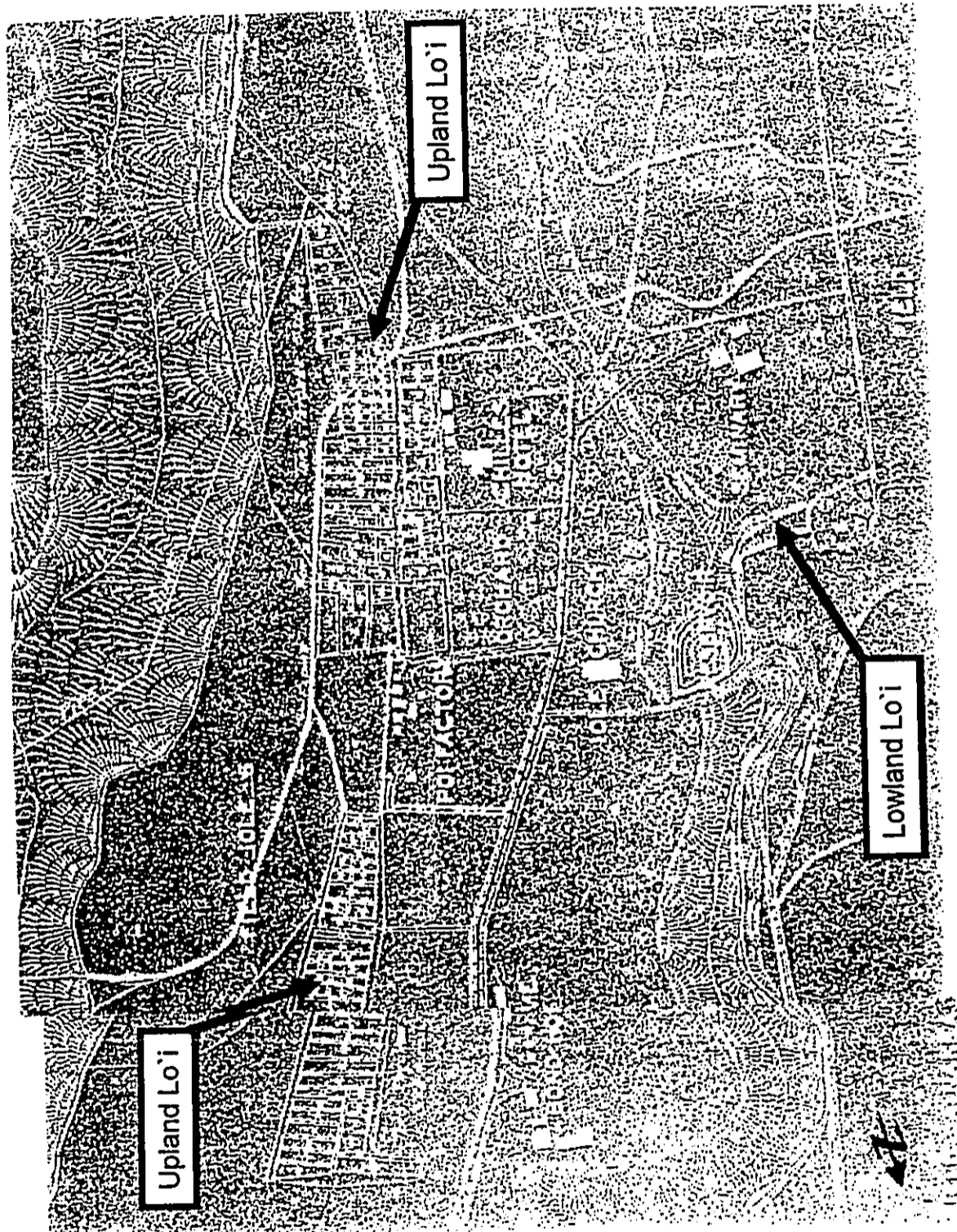


Figure 7. Blueprint of Kohala Sugar Company Lands (date unknown).

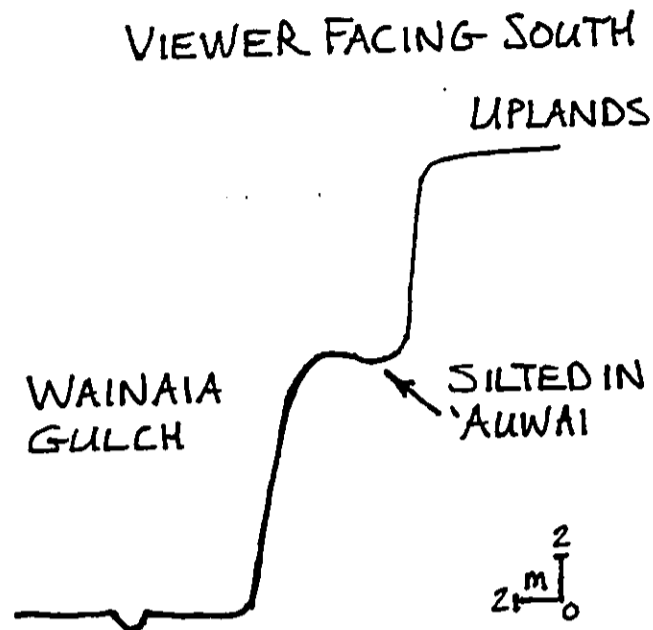


Figure 8. 'Auwai in Wainaiia Gulch profile.

720 foot elevation (along the gulch bank) to the 680 foot elevation where it connects to the uplands. At that point the 'auwai turns at a right angle to feed water into the central ridge of 'iole. The two large upland *lo'i* fields are directly downstream from the "mouth" of the 'auwai.

The 'auwai provides some insights into settlement location. The gradient of the 'auwai probably maximizes the relationship between the flow and evaporation parameters. The 'auwai must flow downhill, but not too radically so to cause problems of washing out or overflowing the banks. Also, the gradient must be steep enough to keep the flow moving and not stagnate or evaporate. Based on this optimal gradient the 'auwai would necessarily arrive at the uplands at a particular location. The *lo'i* would necessarily be placed as close to that source as possible. And ultimately the settlement would be situated around the *lo'i*.

The word *waianaia* is not referenced in *Places Names of Hawai'i* (Pukui *et al.* 1974). *Wai* is the common reference for fresh water, but *naia*, or *na ia*, are both considered as "rare" forms of Hawaiian expression (Pukui and Elbert 1986:259). *Naia* means "insecurely tied", and *na ia* means "belonging to him, her, it". The meaning of the word *waianaia* is not known. *Pali 'Akamoa* is also not referenced in *Places Names of Hawai'i*, but may mean "cliff of the laughing chicken", or cliff of the laughing any number of fauna or flora or other things synonymous with *moa*.

Bond does not mention a third *lo'i*; the lowland one down in the Pali 'Akamoa Gulch. That *lo'i* is visible in part today, and it is noted on the 1949 TMK map of the property (Figure 9). Only a couple of isolated habitations were noted by Bond in this area, and there is no known 'auwai that brings water to this *lo'i* system.

The historical developments associated with sugar cane indicate that native Hawaiians also grew sugar in this area prior to the arrival of the missionaries. In 1835 a business partner of John Palmer Parker's sent for four Chinese sugar masters from China in an effort to explore sugar cultivation in Hawai'i.

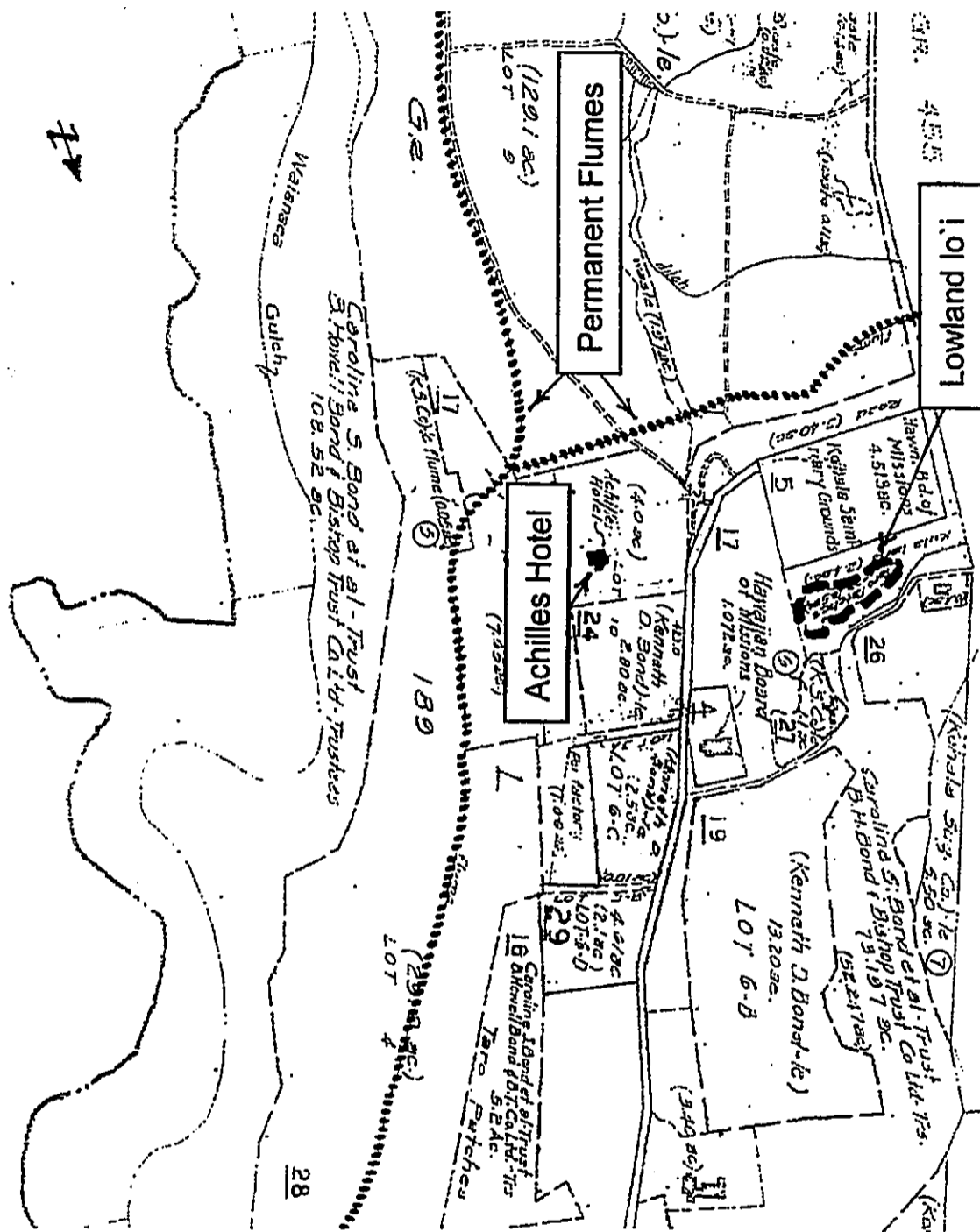


Figure 9. 1949 TMK with selected features: lowland lo'i, Achilles Hotel, permanent flumes.

One of these masters was a man named 'Aikō (1799-1895). He was leasing lands to cultivate native cane in various places on the island of Hawai'i when, in 1841, Governor Kuakini asked him to run a sugar mill at Pali 'Akamoa in 'Iole to grind one hundred acres of Kuakini's cane. Not able to reside in Kohala right away, 'Aikō ordered his sugar partner, Hāpai, to live at the 'Iole mill. 'Aikō moved to Kohala in 1843, but left for Hilo the following year. Hāpai continued running the ramshackle operation [Schweitzer 2003:78].

HAWAIIAN STYLE IN 'IOLE

The perceived "classic" style of Hawaiian settlement, with the vast majority of people living on the shoreline, apparently was not the standard for this particular location. This may in part be due to the configuration of *pali* along the coast, precluding easy access to and from the ocean. While ocean resources were certainly exploited, the habitation appears, at least in 'Iole, to have been centered around the agricultural subsistence loci, the *lo'i* in the uplands. The creation and maintenance of the *lo'i* system, including upland and gulch varieties, and long feeder *'auwai*, would also benefit by locating habitation areas in these places. The development of terraced *lo'i* on "kula lands, a mile or more inland" (Handy and Handy 1991:529) is a trait associated with Kohala windward coast.

The *lo'i* system in 'Iole may have been created as early as AD 1300, a time when similar constructions were built elsewhere in the island (Clark and Kirch 1983; Cordy 2000; Wolforth 1999a, 1999b). The antiquity of the settlements is not readily available, but it is not unreasonable to suggest that the habitations have been focused around the *lo'i* ever since the time that the *lo'i* were created. Another example of a settlement situated away from the shoreline and focused around *'auwai*-fed upland agricultural fields is the Waimea settlement in the Lālāmilo fields (Clark and Kirch 1983), demonstrating that this kind of upland landuse pattern is not entirely unusual on the island of Hawai'i.

One *mauka-makai* trail may have been sufficient to service this relatively narrow *ahupua'a*. That trail may have been co-opted by historic routes, and consequently, is not readily observable on the ground surface as it exists today.

This settlement-subsistence pattern was probably developed early during Hawaiian occupation of the islands, and was maintained and perpetuated in that way for centuries until altered by coming of the foreigners. Although lacking absolute dates, it is likely that the Waipio Valley and Hilo areas were the first to be permanently settled on the island of Hawai'i (Cordy 2000; Kirch 1984), sometime between AD 0 and 900. Based on proximity to Waipio, the settlement in 'Iole could conceivably date to these early times.

Taro and sugar figure prominently in early historical accounts of the agriculture in 'Iole, but a variety of plants were cultivated along the lands that created the component parts of the *lo'i* (Handy and Handy 1991). It is likely that a wide variety of the Hawaiian subsistence staples were cultivated in and around the *lo'i* in 'Iole.

EARLY TIMES

Indications of the antiquity of occupation in 'Iole is evident in the legends associated with the place. Two legends, one regarding *aumakua* and another involving warring rivals, provide some insights into actions of the leaders of the time. Although legends tend to focus on the

events of the powerful, information on their effects on the common folk can be gleaned from the stories. The antiquity of the inhabiting of the place is also hinted at with the form of the word Wainaiā that incorporates a "rare" idiom that could be interpreted as early, or "archaic" etymology.

The project area is within the *ahupua'a* of 'Iole, named for a legendary rat (Pukui, Elbert, and Mookini 1974:57). The rat may be the one associated with the legend of Pikoi-a-ka-alala. This legendary figure was skilled in the shooting of rats with a bow and arrow, and was said to have shot "a rat lying asleep in Kohala across the channel" while standing at Kauiki in Maui (Beckwith 1970:425). Alternatively, the namesake for the *ahupua'a* is associated with a friendly rat that helped during a time of famine. There are several versions of this tale; Emerson's version paraphrased in Beckwith (1970) is recounted in full below.

Makali'i has hung up the vegetable food in a net attached to a cloud at Kaipaku, Hanalei, on Kauai. Puluena comes from Kohala seeking food and puts the rat into the net. A division of land in Kohala district is called Iole after this friendly rat. The chant runs, *Hiu ai la Kaipaku Hanalei. I na mapuna wai a ka nauu.* "Hung up on the ridgepole of Hanalei, to the water springs of the rain cloud (Emerson IN Beckwith 1970:434).

In the other versions of the tale (related in Beckwith 1970), Makali'i is either the famous steersman of the Hawaii-loa, or a mythical ruler. In any event, Makali'i hoards food, and people starve. It is one, or a number of rats, that free the food from the netted bundle, and thus provide sustenance to the hungry people. Although Emerson attributes the name of the *ahupua'a* 'Iole to this rat, it is only "...in Emerson's version [that] Makali'i said to belong to Kua'i and the havoc of his horde to have taken place on the southern coast of Hawaii. At the southernmost point of that island, at Kalae in Ka-u district, rock formations are locally ascribed to objects in the legend..." (Beckwith 1970:435). While the name 'Iole may be associated with the rat(s) from that legend, the legendary event apparently is not directly associated with the *ahupua'a* of 'Iole. Indeed, "the famine myth is generally placed in a distant land" (Beckwith 1970:435).

There is another documented story concerning a "friendly rat". This anecdote was told to the Bonds by Rev. Kekuewa, then retold to Ethel Damon in 1927, recorded in Morgan's master's thesis, and repeated in full below.

Where the name of the land, Iole, Rat or Mouse, had its origin is not now know. Beyond the fact that Iole, half man and half god, had his home on that ridge, present tradition gives no clue. The next "land" was called Honopueo, Filled-with-Owls. And legend has it that Rat cultivated a sneaking habit of despoiling his neighbor Owl's ovenful of smoking taro from time to time. The Bond children, born on Iole land seventy and more years ago [by 1927], heard the story from Rev. S.W. Kekuewa, the first Hawaiian pastor at Kohala, and one of them still tells it in this way.

Pueo, Owl, was in the habit of preparing his imu and filling it well with taro, laulau and other good things. But it so happened that he often found it empty when he came to take out the food, and from starvation he was at last reduced to the mere shadow of a man. Finally, he consulted a kahuna. "Iole is at the bottom of all the trouble," said the Kahuna, "and to circumvent him you must do what I tell you. Very near to your imu you must make a little smudge which will continue to smoke. Iole, as always, will look from afar to see if the imu be ready to rob, for he it is who digs in secretly under the earth and removes all your

well-cooked food before you arrive to open the imu. Perceiving that the smoke has not yet all abated, he will conclude that your food is not yet done and will therefore delay his ravages." Pueo did as he was told. All turned out as the kahuna had said, and Pueo continued to live and wax fat. Thus he became Lanakila, Conqueror, over Iole [Morgan 1981:294].

Another version of this struggle between Pueo and 'Iole was told by Ka'ehuokekai McGiffen of Kohala to Mary Kawena Pukui (Pukui and Green 1995:51-53). This version links the story as told by Rev. Kekuewa (above) to the rat-slaying champion Pikoia-ka-alala. Rat gets the upper hand in the struggle until Owl

...went among those who were skillful in rat shooting but found no one who could destroy this upstart. Then he heard of a certain rat-shooting wizard on O'ahu named Pikoia, the son of 'Alalā the Crow; thereupon he went and made friends with him and told him about the thievery of 'Iole. It was Pikoia's amusement to destroy rats, so they both sailed for Hilo. Pikoia went to the top of Ka'uiki hill¹ and looked toward Kohala. He saw 'Iole and shot an arrow at him. As 'Iole the Rat lay tranquilly dreaming, never thinking of danger, he was struck by Pikoia's arrow and instantly killed. The place where he died was named 'Iole and retains that name to this day [Pukui and Green 1995:52].

The two principal contrasting stories are of a rat that is friendly and saves the people from starvation (as related by Beckwith and Emerson), and a rat that steals from neighbor owl for his own benefit (as related by Kekuewa and McGiffen). Both stories attribute the rat with the naming of the Kohala *ahupua'a*, but the stealing stories take place in Kohala, while the starvation stories take place in South Point, Hawai'i and Kaua'i. Consequently, this rat of legend may have lead a long and storied life, assisting people in need far from his home and getting what he could from his owl neighbor before ultimately loosing it all.

This legend suite associates the land with early heroes including Hawaii-loa, Makali'i, Pikoia, and *aumakua* 'Iole and Pueo. With this antiquity comes a greater claim to power. Waipio Valley was the principal seat of authority for much of the prehistory of the island (Cordy 1994, 2000; Fornander 1996). The legends of 'Iole and Pueo hint of ancient rivalries in the hinterlands of Waipio. The stories of the travels and battles of Kapunohu blend those into the history of human affairs.

The story of Kapunohu includes a chapter concerning family intrigue, shifting alliance, warfare, and political consolidation centering on the *ahupua'a* of 'Iole prior to the arrival and major changes brought from beyond Hawai'i by Pili and Pa'ao. Using genealogical data and assumptions an interval for each generation of 20 years, Cordy (2000:141) estimates that this event took place between AD 1240 and 1320. The presentation of this series of events in this report incorporates variations from several different versions (Beckwith 1970; Fornander 1918;

¹ The reference to Hilo may be a typographical error, because Ka'uiki hill is in Hana, Maui.

Thompson 1971), and many events are left untold for sake of brevity.

The windward side of Kohala was divided into two polities. The east side (also referred to as the "inside") was ruled by Niulii, and extended from Awini to Wainaia Gulch. The west, or "outside", was ruled by Kukuipahu, and was from Wainaia Gulch to Kahua. Kapunohu was born in Kukuipahu, and his sister was married to the ruling chief named Kukuipahu. Through a series of events Kapunohu gains possession of Kanika'a's magic spear named Kanikawi. Kapunohu tests the spear by throwing it through 800 wiliwili trees in a row simultaneously.

Kapunohu is insulted by his brother-in-law, and is so angry that he leaves "outside" court and heads for the "inside" polity of Niulii. He stops at Waioopu in Halaula, and Puaiole in Aamakua for rendezvous with women, ultimately arriving at the court of Niulii. With Kapunohu and his magic spear in the lead, Niulii advances against Kukuipahu initiating the fighting

on their side (east) of the Wainaia gulch at a place called Piauwai" (Fornander 1918:218). The forces of Niulii moved the battle westwards "over the Wainaia gulch and into 'Iole; then into Ainakea directly above Hinakahua at Kapaau, where Kukuipahu with the rest of his army was stationed. At this place the battle became very fierce and the spears went darting back and forth. It was at this place that Kapunohu threw his spear, Kanikawi (whereby the sugar-cane leaves rustled, the blades of grass grated, clouds of dust arose), and by its force killed 3200 men and the slaughter was very great. Kapunohu took all the feather helmets and cloaks and Kukuipahu was killed together with a large number of his men; the rest of his army retreated to Lamakee in Kaauhuhu, where they were overtaken by Kapunohu and the battle was again resumed [Fornander 1918: 218 and 220].

Five more battles were waged progressively further to the west, one involving an enemy champion with a huge magic club. Kapunohu prevails against all, and wins the entire windward lands for Niulii.

Although the story includes mythical guardians (*kapua*), magical weapons, and superhuman heroes, basic elements of the tale are likely representative of the political situation of the past. A rivalry between inside and outside Kohala rulers was likely brewing for some time. The boundary between the two was the Wainaia Gulch. When Kapunohu, probably an *ali'i* well trained in the art of war, was slighted and shifted his allegiance to from the outside to inside court, Niulii pressed his newfound advantage by attacking Kukuipahu and his army at the places named in the story. Details regarding the number of warriors killed and the taking of helmets and cloaks, and the fact that Kukuipahu's army were first met on Niulii territory, may or may not have survived from basic facts over the years of telling. The high numbers of dead, although probably an exaggeration, suggest that these rulers were powerful enough to enlist many if not all able bodied citizens for warfare.

Although the Wainaia Gulch boundary no longer served to physically mark the separation between political groups, it does provide some insight into the apparent low population of Hawaiians noted in later times. Boundary lands are often on marginal areas. Centers of subsistence production, population, and political and religious organization are usually situated in the most productive and appropriately accessed areas (Green 1977; Paynter 1982). That ancient boundary may indicate that the 'Iole area was considered a marginal area within the Hawaiian settlement-subsistence schema. That might explain the low population and lack of habitation on the coast. Areas with accessible shorelines to the east and west of 'Iole were more conducive to

the development of the classic *ahupua'a* style of resource and settlement organization and distribution.

THE POST-CONTACT CHRONOLOGY

This section begins with the presentation of the historical (synonymous with "post-contact") chronology of events associated directly with 'Iole. That is followed by a brief description of the Bond Historic District as it is conceptualized now, based mostly through its presentation as a resource on the National Register of Historic Places. The information is used to generate expectations for the kinds of archaeological resources that might be encountered during the field investigations and laboratory analysis.

BEFORE BOND: 1819-1841

After the death of Kamehameha I, the people continued to live in their dispersed villages situated around the *lo'i*. There is no information to address how the lifestyles here was changed, or not, with the breaking of the *kapu* by Ka'ahumanu and Liloiliho soon thereafter.

The early accounts of the region emphasize that habitation was in the uplands, was not of great numbers, and that the *lo'i* were dominant features of the landscape. Reverend Ellis noted that Kapa'au was an inland village with a low population, and that about 3 kilometers to the east at Halawa there were cultivated fields of "considerable size" that were kept "in good order" (Ellis 1969:384). Artemus Bishop passed through the area in 1825, and Rev. Lorenzo Lyons eventually was assigned as the permanent Protestant missionary to the Kohala district in 1832. The first census was conducted in 1835, and indicated that most Kohala residents lived on the leeward side. Less than 100 lived in each of the *ahupua'a* at and around 'Iole.

The missionaries were based in Waimea from 1823 through 1837, but "a permanent mission was established manned by two workers, a Reverend Isaac Bliss and Mr. Edward Bailey and their wives" (Morgan 1981:34) in 1837 at Nunulu mauka of Kapa'au. This was the thatched meeting house that is just *makai* of the current one within the Bond Historic District. The windward mission was far from Waimea headquarters, so Bliss and Bailey then moved onto that land that was granted to the American Board of Foreign Missions by Gov. Kuakini in late 1839. This parcel was "about eight acres from Ainakea gulch eastward over the Iole ridge to Wainaiia gulch, running *makai* to the old trail and *mauka* to the fine taro patches" (Damon 1927: 71 IN Morgan 1981:35). The precise location of this parcel is not reconstructable due to: lack of knowledge of where the old trail is and which taro patches are being referred to; there is no "Ainakea Gulch" on maps; and eight acres seems notably incongruous with the land vaguely described as it is.

The place name 'Ainakea refers to a kind of sugar cane (Pukui, Elbert and Mo'okini 1974:7). 'Ainakea is not listed as variety of sugar cane in *Native Planters in Old Hawai'i* (Handy and Handy 1991), but there is reference to a "*ko kea*", or "white cane" that may be synonymous with 'ainakea. *Ko kea* was

so called because the flesh is white, is now probably the commonest variety, being planted near Hawaiian homes for medicinal use. Its juice was believed to have therapeutic value, but in the main, mixed with a dose, or drunk or sucked after taking one, it served to counteract bad taste and to lubricate [Handy and Handy 1991:185].

'Aikō's established his sugar operation in 'Iole in 1841 at a place that was "a little to the east" of the old meeting house (Morgan 1981:41). A.O. Forbes' diary describes the place as in he saw it in 1847 (Morgan 1981:56). There were three buildings that comprised the place for making sugar and molasses. The buildings were thatch in native style, except one that was used for grinding cane. The cane building is a "kind of shed with a top like that of a Chinese umbrella, and open at the sides". The mill was inside the cane building, and was made of native wood, worked by oxen. An underground trough connects that to the boiling house. Juice extracted from the cane goes through the trough to a vat in the boiling house. It was dipped into pots and boiled until proper consistency, then set to drain in pots. One long shed held the remains of the cane after it passed through mill.

THE ARRIVAL OF BOND: 1841-1874

Reverend Elias Bond and Mrs. Ellen Howell arrived at 'Iole to relieve Mr. Bliss of his duties there. The meeting house erected by Bliss was badly deteriorated when Bond arrived, but he repaired and used it through 1846 (Morgan 1981:46). Bond then built a wood frame church in 1846, but it blew down in 1849 (Morgan 1981:46). This is the church known as Kalahikiola, or, the Hawaiian Church, that stands today between the Bond homestead and the Kohala Girls' School (Morgan 1981:47).

The American Board of Foreign Missions (ABFM) desired to reduce the outflow of cash to the growing missionary families in Hawai'i. Rev. Bond suggested that he resign from the board to reduce costs, and in exchange get the land he had improved, pledging to continue the mission work. The ABFM did not agree. Consequently, Rev. Bond resigned from the ABFM, and started buying up land to start a business.

"And the Mission did not even give me the house, or what there was of it then. The Board appointed a committee who put a price of \$500 on it and I bought it. That same year, 1849, I made my first government land purchase, 200 acres, through Judge Lee, of the king. It was the Iole ridge and kalo land mauka of the mission station, the favorite land of Kamehameha I and Kamehameha III...Afterward, of Kamehameha IV, I bought 1,200 acres both mauka and makai of this center piece which was the finest part, including the kalo land...thus I bought all of the Iole land from Kamehameha III and IV" [Damon 1927:179-180 IN Morgan 1981:40].

'Iole was claimed as Crown Lands in the Mahele. Elias Bond acquired all of 'Iole through grants and transactions with Kamehameha III and Kamehameha IV. The 1857 tax records indicate that there were 21 taxpayers in 'Iole at that time. And it is here that he founded the Kohala Sugar Company. In 1863 Bond approached Castle and Cooke agents to set up a sugar business. The business struggled at first, but began paying off in 1875. He gave much of his profits to ABCFM and to the library of his old college, Punahou School, Hilo Boarding School, and others (Morgan 1981:44). Education was an important aspect of the Bond lifestyle and mission, and Mr. and Mrs. Bond taught in their homes for many years (Morgan 1981:49). The family prospered, and several children were born and raised at the homestead.

Elias Bond indicates that his sole motive in establishing the Kohala Sugar Plantation was to provide wage work for local inhabitants (Damon 1927:182). Bond built his mill, named the Kohala Mill, at Hala'ula, just south of 'Iole, beyond the Bond Historic District. The scale and

success of the plantations across the islands was such that approximately 2500 immigrants from numerous Polynesian islands were brought to Hawai'i between 1865 and 1885 (Hansen 1963: Robinson 1934). Many returned after their three year contracts were completed. Contract laborers were brought to Hawai'i from China and Japan after 1890. Subsequently, immigrants from Korea, the Phillipines, Puerto Rico, and Portugal were brought to the plantations. The influx of immigrants with disparate backgrounds created a new cultural setting manifest in the material remains, patterns of residence, language, and economic and political systems (Erkelens and Athens 1994; Kuykendall and Day 1976; Tomonari-Tuggle 1988). It is from this population in cross cultural contact that students, teachers, and laborers, attended, taught, and worked at the Kohala Girls' School.

THE KOHALA GIRLS' SCHOOL: 1874-1926

The Bonds started building the first structure (Table 1) at the Kohala Girls' School in 1874 (Morgan 1981:50). The first classes held in December 3, 1874, and classes continued until 1882, when it was closed for 7 years until 1889. Mrs. Bond passed away on May 12, 1881 and "was buried in the garden under some large trees" (Morgan 1981:52). Funds and good teachers were hard to come by, and with the forced retirement of the first principal Lizzie Lyons in 1882, the school closed for seven years. The school was deeded to the Hawaiian Evangelical Association of Congregational Churches in 1887 (Morgan 1981:58) with stipulation that the property would revert back to the Bond family if the church stopped using it as a school, and reopened for educational purposes in 1889. Buildings were added to the complex, and building functions changed over time (Figure 10).

Table 1. Inventory of Buildings at the Kohala Girls' School (from Slocumb et al. 1999:3-36).

Structure or Feature	Built	Remodeled	Destroyed
Bake house	?		
Infirmary	?		
Pump house	?		1894
Old bath house	1874		
Cook house (then "wood house")	1874		
Girls' school house (old dormitory)	1874	1890, 1891, 1900	
Privy	1874	1877	
Storage house	1874		
Old wash house	1874	1876	1894
New school house (then "chapel")	1878	<1907, 1950?	
Carriage house	1884		
Ironing room	1890		
New bath house	1894		
New wash house	1894		
Wood house (was "cook house")	1907		
Carter cottage	1916		
Industrial building (dining hall)	1921		

Achilles Hotel

Elias Cornelias Bond (Rev. Elias Bond's second son) built Achilles Hotel in late 1877 or early 1878 as a residence. The redwood building was two stories high. Cornelias left the islands in family dispute, and the Achilles family moved in after that and ran a hotel that serviced mostly business men (Morgan 1981:55). There may have been one building (see Figure 9) or more (see

Figure 7). The hotel was sold after World War II to a local rancher who tore down building in 1948 to use wood for another home elsewhere.

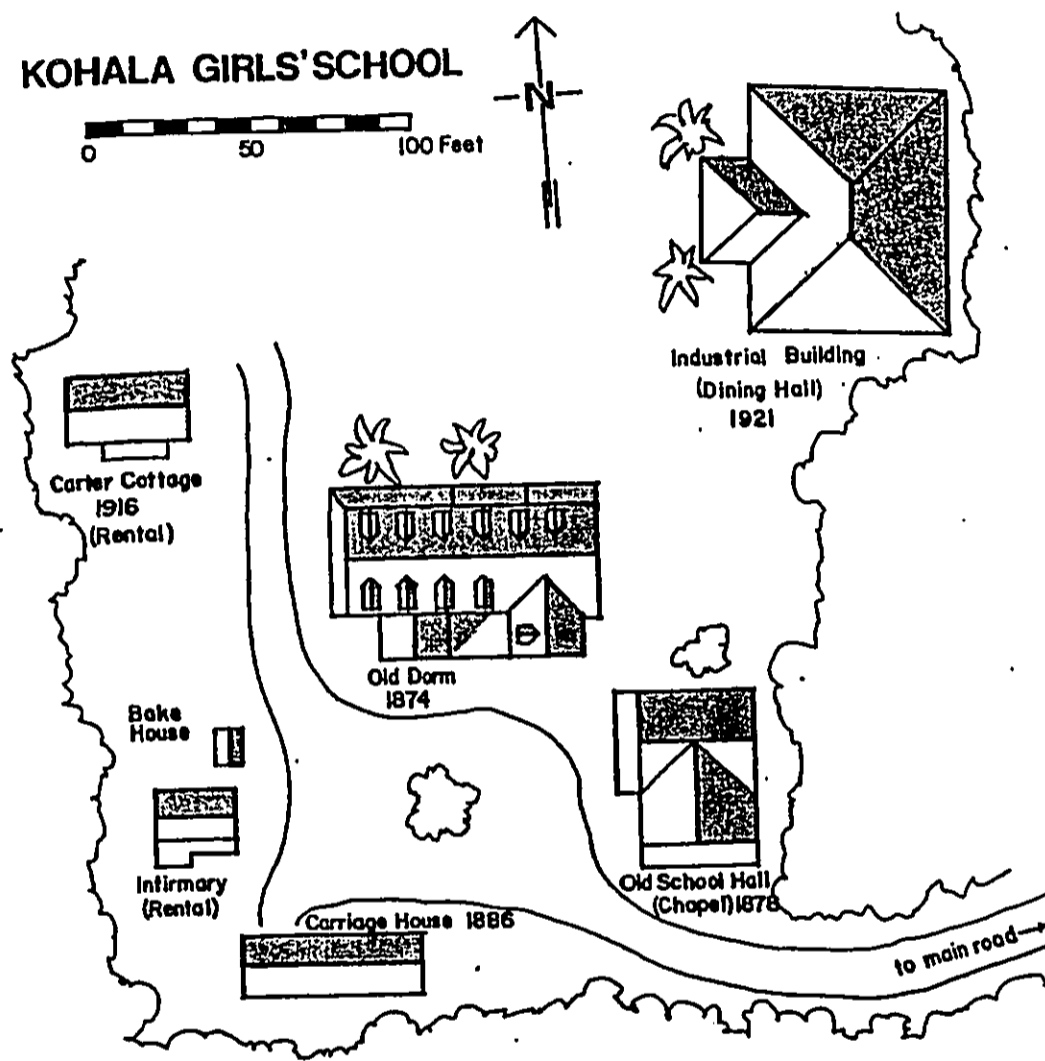


Figure 10. The principal buildings currently standing at the Kohala Girls' School.

Poi factory

A poi factory that was situated near the center of the *lo'i* was run by Ah Tyam (see Figure 7). The poi factory is in the location that is described for sugar mill that was previously run by Aiko. It is very likely that Ah Tyam converted the mill into his factory. The timing of this presumed transference is not documented (Morgan 1981:57), but is guessed to be circa early 1900s. The poi factory closed down soon after World War II.

Kohala Ditch

The Kohala Ditch was built in 1906. This was the beginning of the reliance on irrigation

and fluming techniques that increased productivity and efficiency of the sugar cultivation (Morgan 1981:81). Permanent flumes (see Figure 9) were built as main arteries for the movement of sugar downhill to the mill, including a trestle that crossed the Wainaia Gulch. Smaller, portable flumes were used to move the cut sugar from their place of harvest to the main flumes. Frank Perez helped to implement this mobile fluming system into the 1970s.

Other Developments

Other developments during this period include the installation of a water wheel and electric generator for homestead power by Dr. Bond (Morgan 1981:54). A mechanical ax used in the fire wood business was driven off of the water wheel. Dr. Bond also started, but did not finish, paving the road up to Kohala Girls' School. Elias Bond passed away on July 24, 1896. Son Kenneth Bond worked for the Kohala Sugar Company. Another son Dr. Benjamin Bond lived and worked as a doctor in the Bond homestead for 40 years.

Kohala Landing at Kauhola Point was the principal port for transportation of merchandise and sugar. The one recorded shipwreck at the point occurred there in 1867 (Rogers 1999). The Hawaiian Railroad Company completed the construction of a railroad between Niulii Mill and the port of Mahukona in 1880, and the shipping of goods to and from the region moved to Mahukona. Remains of the various transportation and water control devices are still evident in the area (Erkelens and Athens 1994; Wolforth and Rosendahl 1997), and transportation related remains may traverse the project area.

AFTER BOND: 1926-TODAY

Classes were terminated at the boarding school in 1926, because the public school system was deemed sufficient and appropriate for the education of the local youth (Morgan 1981:50). The old Kohala Girls' School buildings were subsequently used to board girls that had to travel far to Kohala High School. Boarding was discontinued in 1956. The buildings of the school have subsequently been used for retreats and residential rental units.

Dr. Benjamin Bond closed his medical office at the Bond homestead in 1925 (Morgan 1981:57). He left his residence there with his two sisters, and moved to Hilo. Dr. Bond died in 1930. Since then there has been no Bond family members in full time residence on the 'Iole property.

Kenneth Bond leased 60 acres of 'Iole land in 1940 to develop a macadamia nut orchard (Morgan 1981:58). Castle & Cooke acquired 100% ownership of the Kohala Sugar Company in 1937, but could not make the business profitable. The operation closed over a period from 1971 through 1976. In the 1970s Frank Perez assisted in transforming additional acres that were once sugar fields into macnut orchards with the dragging I-beam technique.

The 'Iole Development Corporation was created in 1967 to take the church to court to get the Kohala Girls' School back from the church that was not using it, but had retained the rights to it, contrary to the original Bond's deed (Morgan 1981:59). That task was eventually successful, and the property came into the ownership of the corporation in 1980.

THE BOND HISTORIC DISTRICT

A 50-acre parcel that encompasses the Bond Homestead, Kalahikiola Church grounds,

the Kohala Girls' School and orchards in and around these areas was listed on the National Register of Historic Places in 1977 as the Bond Historic District (see Figure 2). There are 34 contributing structures. The Bond Homestead is in the lower elevations of the district. The residences and workshops are within this Bond Homestead area. The Kalahikiola Church and related buildings are in the middle elevations. The Kohala Girls' School is in the upper elevations of the district.

The Bond Historic District is situated within the larger Bond Estate property. The history of investigations at the Bond Estate has focused primarily on the architecture, material remains, and historical significance of the Bond Historic District. The first investigation was a Historic American Building Survey (HABS) of the Bond House in the homestead area (Wilkins 1967). Photographic and archival research was conducted for the Bond House structure and material contents to evaluate the potential for the development of a museum in the district (Frost and Frost 1968, 1969, 1971). The Bond Homestead area was surveyed in 1969 (Morgan 1980). The first investigation at the Kohala Girls' School was the production of a contour map in 1971 with notation for significant landscape features (Morgan 1980:113). These investigations were used in the production of the nominations for Bond Historic District to the Hawai'i Register of Historic Places (Site 50-10-2-7100) and NRHP.

Subsequent to listing on the state and national registers, Paul Morgan produced a report for general readership (Morgan 1980), and completed a master's thesis (Morgan 1981) on the Bond Historic District. Two preservation plans were prepared for the 'Iole Development Corporation (Church-Suzuki Architects 1990; Pacific Preservation Field School 1991).

POTENTIAL SUBSURFACE HISTORICAL RESOURCES

Prior to this current Archaeological Inventory Survey, no archaeological tests had been conducted within the Bond Historic District. The distribution and type of historical buildings and activities suggest that subsurface archaeological remains are likely to be present within the project area (particularly at the Kohala Girls' School), however. It is likely that there are subsurface structural elements associated with the 19th century infrastructure and landscaping at the site. These would include, but not be limited to, privies, cisterns and septic tanks, a network of pipes associated with the cisterns and septic tanks, stone and/or earthen walkways and driveways, postmolds from wood fences and light-duty structures, gardens, trash disposal areas, builder's trenches alongside the foundation of walls. In addition, it is not uncommon to find historical artifacts scattered throughout a historical site in non-feature contexts. Material remains associated with the various activity locations (represented by the bath, cooking, industrial, and wash loci) should be present in the ground.

FIELD ACTIVITY AND RESULTS

THE COMMUNITY RESOURCES

Communication with knowledgeable and concerned local residents helps to provide insights into the broader concept of cultural practices and beliefs. As outlined in the November 19, 1997 *Guidelines for Assessing Cultural Impacts* from the Hawai'i Office of Environmental Quality Control (OEQC), information was collected sufficient to generate a cultural impact assessment (CIA) in accordance with State of Hawai'i guidelines and regulations. That includes the information presented in the preceding chapters of this report, and consultation with current and past Kohala residents.

The OEQC guidelines stipulate that cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man-made and natural, that support such cultural beliefs. This section provides documentation of the consultation process conducted to achieve an understanding of the types of cultural resources that might exist in the project area. A synthesis of the results of the interview work, historical research, and archaeological results is presented at the end of the report to assess the impacts to cultural resources.

The interviews were organized and conducted by Ms. Lani Bowman, longtime resident in Kohala. As part of that interview and assessment process, Ms. Bowman also reviewed a variety of printed resources (Damon 1927; Ellis 1969; Formander 1996; Frost 1968, 1969; Hind 1941; Kamakau 1992; Kirch and Babineau 1992; Moffat and Fitzpatrick 1995; Morgan 1980, 1981; Stephensen 1977; Stokes and Dye 1991; Taylor *et al.* 1991). In addition, relevant websites were inspected: CKM Cultural Resource (www.moolelo.com/ckm.html); Kahea-The Hawaiian Environmental Alliance (www.kahea.org/cis/); PASH issues (www.kekiai.org/state/altPASH.html); CIA for Kahana (<http://the.honoluluadvertiser.com/article/2001/Mar/28/lh/lh16a.html>); Sierra Club (www.hi.sierraclub.org/debate.htm).

People from a variety of professions, agencies, and backgrounds were consulted. Although the interviews addressed any and all information associated with 'Iole that anyone was interested in discussing, the focus of the consultation was the events and beliefs associated with the Kohala Girls School.

Groups and individuals approached included: descendants of people who once lived and/or had some kind of relationship with the area; Hawaiian cultural practitioners; local and state historians and those knowledgeable in cultural practices; former Kohala Girls School attendees; past and present employees that worked on land in 'Iole; "old timers" from North Kohala; museums professionals; Hawaiian Civic Club; Na Kūpuna; and Kohala Senior Citizens. Information release forms from many of the interviewees are on file with SCS and New Moon Foundation.

Ms. Bowman consulted with the people identified below. While a variety of types of information was provided by many interviewees, only the information relevant to cultural practices and places is presented in this report. Otherwise, those interviewed indicated no knowledge of any archaeological sites, traditional cultural practices, or gathering uses in the project area, Kohala Girls School, or surrounding area.

Kohala Girls School Attendees

Eva Kealamakia attended the school from 1839 to 1942. She provided photographs of the school from her period of enrollment. She also mentioned that her sister Ella Kimura, and another woman, Elizabeth Kimura, both Waimea residents, attended the school around that time.

Winnie Gonzalves was a student at the school in the late 1940's and early 1950's. She currently resides in Hawi.

Pua Tavares attended the school in the middle 1950's. She was one of the out-of-district children sent to the school as a Kohala High School student.

Garland Thoman is the son of the last school principal. He graduated from Kohala High School in 1953.

Community Groups

Members of the group Na Kūpuna were contacted: Marie Solomon, Libby and Sonny Pa'alua, Armstrong Yamamoto, Kindy Sproat, and Dale Sproat. Ms. Solomon shared concerns about the invasive trees in and around the project area, especially in the lowland *lo'i* just east of the Kohala Girls School. She also shared information on the history of 'Iole. Sonny Pa'alua provided information on former residents and people that may be familiar with *lo'i* in North Kohala.

Ka'ahumanu Society members were contacted: Dora Lincoln, Miriam Reyes, and Mary Lee.

The Hawaiian Civic Club was consulted with at their meetings. They provided information on the naming of the *ahupua'a* 'Iole. Member Anthony Ako Anjo expressed concerns over the project, and mentioned that some Hawaiians believe that the old Bond Estate used Hawaiian people for slaves, and that consequently there are many unsettled spirits on the property. He said that mainland visitors have seen apparitions and an unbalanced energy level causing them to leave the dormitory rooms prematurely.

Approximately 75 citizens attended the Senior Citizen Meeting and were asked to provide information on sites and practices in 'Iole. No information was provided at that time.

North Kohala Residents

Suse Soares' mother was a student at the school. She was born and raised in Honomakau.

Betty Trawick and Betty Chang are sisters that grew up in North Kohala.

Rose Maeda was born and resides in Niuli'i.

Alfonso Mitchell lived in Mahukona and Kokoiki. He worked with Ted Sparrow and Tom Fujii in the 1950s and 1960s at a piggery near the Bond wood lot.

James Tohara moved to North Kohala in 1947 and was a businessman in Hawi. He later worked for Mauna Kea Beach Hotel.

Hatsue Hayashi stayed with her uncle Herbert Waki at the old infirmary next to Kalahikiola Church when she was in elementary school in the 1940s. Mr. Waki helped plant the macadamia nut orchard for Kenneth Bond. Ms. Hayashi recalled being told by her uncle not to go to the Bond homestead, because it was haunted and the piano would play by itself. She related that on one rainy Sunday she accompanied her uncle to the homestead. While he was checking for leaks, she heard the piano play by itself.

Frank Perez was born and raised in Kohala. He worked for Kohala Sugar Company, then in 1950s worked with Lyman Bond as a caretaker of 'Iole. He recalled the Kohala Sugar Plantation bulldozing the eastern land in 1960s where the *lo'i* were to plant sugar cane. He also reported that in the early 1950s the land surrounding the Kohala Girls School was bulldozed by Arthur Lee to get rid of the Christmas berry and guava so the land could be used for pasture.

Ruth Rosimo lived in the old infirmary at the Kohala Girls School from 1962 to 1981. Ms. Rosimo did not experience visits from spirits during her stay there.

Daniel Winter was 'Iole Corporation Land Manager from 1978 to 1993. He noted that the entire area surrounding the Kohala Girls School was bulldozed in the 1980s to remove dense vegetation that was encroaching on the buildings. Mr. Winter participated in the restoration of the macadamia nut fields that had become covered with alien vegetation prior to his tenure on the land.

Florence (Treadwell) Hosbein is the daughter of Dr. Treadwell, a North Kohala physician from 1925 to 1941. She lived in Hawi at that time, and visited the Achilles Hotel.

Professional Organizations

Kepā Maly, of Kumu Pono Associates, was contacted, and he provided information on the relevant Māhele documents, including testimony and boundary details.

Stewart Ching, Curator at the Mission House Museum, was contacted regarding artifacts from the Bond Estate. The only items he mentioned are a *loulu* hat and two *mānele* that were used to carry Ms. Bond and her children.

Lynn Manuel, Curator at the Lyman House Museum provided a list of artifacts associated with the Bond Estate. There is no provenance connected to the Hawaiian artifacts, such as *kapa* beaters, on that list, suggesting that the items may have come from somewhere else and have been given to the Bond family. Ms. Manuel mentioned that the Peabody Museum might have other artifacts associated with the Bond family.

Jeff Melrose, Land Planner for Kamehameha Estates suggested examining the Land Commission Awards and title reports.

FIELD METHODS

The field methods were designed to test for the presence of the kinds of resources expected to exist on the property, as outlined in the previous chapter. Surface survey of the entire project area was conducted to identify potential remains of prehistoric habitation and agriculture, and impacts to the land during the multiple uses during historic times. The project area was walked systematically at a maximum of 10 meter intervals, and multiple trips were made over much of the place. Consequently, the surface of the entire project area was thoroughly inspected. In addition, portions of the land beyond the project area were inspected to be able to understand how the shape of the different landscapes related to, and reflected, past activities in those places, and to see how the broader network of activities in 'Iole were coordinated with those within the smaller project area. This task helped to create a baseline for assessing the landform within the project area.

Subsurface tests were conducted at 20 locations within, and adjacent to, the project area (Table 2). The primary reason for conducting these tests was to investigate how the landform was used and modified over time. Consequently, none of the tests were situated in archaeological "features" (Figure 11). Rather, the tests were strategically located on various landscapes to: 1) expose profiles in different physical settings to understand how each place was represented in the soil profile, and 2) explore for certain kinds of modifications, or features, that may exist below the surface that would provide data on how the land was used.

Table 2. Inventory of Exploratory Tests.

XT#	Location	Test for	Result
1	Pali 'Akamoa Ditch	Presence of metal pipe	Negative
2	Quarry road above KGS	Old road	Positive
3	Achilles Hotel vicinity	Building foundation	Positive
4	Achilles Hotel vicinity	Building foundation	Negative
5	Achilles Hotel vicinity	Building foundation	Negative
6	Achilles Hotel vicinity	Building foundation	Negative
7	Achilles Hotel vicinity	Building foundation	Negative
8	Achilles Hotel vicinity	Prehistoric habitation	Negative
9	Achilles Hotel vicinity	Prehistoric habitation	Negative
10	Achilles Hotel vicinity	Prehistoric habitation	Negative
11	Achilles Hotel vicinity	Prehistoric habitation	Negative
12	Upland east of Achilles Hotel	Lo'i	Positive
13	Upland west of poi factory	Lo'i	Inconclusive
14	Upland at Kohala Girls' School	'Auwai	Negative
15	Upland at Kohala Girls' School	Historic water control feature	Positive
16	Upland at Kohala Girls' School	Lo'i	Negative
17	Upland at Kohala Girls' School	'Auwai	Negative
18	Lowland at Kohala Girls' School	Lo'i	Negative
19	Upland above Kohala Girls' School	'Auwai	Positive
20	Lowland at Kohala Girls' School	Old carriage road pavement	Negative

The value of the tests is in the data contained with the soil stratigraphy, and therefore the units were not screened. Some material remains germane to the interpretation of some units were encountered during the testing process, and were collected and are reported on below. The methods of presenting the results of these investigations deviates from typical inventory survey reporting. In this project the process of identifying resources shifts from the usual assessment of stone features on the ground surface, to reading the data in the shape of the terrain itself and searching for resources below the surface. The subsurface sampling could have been conducted randomly (blindly hoping to encounter something), systematically (in a grid with numerous tests placed mechanically on the project area), or as I have chosen to pursue, based on an evolving set of hypothesis generation and testing. In this approach things that are learned from one test were applied to the process of deciding on the location of subsequent tests, and provided data for interpreting those tests. Since I have undertaken this course, I feel that it is incumbent upon me to spend the extra energy in this report to explain how that process was employed. Without that explanation, the mere reporting of stratigraphy color and thicknesses and other data from the tests would not make sense with regard to the interpretations that are presented of them.

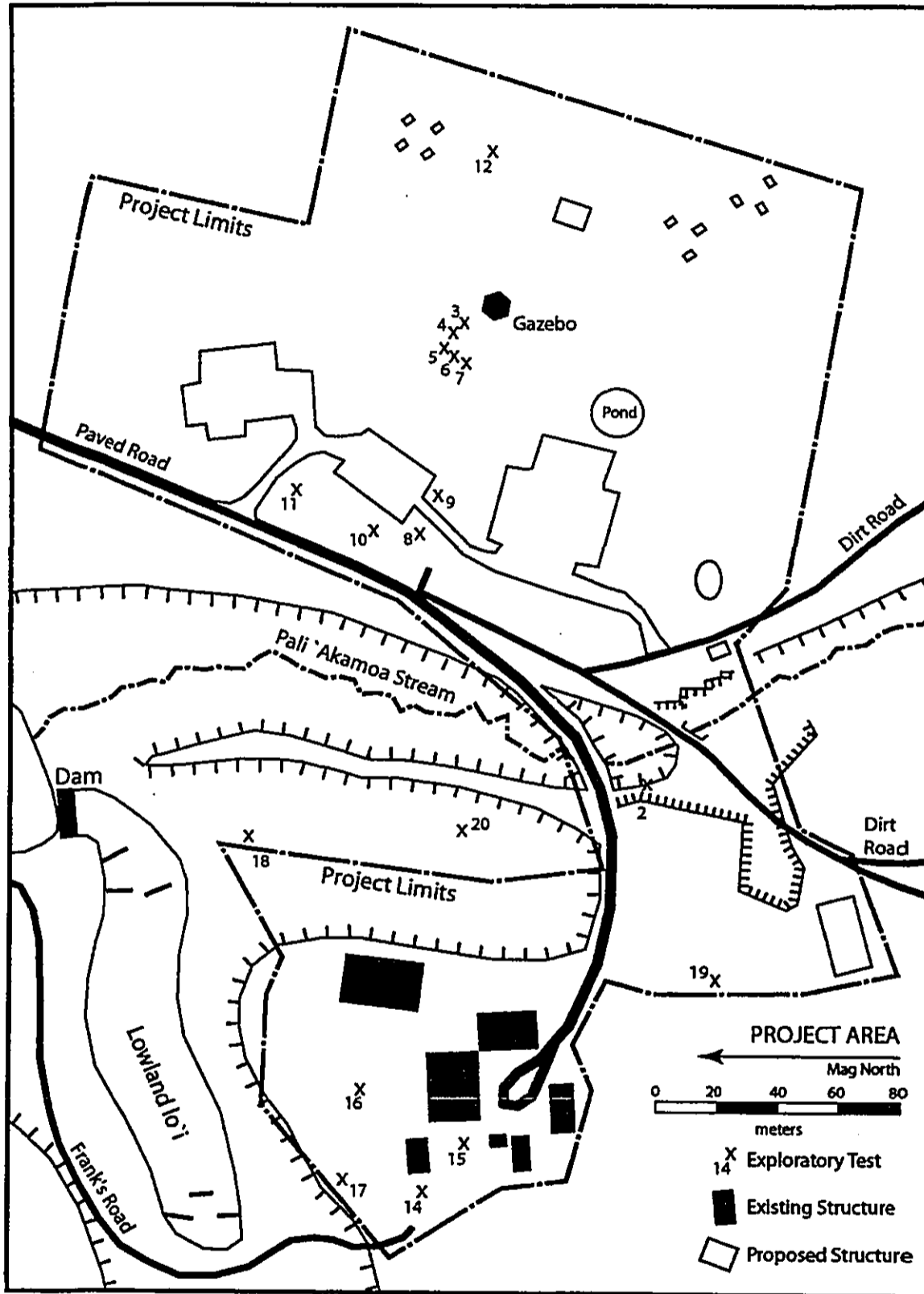


Figure 11. Project Environs with Some of the Exploratory Tests.

I have also taken a novel approach to site and feature identification. This is not done cavalierly. Rather, it is in direct response to, and in harmony with, the history of investigations at the Bond Estate and the parameters of cultural resource management evaluations for this particular project area. The Bond District is registered on the Hawai'i Register of Historic Places as number 50-10-02-7100. Features of sites are typically labeled 1 through maximum number, or as others chose to use, letters from A to ZZZ and beyond. The assignment of "feature" numbers at the Bond Estate is confusing, with numbers being assigned in the National Register of Historic Places listing that do not correspond with those assigned during the Hawaii Register of Historic Places listing (Slocumb *et al.* 1999:1-7). Rather than complicate the matter by selecting one style over another, or creating a whole new, third style that involves introducing subsurface features to the above surface feature listing, this report follows others that have recently grappled with this problem (Free 1999; Morgan 1981; Slocumb *et al.* 1999) by simply giving *name* labels, rather than number or letter labels.

Assignment of numbers or letter designations was considered, but there were several complications that could not be easily resolved.

- Should an *'auwai* be labeled as a separate site from the *lo'i* that it connects to? If so, why. If not, why?
- If the *lo'i* and *'auwai* are labeled as features of one site, then where does the site begin and end? Logically the site definitions should cover the entire site, which in this case would be from the natural water source to the *makai* outlet of the channel, which may be the ocean.
- Are the individual terraces of multiterraced *lo'i* separate features of one site? Are they separate sites from one another?
- Is a pathway that forks into three pathways one site with three features? Three separate sites? No site at all, in harmony with other archaeological colleagues that do not assign numbers/letters to pathways?
- Is a historical dam at the same location as a prehistoric dam one feature of one site? A separate feature? A separate site? Part of the *'auwai* and *lo'i* site that it leads to?
- Is a septic tank a feature or its own site?

This consideration is further complicated by the fact that prehistoric features are used and modified during the historical era. Assigning number/letter labels to these could create artificial boundaries and distinctions between these things that blend together physically, functionally, and chronologically. In addition, many resources were observed beyond the project area, but were not fully explored. Assigning numbers to these less-than-thoroughly-evaluated resources could be misleading and inappropriate.

In the final analysis I recalled that numbers and letters are simply helpful tools to provide organization to sometimes complex data. There is nothing compulsory about using numbers or letter designations; they simply are the most useful tool in almost all instances. In this case, however, numbers or letters would impose an arbitrary layer of labels that would confuse, not clarify, the ability to organize, analyze, and discuss the resources.

At the Bond Historic District the houses already have labels associated with the types of activities carried out in them. One of the old springs that feeds an *'auwai* has a name passed down from Hawaiian times. Bond writes of the things he built, and refers to them with useful labels. All labels that are currently associated with the features encountered and discussed in this report will be used. In some instances, I have introduced new names to apply to previously unknown, or never discussed resources.

THE PREHISTORIC RESOURCES

- There were several expectations for prehistoric resources in the project area.
- *Lo'i* in the uplands.
 - *Lo'i* in the lowlands.
 - *'Auwai* associated with the *lo'i*.
 - Habitation around the *lo'i* and trail.
 - Habitation in isolated locations.
 - A mauka-makai trail.

Lo'i in the Uplands

Oral history and 20th century maps indicate that *lo'i* existed in the uplands to the east of the project area. The poi factory, located in the center of the upland *lo'i*, closed down after World War II, the lands were graded, and sugar was planted as part of the Kohala Sugar Company holdings. Sometime in the 1970s the fields were taken out of sugar, and macadamia nut trees were planted. Frank Perez recalls that bulldozers were used to grade the terrain after the last sugar cane harvest. An iron "I-beam" was fastened to the back of the bulldozer, and was dragged over the ground surface. One of these I-beams, a 23 foot (7 meter) piece with plates and loops welded on, and thick twisted wire attached, rests beneath a banyan tree in the Achilles Hotel parcel not far from the *lo'i*.

There is a direct, yet subtle, correlation between the surface configuration and the upland fields (currently in macadamia nut orchards) that were once in *lo'i*. The surface of all of the areas that are marked as having been in *lo'i* on historic maps (see Figure 7) are slightly undulating. Non-*lo'i* areas are mostly level. One exploratory test (XT 12) was dug into the field known to have been a *lo'i* situated to the east of the Achilles Hotel parcel (Figure 12).

Excavations to 65 centimeters below the surface (cmbs) in XT 12 indicate that a *lo'i* did exist in this location. This was expected, but the exploratory trench provided empirical evidence of that, and a clear indication as to what kinds of stratigraphy are by *lo'i* in the uplands (Figure 13). There is a thin black layer (Layer 1) of loamy topsoil over approximately 35 cm of mixed and lensed strata (grouped into Layer 2) that is a clayey loam. The lenses of Layer 2 are variously gray, or brown, or orange brown, and are roughly interspersed with one another, as opposed to regularly layered. There is a relatively high density of the local lava throughout Layer 2. Layer 3 is a gray clay with numerous iron and magnesium concretions.

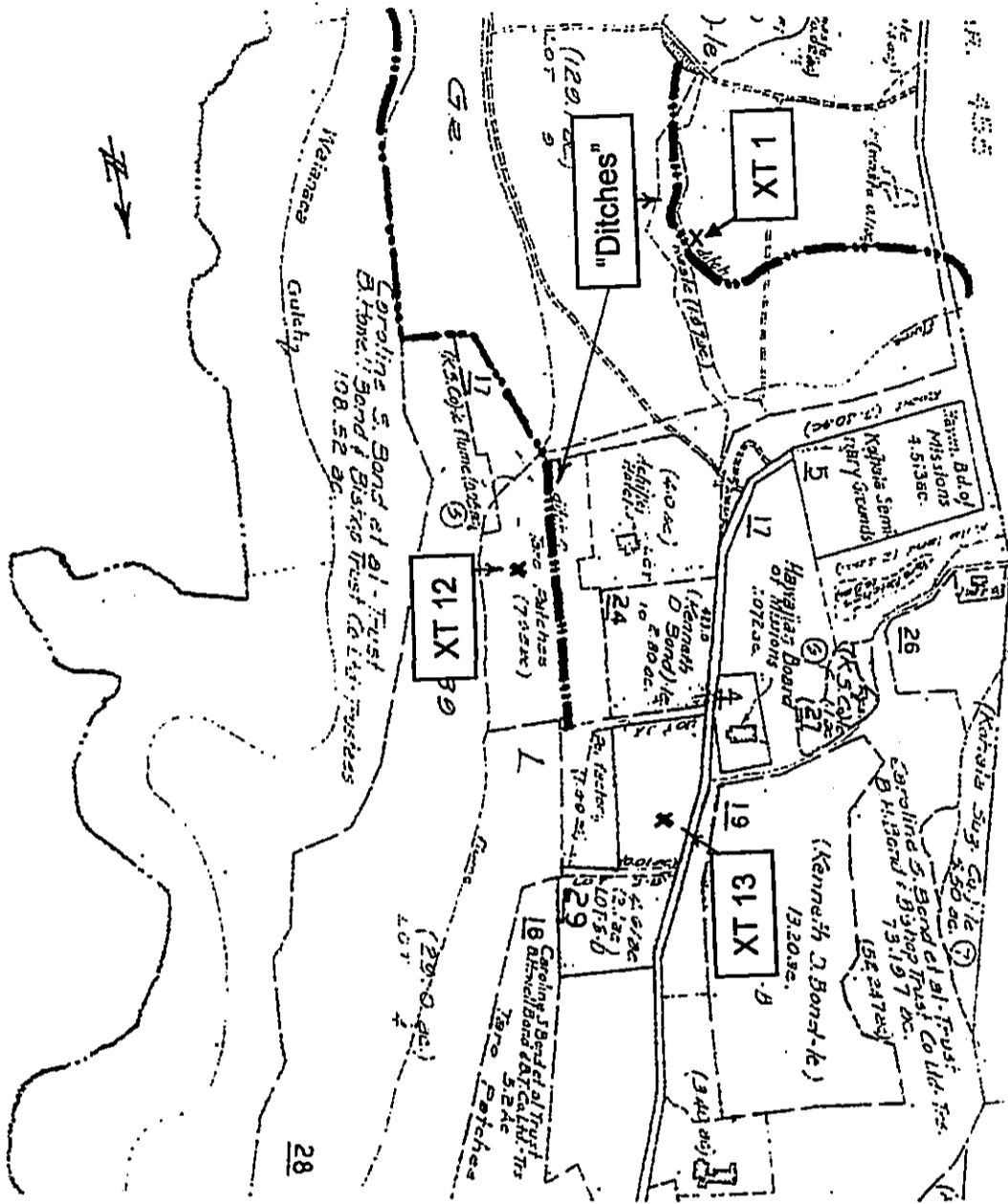


Figure 12. 1949 TMK with selected features: XT 12 in "taro patches", XT 13 in terraced field, and "ditches".

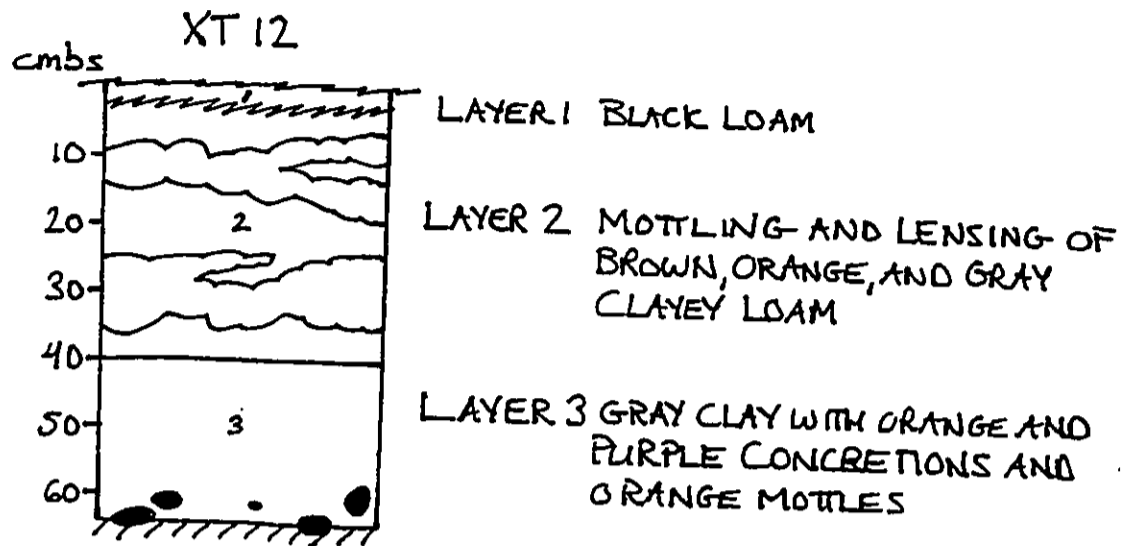


Figure 13. XT 12 profile.

This configuration of stratigraphy is directly representative of the *lo'i* (Layer 3) being covered by soils later (Layer 2). The gray clay was deposited by the slow moving water in the *lo'i*. The numerous concretions are further testimony to the high water content of the strata. The roughly lensed Layer 2 reflects multiple soil deposits over the *lo'i*, each rugged lens probably representing a pass over with the heavy machinery.

The *lo'i* stratigraphy contrasts with the profile of upland soil that has been subjected to sugar cane cultivation without any prior *lo'i* (Figure 14). Tests (XT 8 and XT 10) in the vicinity of the Achilles Hotel exposed the thin topsoil (Layer 1) over brown clayey loam (Layer 2) with orange brown brown mottling, and pieces of charred material to a depth of between 20 and 25 cmbs. Below that is the undisturbed, natural B horizon (Layer 3), represented by the dark yellowish brown clayey loam lacking any cultural material. Layer 2 is indicative of the burning and churning of the upper foot of soil during sugar cane cultivation. The thin topsoil with a relatively abrupt transition to Layer 2 is further evidence of the recent nature of this activity; an entirely undisturbed soil profile would display a deeper topsoil with a thick zone that blended into the underlying strata.

The relationship between past uses of upland fields and their soil stratigraphy was clearly established with the tests at XT 3, XT 8, and XT 10. This information was used to test whether upland fields elsewhere in the project area had once contained *lo'i*.

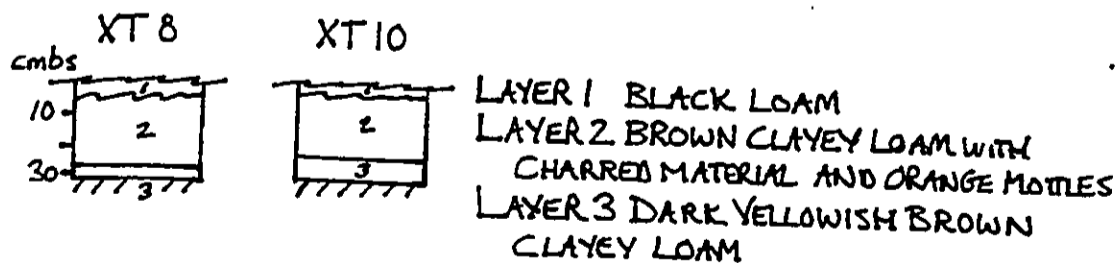


Figure 14. XT 8 and 10 profiles.

There is one field that did not fit neatly into the dichotomy of *lo'i* on the old maps represented by undulating fields vs. no *lo'i* on old maps associated with level fields. There is an undulating field near the road that is not represented as having had *lo'i* in the past (see Figure 12). The outer edges of this field are in the potential impact area for project development.

The results of the test (XT 13) in this field were interesting, but somewhat inconclusive (Figure 15). The soil profile does not fit with expectations for either of the tested conditions, those being 1) *lo'i* covered by sugar then macnut, or 2) no *lo'i* with sugar then macnut. Instead, in addition to the usual thin topsoil (Layer 1) over the burned and churned sugar cultivation zone (Layer 2), XT 13 had an approximately 15 cm thick darker brown loam between the brown clayey loam of Layer 2, and the natural and undisturbed brown clayey loam (Layer 3).

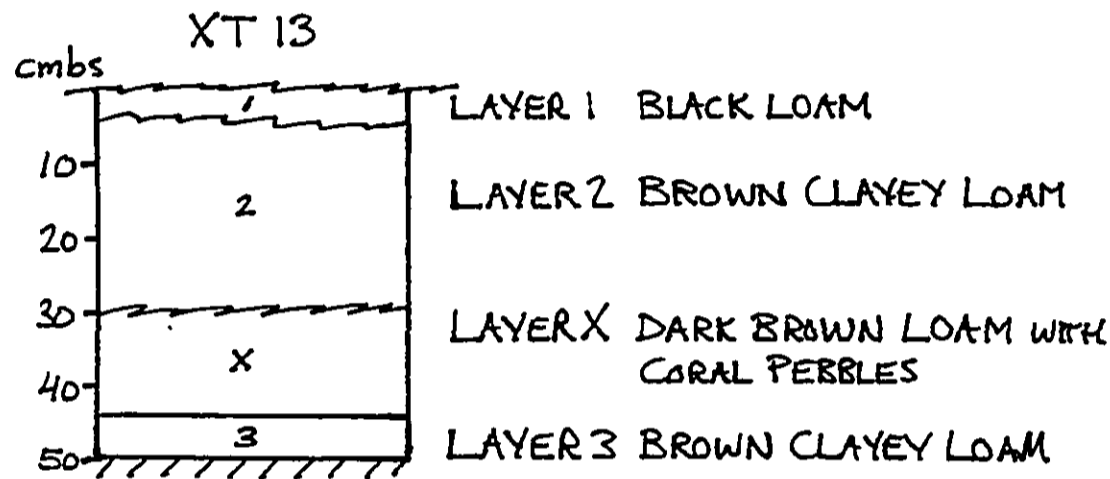


Figure 15. XT 13 profile.

The presence of a darker loam between lighter clayey loams cannot be explained easily by natural processes in an upland setting. More likely it is a reflection of cultural modification. This supposition is bolstered by the presence of a relatively high density of pieces of coral in this layer (Layer X). Sixteen pieces of water rounded coral ranging from 1 to 3 cm were recovered during the excavation of Layer X. Other pieces were observed in the profile and backdirt. These pieces were from Layer X only. This set of circumstances is interpreted as indicating that some type of agriculture was conducted in these fields prior to the planting of sugar cane in industrial scales during historic times. That could have been the cultivation of dryland taro, ancient sugar cane, or irrigated but not inundated fields of any number of cultigens.

It is suspected that the coral was introduced into the fields as a fertilizing agent. The benefits of "liming" *lo'i* prior to planting were recognized during the early 1900s (Caughey and Emerson 1914 IN Handy and Handy 1991:99). The prescription for successful treatment of *lo'i* was "per acre 300 lbs. ammonium sulphate; 450 lbs. superphosphate; 400 lbs sulphate of potash" (Handy and Handy 1991:99). Yet it is unclear whether the presence of coral in the *lo'i* fields represents soil treatment practiced during historical or prehistoric times. There are unanswered questions about the timing, extent, and specific cultigens associated within this field that are addressed later in this report. At a minimum, the exploratory test here indicates that some kind of

agriculture was practiced in this macadamia nut orchard prior to the time that it was planted in sugar cane for the Kohala Sugar Company.

The other area that was tested for potential upland *lo'i* within the project area is the lawn of the Kohala Girls' School. The multiple and intensive uses of the land at and around the Kohala Girls' School during the 19th and 20th centuries altered the landscape there (for details see the discussion later in this report regarding the archaeology of the Kohala Girls' School). Of principal concern in testing whether a *lo'i* once existed on this upland location, the profile exposed in XT 16 is conclusive evidence that there was no *lo'i* there (Figure 16). The profile represents a natural, undisturbed upland soil with a thick (20 cm) black loamy topsoil (Layer 1), blending into a homogenous brown loamy B horizon (Layer 2), blending into a homogenous grey brown clayey loam Bt horizon (Layer 3). There is no evidence of a *lo'i* clay, or of a churning and burning sugar cane zone, or of a Layer X with coral. The thick topsoil indicates that it has been that way for a long time, and as does the blending of the layers into one another.

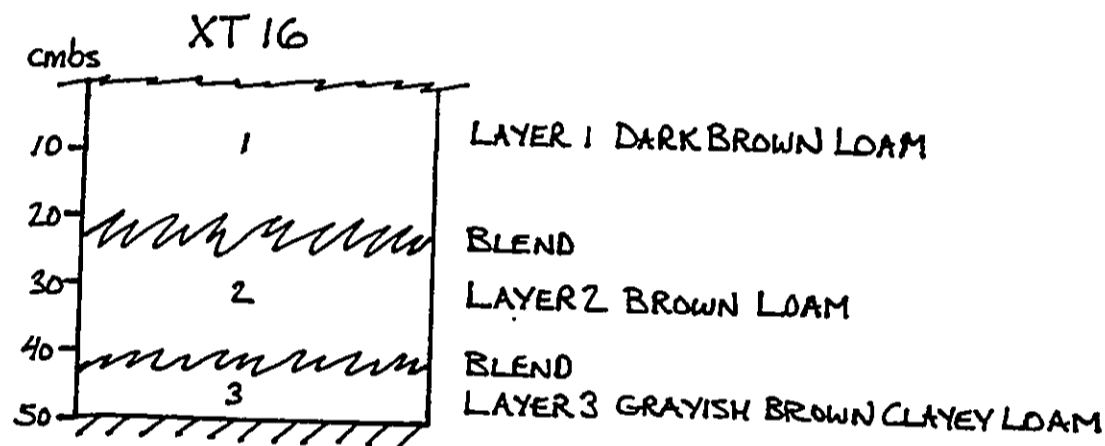


Figure 16. XT 16 profile.

Other exploratory tests were conducted in the uplands of the Kohala Girls' School for other reasons (XT 14, XT 15, and XT 17). The profiles of these units, discussed in detail elsewhere, reinforce the conclusion that there were no *lo'i* in the Kohala Girls' School uplands.

Lo'i in the Lowlands

The oral histories and old maps indicate that *lo'i* existed in the lowland immediately *makai* of the Kohala Girls' School. Remnants of this *lo'i* system are visible today in the location depicted in old maps (see Figure 7).

Water is retained in the system by the cement dam situated in a narrow portion of the lowland area (Figure 11). A presumably older dam made of stone is situated just *mauka* of the cement dam. High grasses cover the *lo'i* and retard the ability to examine the network of dams and terraces over the approximately 100 by 30 meter (400 by 100 foot) system. Slow flowing water is observable in the system. The water appears to originate from a spring at the western end of the *lo'i*. The terrain at the western slopes gently up to the uplands approximately 6 meters above. In the central portion of the *lo'i* the gulch has steeper and higher (10 m) banks. At the eastern end the slopes are a gentler gradient.

The presence of the cement dam, and the inclusion of the *lo'i* on historic maps suggests

that the *lo'i* were used, and may have been created, in historic times. Although absolute dating techniques were not employed here, there is other evidence that strongly suggests that the *lo'i* was created and used long before the arrival of the Bonds to the property. Frank Perez attests to the nonuse of the *lo'i* back through the mid-20th century. The cement dam was created to capture water to be used to supply the fields just *makai* of the church. A pipe transmits the dammed water at the lower end of the *lo'i* to a little cistern below the church. The number "1919" was formed into the cement of the cistern, presumably at the time of its construction. From there, the water was distributed into the sugar fields below. The rock dam just above cement dam does not function to assist in water distribution to sugar era fields. Consequently, it is presumed that the rock dam, not the cement dam, was built specifically to hold the water for a functioning *lo'i*. If the *lo'i* were created during historic times, it is presumed that historic era technologies present in the Bond homestead, church, and Kohala Girls' School would have been used in the creation of the *lo'i* itself and the *lo'i* dam. In contrast to that assumption, the *lo'i* and dam configuration are in accord with expectations for traditional Hawaiian practices (Handy and Handy 1991). This set of circumstantial evidence provides a less than conclusive demonstration of the antiquity of the *lo'i*. A more concrete line of evidence can be garnered from the relationship of this lowland *lo'i* to the prehistoric *'auwai* that feed it (discussed below).

The System of 'Auwai

Lo'i require a renewable and controllable supply of fresh water to function properly (Clark and Kirch 1983; Earle 1978; Handy and Handy 1991). To this end, Hawaiian technology employs the use of *'auwai* to move fresh water into and out of the *lo'i* at specified times in the cultivation cycle of wetland taro. One *'auwai* in 'Iole was observed by, and commented on, by Bond upon his arrival. This *'auwai*, in Wainaiia Gulch, was modified over time to continue to be useful for the changing needs.

A couple of "ditch" fragments are noted on the old maps (see Figure 12). The origin and destination of the water to be transported through those ditches is not clear from the maps. The maps also do not supply any indication as to when the ditches were built, or how they were used. The explication of the *'auwai* system is critical to understanding the nature of the *lo'i* system in 'Iole. Consequently, considerable effort was expended in this inventory survey beyond the confines of the project limits to discern the full extent of the components of the *lo'i* and *'auwai*. This task turned out to be instrumental in uncovering additional *'auwai* on the property, and in interpreting the changing pattern of water control over time. The morphology of that ditch is briefly described, and subsequently used to interpret the function of other *'auwai* present on the property.

The Wainaiia 'Auwai

The *'auwai* in the Wainaiia Gulch is approximately 1 kilometer (0.6 miles) long beginning at approximately 1,040 foot elevation where the Bond Tunnel and modern water control devices are still in use. The *'auwai* is built into the side of the gulch bank (see Figure 8), sloping downward a total of 320 feet (from 1,040 to 720 foot elevation) over a distance of approximately 3,200 feet for a gradient of 10% (320/3,200). The *'auwai* passes by and uses water associated with a spring referred to as the "Spring of Kamehameha". Changing *'auwai* technology is evident some places where channels fork off to create later and straighter pathways (older channels wind around some protuberances), and tunnels were built to go through other difficult areas. These additions took place during the historic era.

Dr. Benjamin Bond, son of Elias Bond, followed the evolution of Kamehameha's water course over the years. With forests disappearing up mauka because of over-harvesting and cattle, the groundwater level around the Bond homestead had been dropping steadily: "My father was obliged to dig the watercourse two feet lower to obtain much of a flow. Later, my older brother Cornelius reduced the level three feet more. And digging little by little each year as means afforded, I in my turn have lowered it five feet further" [Schweitzer 2003:78-79].

The Wainaia 'Auwai serviced the *lo'i* that were used to supply the poi factory during the historical era. The upper elevations of the 'auwai were later used to set a metal pipe that transmitted, and still transmits, water from the Bond Tunnel to communities further *makai*. That pipe connects to other pipes that currently serve the Kohala Girls' School and the Bond Homestead.

In review, the information provided in old maps and oral histories indicates that the ditch referred to here as the Wainaia 'Auwai (and noted as "trail" on 1949 TMK) was recognized by early chroniclers as associated with the Spring of Kamehameha, and serving the *lo'i* in the uplands. It is probable, and indeed expected, that the 'auwai was created much earlier than the time of Kamehameha I. Subsequently the 'auwai continued to be used to supply water to the *lo'i* for the poi factory production. It is likely, though not demonstrable with the available data, the 'auwai supplied water for irrigation of the sugar fields in the early 1800s associated with the Aiko sugar mill. Multiple parallel branches of the 'auwai along the side of the gulch, including the construction of some tunnels, represent modifications during the historical era to keep the supply flowing. Finally, the 'auwai was "replaced" with piping that coincides with a portion of the 'auwai channel, but reaches the uplands at a higher elevation.

Surface survey during the inventory survey process has identified an additional part of the history of the Wainaia 'Auwai use and modification. There is no clear pathway on the ground surface between where the Wainaia 'Auwai issues forth from the side of the gulch onto the uplands, and the uppermost *lo'i* field. In contrast, the 'auwai is readily apparent in the form of a low, broad swale in the ground surface below the poi factory in the area between the two sets of *lo'i* (Figure 17). That portion of the 'auwai provided water to the lower set of *lo'i*. This "connector" 'auwai segment was tapped by another ditch, and based on the ditch morphology and destination of the water, it appears that this "tapping" ditch was created by Bond to supply his homestead and industrial area with fresh, running water.

The tapping ditch connects to the 'auwai at an almost right angle just below the poi factory. The ditch is suspended along side of a relatively steeply sloping hill (see Figure 17). In contrast to the old Hawaiian style of 'auwai configuration, this ditch does not "hang" off the side of the hill. Instead, a large (2 meter high maximum) stone terracing wall was built, and the ditch is situated on the top of that. The ditch is currently covered by the road, the alignment of the

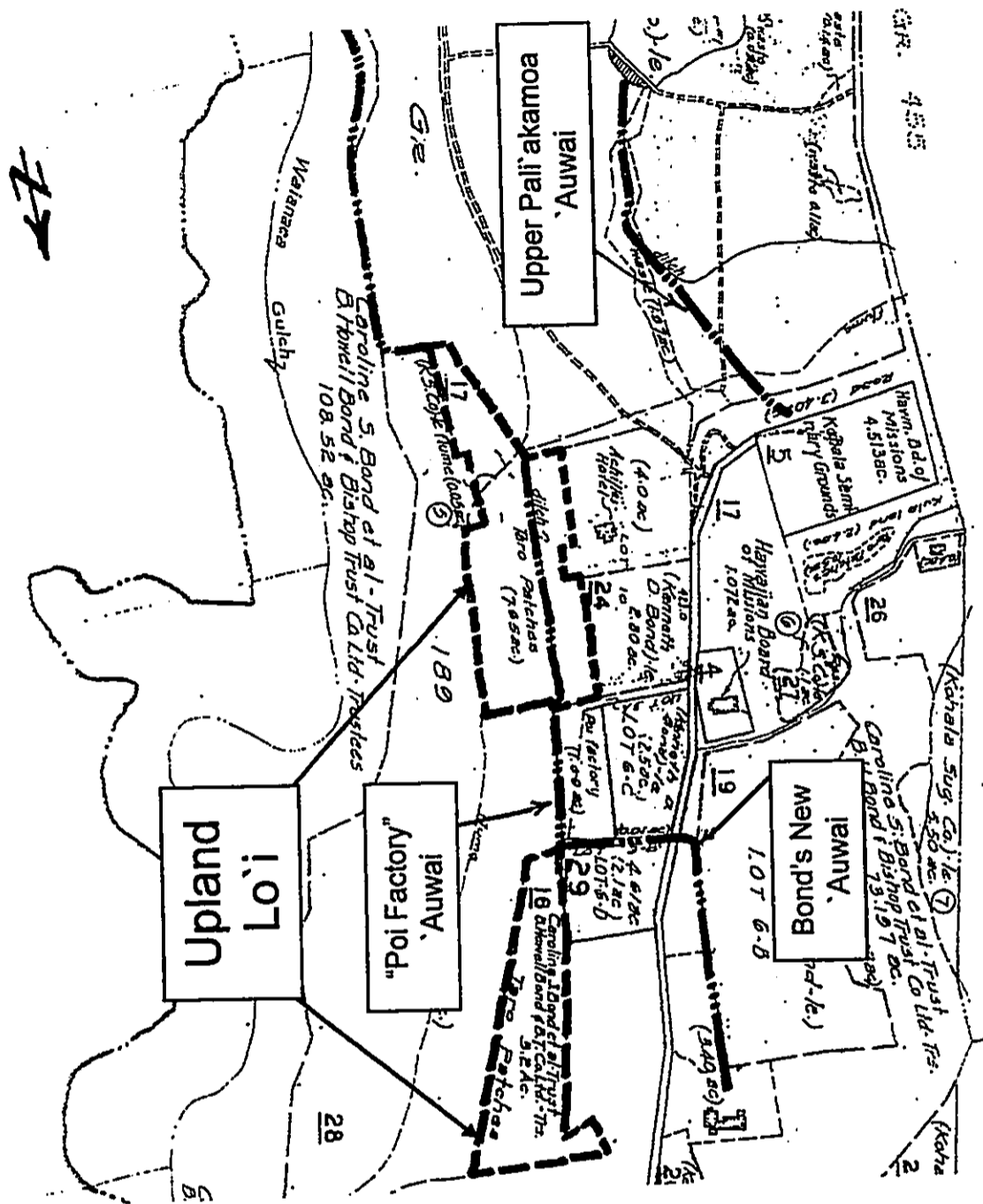


Figure 17. 1949 TMK with selected features: poi factory 'auwai, Bond's new 'auwai, Pali 'Akamoa "ditch".

ditch coincides with the only break in the long stone wall that is alongside the road. That wall was probably built within the first couple of decades of Bond's time on the property. The break in the wall is formalized with the presence of large round boulders that mark ends of the wall at the less than 2 meter wide opening.

The ditch forms another right angle a few meters west of the break in the roadside wall, and from there is oriented directly to the Bond homestead. Among the various support buildings in the homestead, Bond built a water powered stone crushing machine. A subsurface pipe that in part coincides with the ditch testifies to the use of that industrial area during later historic times, but the pipe is only in the ditch for part of its pathway. The pathway of the pipe is a direct line between the Bond homestead and a connection of pipes in the Achilles Hotel area. From there, the pipe angles and creates a straight pathway to the Wainaia Gulch (which is the pipe in the gulch mentioned previously). The pipe, then, is a later modification to the water distribution system that represents a more direct route of supplying water to the homestead with modern technology as compared to the earlier version represented by the ditch that tapped the old *'auwai*.

Could this ditch have been created during the prehistoric era? The stone terracing wall, the formalized gap in the roadside wall, and a destination other than a *lo 'i* are strong circumstantial evidence for a historical origin of this ditch. This puzzle is beyond the current project area, but tests can be devised to find out more about the origin and function of this ditch segment.

The Upper Pali 'Akamoa 'Auwai

The information gained from the study of the previously known *'auwai* in the Wainaia Gulch, and the investigation of modifications to that *'auwai* during the historical era provides a solid baseline with which to pursue the potential for *'auwai* at the project area at the Kohala Girls' School.

There is a ditch shown on the 1949 TMK that emanates from Pali 'Akamoa Gulch (see Figure 12). The map shows the ditch curving to the west and hooking up with a flume. Based on this data, it appears that the ditch was used to feed water into the flume, keeping the supply of water in the flume sufficient to perform its duty of transmitting harvested sugar cane from the fields to the mill further *makai*. But that is the function of that ditch at the time of the creation of the map in 1949.

Was that ditch created during the historical era for the sugar cultivation processes only? The information available from the current configuration of the surface and maps offered conflicting and unconvincing evidence regarding this question. In support of the an earlier, prehistoric origin for the ditch, the Upper Pali 'Akamoa ditch looks like the prehistoric Wainaia Ditch in that both hang on gulch side (Figure 18). But if it is a prehistoric ditch, there is no clear destination for the water. The maps do not show any *lo 'i* in the uplands above the ditch, there is no oral testimony that *lo 'i* were there, and there is no physical indication on the ground surface that the *lo 'i* were there. Why would the prehistoric ditch bring water up from the Pali 'Akamoa Stream to this area? In contrast, if the ditch was created during historic times, why would it be so similar in shape to the prehistoric Wainaia 'Auwai?

Field investigations were designed to determine the time of origin and destination of the water that was supplied by the Upper Pali 'Akamoa Ditch. First, the ditch within the gulch was surveyed from the dam in Pali 'Akamoa Stream to where it comes up to the upland surface, a distance of approximately 1,000 feet (300 meters). The ditch hangs on the gentle slope of the gulch edge. An eight inch metal pipe is visible in the center of the approximately 2 meter wide ditch in some places. The pipe is below ground surface near the uplands, and is not visible further *makai*.

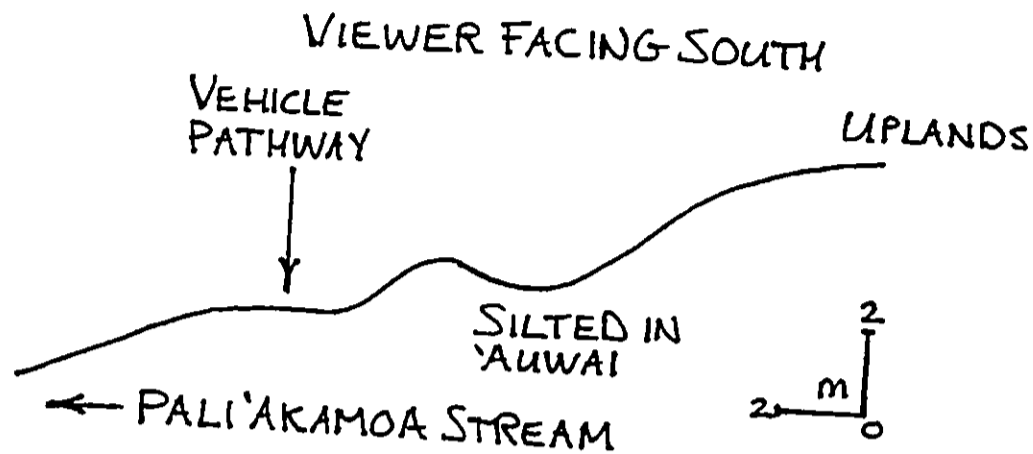


Figure 18. Upper Pali 'Akamoa 'Auwai profile.

Frank Perez supplied important information on the current status of the remainder of the pipe's location and function. The buried pipe turns westward and carries water to the property boundary at western edge of the *ahupua'a* of 'Iole. The still-buried pipe turns northwards, and continues along the property/*ahupua'a* boundary beyond the Bond Estate to supply water to communities near the highway. This portion of the pipe is itemized as "centerline 10 ft. water pipeline Esm't "k"" on the current TMK map, although it does not show up on the 1949 TMK. An exploratory test (XT 1) was dug across a portion of the ditch where it was clearly visible just before it exited the gulch onto the upland surface to gain insights into the shape of the ditch. The unit was abandoned due to large size and dense distribution of tree roots, so no significant data was obtained on the ditch cross section shape.

There is no obvious evidence of the ditch on the ground surface once it leaves the gulch. If the ditch was created and used during the prehistoric era, then it must have delivered water to some place for some reason. The two best possibilities were: 1) to the *lo'i* in the lowland just *makai* of the Kohala Girls' School, and 2) the level upland at the Kohala Girls's School. An exploratory test (XT 16) was situated to test whether a *lo'i* had existed on the upland at the school (see Figures 11 and 16). The profile of XT 16 is of an undisturbed natural soil solum. The thick humic layer blends into the homogenous brown loam B horizon, which blends into the lower homogenous gray brown clay loam Bt horizon. This profile does not resemble the *lo'i* profile, indicating that *lo'i* were not built and used on this upland setting.

Lo'i clearly were built and used in the lowland nearby, and their remnants are visible there today. But there are indications that the *lo'i* are fed by a spring. Roy Oness showed me the place where water seeps from the ground near the *mauka* end of the *lo'i* system. Water also continuously falls over the dam, indicating an influx of water into the system. The status of the spring is unclear, however. It appears that there are a few *lo'i* terraces at a slightly higher elevation than the spring. In addition, the subterranean pipe that is associated with the Pali 'Akamoa Ditch passes nearby, and has a leak just uphill from this location. If the *lo'i* were spring fed, then there may not have been a need to supply them with 'auwai water. The inconclusive status of the spring, however, threw some doubt into this proposition.

If the *lo'i* were supplied by the *'auwai*, there was still no indication that the presence of an *'auwai* between where it entered the uplands, and its potential destination at the lowland *lo'i*. The construction of the Kohala Girls' School, and subsequent additions and modifications were expected to have destroyed any *'auwai* that may have existed there. The macnut orchard above the school had already clearly done so. There is some land between the macnut orchard and the school area that apparently has not been used or modified in any way. Large palm trees grow in the naturally undulating terrain. Close inspection of this terrain revealed a shallow linear depression alongside a gentle slope. This aligned closely with the angle and orientation of last known location the Pali 'Akamoa Ditch mauka. An exploratory test (XT 19) was situated over this topographic feature to test whether it represented the remains of a ditch (see Figure 11).

The results of XT 19 were positive (Figures 19 and 20). The 2.5 by 1.5 meter unit exposed a composite ditch that had been silted in. The profile of the southeast face shows that Layer 1 is the 10 cm thick black loam organic humus at the surface. Layer 2 is a homogenous dark brown loam representing the natural B horizon. Layer 6 is the natural Bt horizon with a brownish yellow clay loam. The ditch intrudes into these natural layers to a depth of approximately 90 cm (3 feet) below surface. Layer 3 is a mottled reddish brown loam that blends into the natural Layer 2. Layer 4 is a mottled dark gray loam. Layer 5 is a dark gray brown that is mottled with soils similar to those in Layer 3 and Layer 6. There are many rocks in this layer, and they make up approximately 20% of the matrix. The opposite exposed profile displays the same ditch strata and configuration.

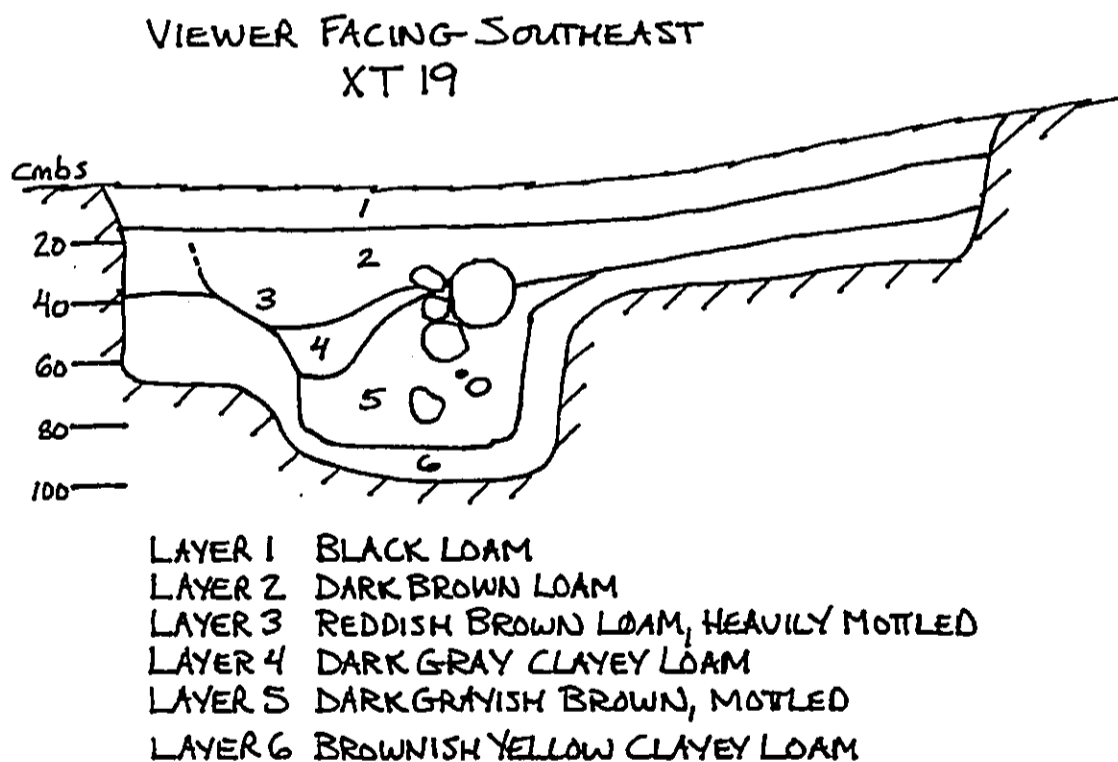


Figure 19. XT 19 profile.



Figure 20. XT 19 profile, view to northwest.

Based on profiles of prehistoric *'auwai* that are situated in soils elsewhere on the island (Clark and Kirch 1983; Wolforth 1999a), it is expected that a prehistoric *'auwai* is broader than it is deep. The profile should be a shallow basin, sometimes with multiple strata representing multiple silting events. The ditch in XT 19 contrasts with that with parallel sides that are deeper than it is wide. This suggests a historical origin. The data expressed in the XT 19 profile, in combination with the broader context of the ditch location and potential destination, indicates that the ditch was created during prehistoric times, then altered for historical uses. This kind of alteration of the old *'auwai* is documented to have occurred at the Wainai *'Auwai*.

Dr. Benjamin Bond, son of Elias Bond, followed the evolution of Kamehameha's water course over the years. With forests disappearing up mauka because of over-harvesting and cattle, the groundwater level around the Bond homestead had been dropping steadily: "My father was obliged to dig the watercourse two feet lower to obtain much of a flow. Later, my older brother Cornelius reduced the level three feet more. And digging little by little each year as means afforded, I in my turn have lowered it five feet further" (Schweitzer 2003:78-79).

The circumstantial evidence for the prehistoric origin is that the ditch hangs on the gulch like the other prehistoric *'auwai* nearby, and is oriented to supply water to the logical destination, the lowland *lo'i*. Subsequent use and modification of the *'auwai* by the Bonds would alter the typical shallow basin profile into a deeper and alternate shape. The destination for the water during the Bond times is explored in a subsequent section of this report dealing with Kohala Girls' School archaeology.

The quantity of the rock in Layer 5 needs attention. The quantity of rock in Layer 5 stands in contrast to the dearth of rock in all other layers in this test excavation. The rocks are not waterworn, indicating that they do not represent a natural water course here. The isolation of the rocks in Layer 5 suggests that this is a byproduct of human activity and not a natural phenomenon. The reason for the inclusion of rocks in this layer is not readily evident, but it is

suggested that the rocks may have functioned to keep the deep, parallel sided ditch from slumping in on itself while still permitting the passage of water.

The shapes of Layer 3 and Layer 4 are intriguing. Their superpositioning above Layer 5 clearly indicates that they were created after Layer 5 filled in. It is expected that the filling of Layer 5 marks the end of the use of the channel. If that is the case, then Layer 4 may represent a natural flow of water through this filled in channel. That silted in, then continued to have water flow represented by Layer 3. The location of the both of these layers on the makai side of the Layer 5 channel lends some support to this proposition; natural flow would have gravitated to that side. Alternatively, the channel may have been used as a ditch after Layer 5 filled in. How this would have been done, especially considering the problems encountered by Bond with the changing hydrology in 'Iole, is not known.

The Upper Pali 'Akamoa 'Auwai drops 50 feet (15 meters) over a distance of 1,000 feet (300 meters) for a gradient of 5%. This is a slightly steeper gradient than the Wainai Gulch, but these figures are based on USGS topographic scales. Detailed investigations of the 'auwai technology should include more refined topographic data.

The positive results of the exploratory unit designed explicitly to test for the presence/absence of such a feature lends strong support for the proposition that this channel was created during prehistory to supply water to the lowland *lo'i* (see Figure 9). In contrast, there is no absolute date for the 'auwai, and the *mauka* continuation of the channel has not been identified. Negative results were obtained from XT 14 and XT 17. Construction and modification to the land at the school may have destroyed such evidence, but the intact profile in XT 16 argues that there are still undisturbed parts of this landscape. Data recovery efforts can be designed to trace the 'auwai further, and gather more data such as charred remains and pollen samples, to assist in assessing the origin of the channel.

Based on the information gathered from oral interviews, historical documentation, maps, and field investigations on the surface and in exploratory tests into the extent, shape, and destination of other ditches in 'Iole, it is suggested that the following chronology for the Upper Pali 'Akamoa 'Auwai best explains the evidence that is currently available.

- First: the Hawaiians built Pali 'Akamoa 'Auwai at an unknown date long ago to supply water to the *lo'i*, and used it for that purpose for many generations.
- Second: the Bond family used the ditch to supply fresh water to the Kohala Girls' School area.
- Third: the Bond family dug deeper into the ditch to keep it functional.
- Fourth: the Kohala Sugar Company laid pipe in the ditch (after building the reservoir in the Pali 'Akamoa Stream) and diverted the water to the north to keep water flowing in the primary flume.
- Fifth: the pipe was added on to and the water is moved downhill to supply water to communities further *makai*. This chronology is replicated in part with the Lower Pali 'Akamoa 'Auwai.

The Lower Pali 'Akamoa 'Auwai

The Wainai 'Auwai serviced the extensive *lo'i* system in the uplands of 'Iole. The Upper Pali 'Akamoa 'Auwai probably serviced the *lo'i* system in the lowlands of below the Kohala Girls' School. Another 'auwai was discovered during this Archaeological Inventory

Survey: the Lower Pali 'Akamoa 'Auwai serviced the *lo'i* in the uplands in the field above the Bond Homestead and below the church (Figure 21). This field is now in macnuts, but an old photograph shows *lo'i* (Damon 1927: 57).

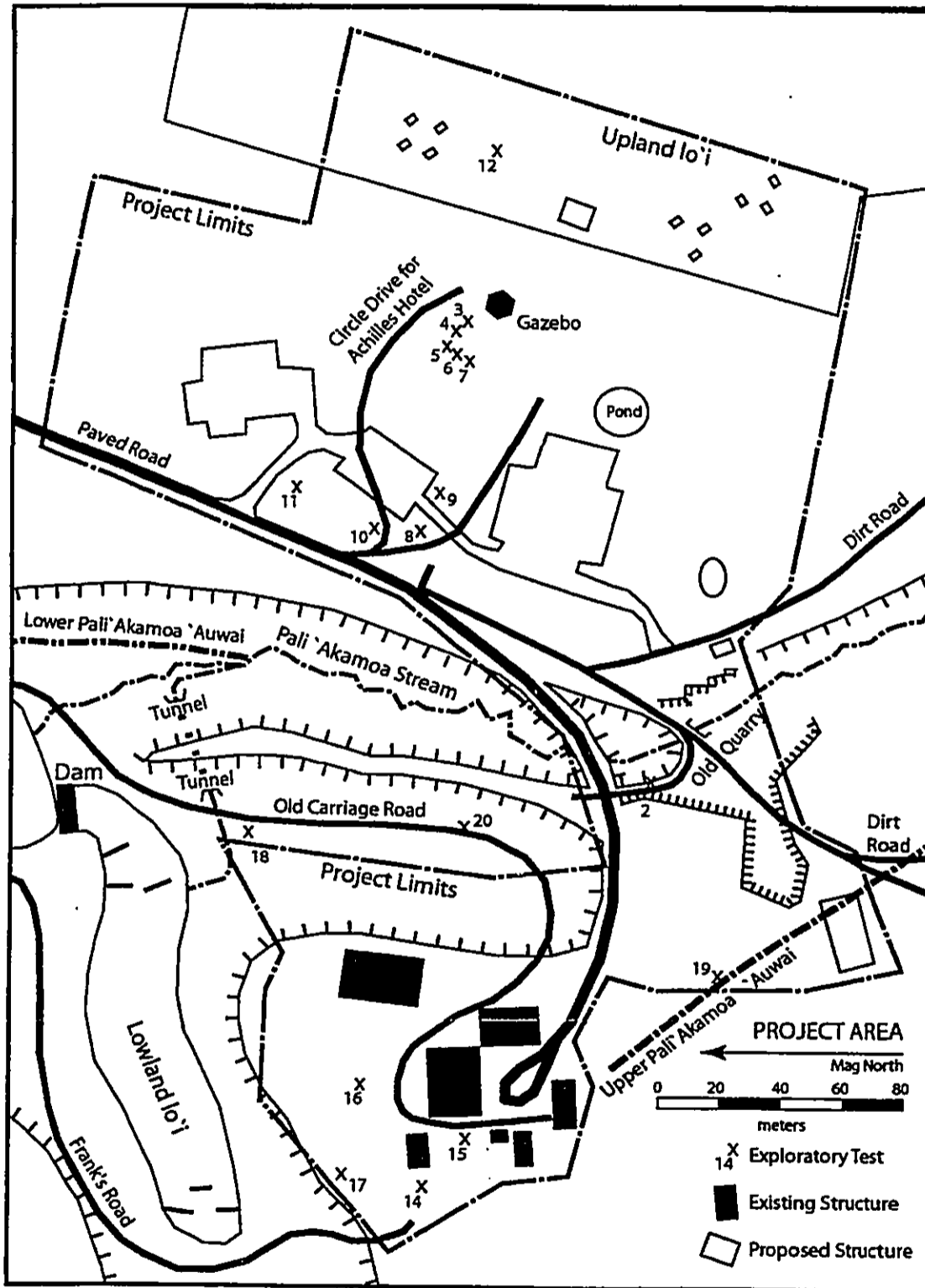


Figure 21. Cultural Resources Identified in this Inventory Survey.

The 'auwai begins in Pali 'Akamoa Stream and hangs on the south bank of the gulch. It enters the uplands just below the church. It is probably no coincidence that Bliss and Bailey built the first meeting house here in prior to Bond's arrival. It is most likely that the 'auwai was there, and Bliss and Bailey took advantage of that, rather than that they built his meeting house, then built a ditch to bring water to it. This interpretation is supported by the presence of the *lo'i* at this place, the natural and ancient destination of the 'auwai.

The Lower Pali 'Akamoa 'Auwai is similar in size to the Upper Pali 'Akamoa 'Auwai. It is approximately 350 meters (1,150 feet) long, and drops 18 meters (60 feet) for a gradient of 5%.

Habitation and Trails

The old documentation, maps, oral history, ground surface undulations, and exploratory tests combine to indicate that there were three 'auwai within the area studied that supplied *lo'i* in various places in 'Iole. The old documentation from Bond supplies the only evidence of prehistoric habitation associated with this agricultural system. Habitation at the time of Bond's arrival was concentrated around the main *lo'i*, but there is also mention of single habitation units situated to the north and west of there.

No stone remains that might be associated with prehistoric habitation were identified during the 100% surface survey of the project area, and the random survey of the areas beyond the project area. No items that might indicate prehistoric habitation, such as subsistence debris or tools, were recovered from any of the exploratory tests. This information suggests that any habitation areas that once existed around the upland *lo'i* have been plowed away by the ground altering activities associated with the Kohala Sugar Company sugar cultivation, and the ground shaping for, and planting of, the macnut orchards.

There is one location that circumstantial evidence suggests may represent one of the outlying habitation areas mentioned by Bond. There is a level area on the blufftop that is just north of the lowland *lo'i*. There are debris and cement pieces here representing a house and domestic activities. An old map (Figure 22) indicates that a parsonage once existed at that location. Frank Perez remembers seeing the ruins of that residence there, but no one was occupying that space during his tenure on the land. Based on this data, it is likely that the parsonage was abandoned prior to circa 1950. It is suggested that this represents the last occupation of a sequence of occupations that dates to Bond's time, and possibly before. Elias Bond referred to a road leading to Ah Lo and Kekuewa place(s), and Rev. S. W. Kekuewa was the first Hawaiian pastor at Kohala (Morgan 1981:294).

It is very likely that Rev. S. W. Kekuewa resided at the parsonage located on the uplands above the lowland *lo'i*. Given that Rev. Kekuewa was a Hawaiian, it is also very likely that the residence was there before the arrival of Bond in 1841. Further extension of that line of thought suggests that the Kekuewa residence was used by the reverend's ancestors. Archaeological tests could be devised to test this proposition, but this area is beyond the project area, and no additional investigations were carried out for this project. An interesting correlate to this speculation is that the name "Keliholoholo" appears on the land grant (#455) for this property on the 1910 map (Figure 23). The name "Keliholoholo" was referred to by Bond as the "last house to be removed" in the passage cited earlier in this report regarding the native Hawaiian settlement distribution. The 22 acre parcel of Gr. 455 includes the parsonage, and the land "just above the Seminary buildings" where another Hawaiian home is referred to by Bond.

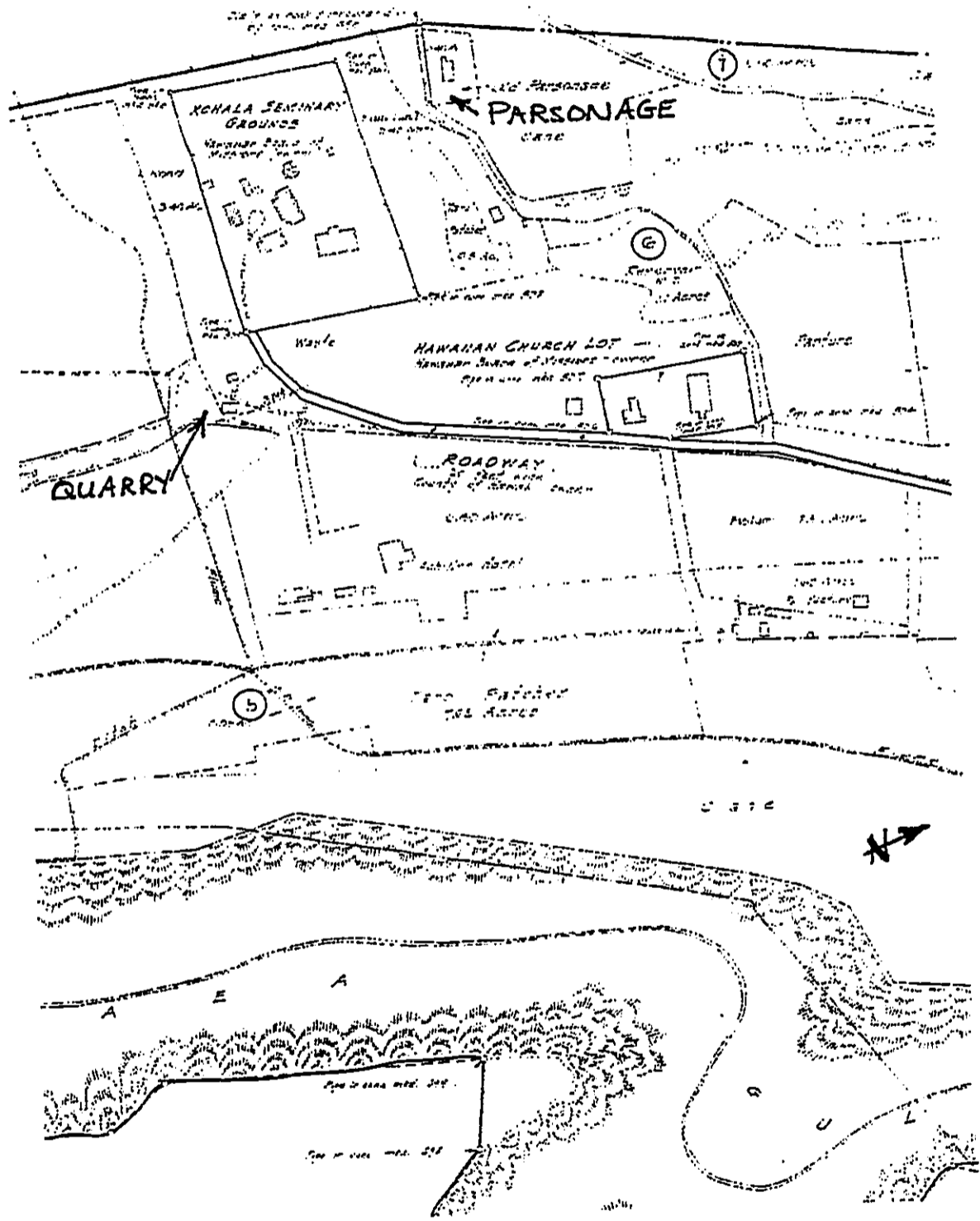


Figure 22. Old map (date unknown, from Schweitzer 2003:74).

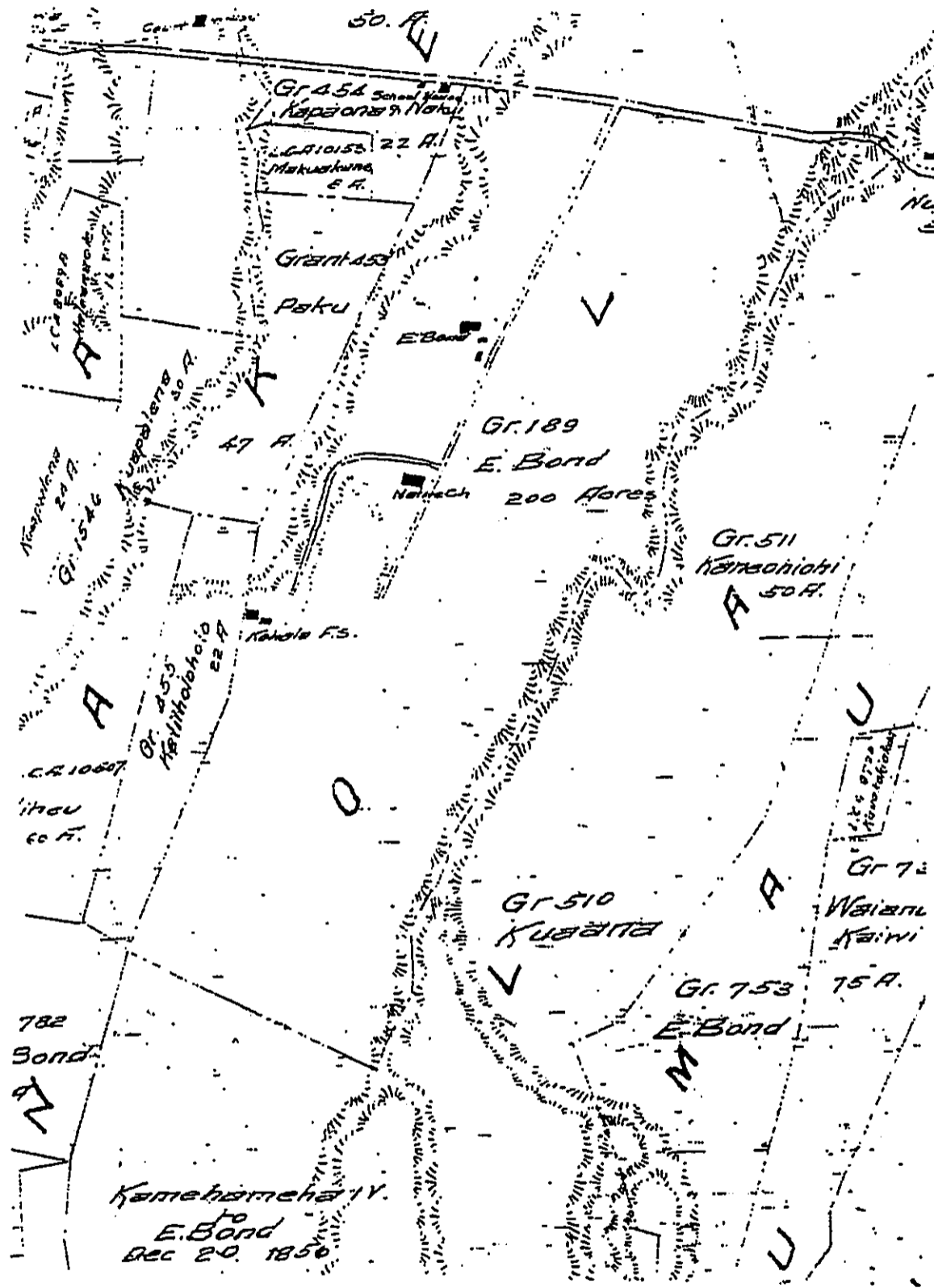


Figure 23. 1910 map.

The surface was scrutinized for evidence of trails and pathways. Pathways of various kinds are a prominent part of the historical landscape (discussed in detail later in this report), but no evidence was observed of prehistoric trails. It is quite likely that old trails were coopted by historic pathways, which have been upgraded and altered with increasingly modern techniques and materials over the decades and still used today.

The Prehistoric Landscape

The data collected during the field investigations, including the discussions with knowledgeable informants, adds detail and clarity to the image of the prehistoric landscape that was generated prior to entering the field.

Three *lo'i* systems were known through documentation. The one in the lowland is visible in a deteriorated condition today. Tests into the main set of upland *lo'i* provided data on the kind of stratigraphy that the upland *lo'i* that have been modified by sugar and macnut cultivation make. That data was used to determine that there was no upland *lo'i* on the land at the Kohala Girls' School. That data was also used to establish that filled-in *lo'i* leave a subtle undulating topography. That information precipitated the observation that another previously unknown *lo'i* may have existed to the north of the poi factory. A test in this area was inconclusive, but did supply information that some kind of agricultural activity was conducted in this undulating field.

The main *lo'i* was clearly linked to a water source, an essential part of the *lo'i* system, but the other two *lo'i* were not. The possible spring associated with the lowland *lo'i* was problematical, and that stimulated research into a potential '*auwai*' source for that system. Tests confirmed that an '*auwai*' was in place in a previously unknown and unexpected location, that can best be explained as a channel to service the lowland *lo'i* that was subsequently modified during the historical era. This '*auwai*' has not been conclusively linked to the lowland *lo'i*, however. Another '*auwai*' was discovered. This one links the continuously flowing Pali 'Akamoa Stream to the *lo'i* in the uplands below the church. The system of water distribution to all of the known *lo'i* can now be accounted for with '*auwai*'.

Field investigations could not identify habitation areas and trails, but that certainly does not mean that they did not exist. Rather, the empirical evidence of their existence has been so highly altered or destroyed that none can be gleaned from this type of investigation. Evidence of prehistoric habitation may remain beyond the project area in the location identified just north of the lowland *lo'i*.

THE BOND-ERA RESOURCES

The Pathways and Quarry

There are several historical pathways that enter and exit the project area. These do not readily reveal information on when they were created, used, altered, or abandoned. Information from other sources, and broader contexts, can assist in making educated guesses about that, however.

Main route

The main *mauka-makai* route through the property is the county road that has one terminus at Highway 270 and another at a gate near the Achilles Hotel parcel. This route shows

up on old maps, and is linked to the Bond residence (see Figure 23). From this information it can be assumed that this route was the first pathway to be used during the historic era. It is likely that it is also the principal *mauka-makai* route that was used during the prehistoric era, based on Bond's recollections. No vestiges of any potential ancient trail alongside this route were observed during the inspection of the road during this investigation.

The main route is paved from its intersection with Highway 270 to approximately 130 feet (40 meters) *makai* of the gate at the road. Above the paved area the road is paved with large cobbles to a location just *mauka* of the gate. The road forks there, and there are no cobbles on the pathways to the east (to the 'Iole fields), or the west (to the 'Āinakea fields).

The cobbles represent an earlier road surface technology. The archaeological methods used in this project cannot divine the age of the cobbled surface, but extensive investigation of historical documentation may provide that data. An exploratory test further *mauka* along this route into the quarry area (described in detail below) suggests that this cobble pavement was created relatively early in the Bond era, probably before 1874.

Old Quarry Road

The road that forks to the east (to the 'Iole fields) is of no further interest to the project area archaeology, and is not pursued in this report. The road that forks to the west (to the 'Āinakea fields) has two major building events (see Figure 17). The first road built here made a 180 degree loop, and appears to have terminated at a place where a ridge has been modified. That loop segment shows up on old maps (see Figure 12), but is not obvious on the landscape today.

An exploratory test was conducted over a level area that corresponded to the location of the potential location on the old map (XT 2). Cobbles were encountered at a depth of 27 cmbs (Figure 24). These cobbles occur in a level, compact arrangement, and are identical in size, and rock type to those that make up the road pavement just *makai* of the gate. The correspondence of the map and excavation data strongly indicate that this part of the road once connected to the main route. This data also supplies information on the relative date of that road and other historical structures in this area.

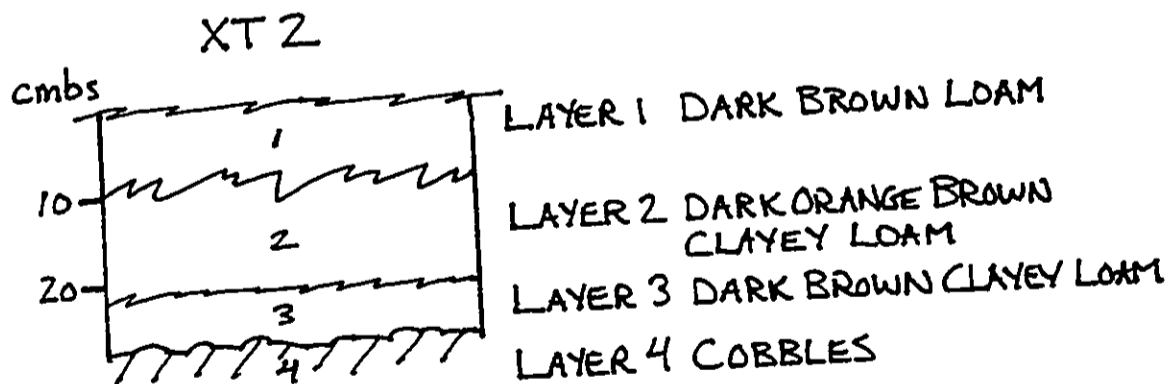


Figure 24. XT 2 profile.

First, and most recently, the currently existing road to the 'Āinakea fields is dirt and covers a portion of the cobble road, indicating the cobble road predates that. Second, the road to

the Kohala Girls' School is paved with a much finer cobble pavement. The Kohala Girls' School was started in 1874, so it is likely that this road with finer paving was built in 1874, or sometime after. The road to the Kohala Girls' School appears to be built over a portion of the looping larger cobble road, indicating that the larger cobble road was built before 1874. Information about the quarry function and date (discussed below) is relevant to the dating of the old quarry road.

The Quarry

The quarry area (see Figure 23) is evident in the vertical rock exposures on both sides of Pali 'Akamoa Stream. This contrasts with the natural stream bank morphology manifest *mauka* and *makai* of this area, where the gradient of the sloping banks are relatively gentle down into the course of the stream.

The quarry had to have been built, at least in part, before the road was built, because the road is down in the quarry. So the quarry was built before 1874. The most likely candidate for the impetus for quarrying rock on the Bond estate is the construction of the stone church in 1855, a date that does not contradict the evidence of the relative and absolute dating cited above for the old quarry road.

It is likely that the initial quarrying was conducted on the east side of the stream, as this area is the first to be encountered by the old quarry road. It also exhibits the most trim and neat quarrying, with multiple corners arranged at right angles to one another. As the quarrying proceeded, it did so by crossing Pali 'Akamoa Stream. It was probably at this time that the stream was channelized with rocks that have been placed in the ground to form a straight and not very wide (less than 5 feet) water course over an approximately 120 foot (36 meter) distance. Continued quarrying on the west side of the stream resulted in the removal a large portion of the west stream bank. The old quarry road would then have been able to have been built over the channel and looping back towards the north.

The ridge at the end of the old quarry road has been lowered by approximately three feet. This leveled area has a small quarry that is at least 5 feet (1.5 meters) deep. It is currently partially filled with debris probably from the mid-1900s. When this area was quarried, and why this particular little spot was quarried is not known.

There is a westward expansion of the main quarry further into the western bank of Pali 'Akamoa Stream. This extension represents the last of the three major quarrying episodes. The base of this extension of the quarry is multilevel, with increasing elevation proceeding westward. The outer rim of the quarry is less symmetrical and more curved than the earlier portions of the quarry. The quarry is bisected by a more recent road made of dirt that leads to the 'Āinakea fields. The shape of the quarry walls on the west extension, and the multilevel base contrasts with the trim and neat quarry on the east side. This data seems to suggest that the initial quarrying was conducted in a fastidious manner, and subsequent quarrying was done with less concern for the resulting visual impact of the work.

There are two buildings noted on the undated map (postdates 1874) that are associated with the quarry road (see Figure 23). The function of these small buildings is unclear, but their small size and direct association with the quarry suggests that they were not habitations, but rather some kind of shop or shed to serve the quarry. The direct association with the "ditch" there also suggests that the larger building may have used water to power some kind of machinery.

Old Carriage Road

A map of the area from 1910 (see Figure 23) does not show the old quarry road, but it is the only historic map that shows the, what is commonly referred to by people working in the New Moon Foundation, as the old carriage road. This road was discovered during the clearing of the thick understory vegetation and bamboo in the gully east of the Kohala Girls' School. It is manifest as a level pathway approximately 6 feet (1.7 meters) wide alongside the gully to the east of the Kohala Girls' School.

The road continues alongside the gully slope, rising in elevation at a gentle grade as it proceed *mauka* (see Figure 21). It turns westward near the head of the gully and continues to increase in elevation as it completes a 180 degree turn to the north. It is no longer obvious alongside the gully slope to the east of the building that was variously used as the old school house and a chapel (built in 1878). Modifications to the slope here include a septic tank, a driveway that connects the current ingress to the school to the side of the dining hall (built in 1921), and pieces of brick and cement. At first glance the old carriage road appears to end at the back of the old school house/chapel.

Thanks to the careful observations of Roy Oness and the clearing work done by he and his crew, one can see that there are subtle topographic indications that the old carriage road once continued past the old school house/chapel and up to the level ground in the front of the dormitory (built in 1874). Furthermore, the old carriage road appears to have curved across the front lawn, and then turned at the side of the dormitory building to lead to the old carriage/wash house in the back.

This arrangement of the original road to the Kohala Girls' School is feasible given the transportation technology of the time, and the layout of the buildings. The use of vehicles drawn by draft animals would require a gentle gradient for the road. It is easier to cross, or ford, Pali 'Akamoa Stream behind the church (where there is no need to create a bridge). The road facilitates a presentation of the travelers to the front of the main building (dormitory) first, and a connection to the necessary accommodations for the vehicle (carriage house) ultimately.

An exploratory test (XT 20) was conducted in the middle of the pathway on the east side of the gully to investigate the material morphology of the road. There was no cobble paving found within the 60 cm deep test. The road was a simple dirt construction cut into the side of the gully.

The chronology of the building, use, and abandonment of this road can be gleaned from the map and building dates. The integrated configuration of the road with the dormitory and carriage house indicates that the road was probably built simultaneously with the earliest of those two buildings, the dormitory, in 1878. The presence of the old carriage road on the 1910 map indicates that the road was still in use at that time. The industrial/dining hall was built in 1921. The driveway to that building covers and modifies the old carriage road. The 1949 TMK does not show the old carriage road, but does show the currently existing driveway into the Kohala Girl's School. Based on this set of evidence, it is likely that the old carriage road was built in 1874, and was abandoned when the industrial/dining hall was built in 1921, or at the very latest, by 1949.

Kohala Girls' School Driveway

The current driveway to the Kohala Girls' School connects the main road just below the gate to a circular drive in the back of the dormitory (see Figure 23). The driveway passes over a large stone bridge that spans the Pali 'Akamoa Stream. The surface of the driveway is paved with cobbles that are notably smaller than those in the old quarry road. The driveway and the bridge are wider than the old quarry road, suggesting that it was built to facilitate movement of larger vehicles. The head of the dry gully has also been modified to accommodate the construction of the driveway. The information from maps discussed above regarding the other nearby roads, suggests that the driveway to the Kohala Girls' School was built probably in 1921, and certainly by 1949. The timing, in conjunction with the finer paving and wider berth, indicates that the driveway was built for the passage of motor vehicles.

Frank's Road

The last pathway created to connect the lower lands with the Kohala Girls' School area is located on the west side of the school complex (see Figure 21). This pathway was bulldozed by Frank Perez during the 1970s. One terminus of this road is at the cinder parking area in the front yard. The pathway then cuts into the gully side, proceeds down into the gully, up the other side of the gully, over the reservoir dam, and further *makai* to the macnut orchard *makai* of the church.

Kohala Girls' School

A variety of buildings where a variety of activities were conducted make up the Kohala Girls' School. Some buildings were added to the complex over time, and others have been razed. The functions of many of the buildings changed with the changes in orientation and administration. These kinds of developments probably also altered patterns of refuse disposal, transportation, recreation, and other mundane aspects of group living. The chronology and anthropology of that history is beyond the scope of this investigation. This archaeological examination is charged with accounting for the identification and evaluation of subsurface remains that were created as a result of the historical events. The investigation was designed to identify the kinds of items expected to be created in historical settings as outlined in the earlier portion of this report.

Pathways

The pathways into the Kohala Girls's School and their changing configuration over time have been discussed above. There are no intact stone pathways in the school complex. A set of pathways that appear on the 1971 map of the complex has been removed (Figure 25), and many of the cement slabs that made up that pathway are neatly stacked in storage at the complex. The layout of this set of pathways is oriented to moving people from the circular driveway terminus to and from the industrial/dining a hall. Based on that configuration, it appears that this set of pathways was built at the earliest in 1921.

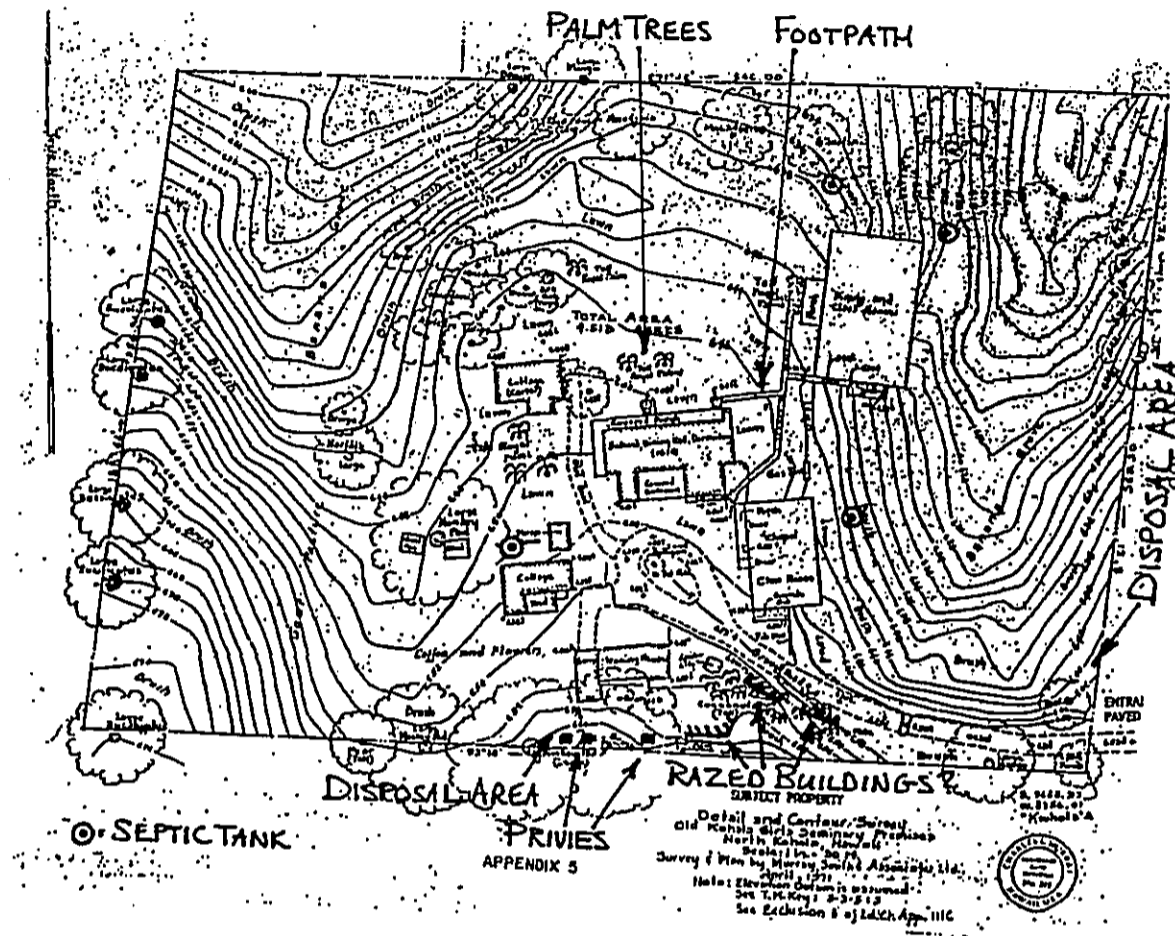


Figure 25. Topographic map of the Kohala Girls' School (1971).

There are two large palm trees oriented as a pair perpendicular to the front door of the dormitory. This orientation is highly suggestive of an arrangement for a pathway that would have connected the front of the dormitory to the old carriage road. Such an arrangement would have been as aesthetically pleasing as it would have been practical in the movement of people to and from the complex between from 1874 through 1921 via the old carriage road.

Privies and septic tanks

There are three cement-lined holes behind the carriage/wash house. These are filled with vegetation and debris. No tests were conducted here, and the full extent and depth of this set of features is unknown. It is likely that these features represent privies. They are in the appropriate location (in the back of the carriage/wash house and near the edge of the developed area), and have appropriate configuration (multiple ones to accommodate the group living, and separated to accommodate both sexes or multiple statuses). Although the circumstantial evidence for their use as privies is compelling, there is anecdotal information that these may represent bomb shelters. This information was passed on to me from people working at the New Moon Foundation reconstruction, that had heard it from another source. It is conceivable that these were originally privies that were subsequently abandoned, and then modified to serve as bomb shelters. Additional archaeological and interview research could be devised to test these propositions.

Bond's notes include mention of privies at the Kohala Girls' School (in Slocumb et al. 1999:3-52), and the change to indoor plumbing perhaps at the turn of the century. The same passage in Slocumb et al. (1999) mentions that "water was piped to the school house as early as 1875, although the infrastructure was probably not in place at this early date to support extensive use of indoor plumbing for toilets" (Slocumb et al. 1999:3-52).

There are four septic tanks in the complex: one behind the old school/chapel, one next to the cottage, and two aside the industrial/dining hall. Portions of metal pipes can be seen at ground surface connecting the buildings to these locations. The time and sequence of the creation of the septic tanks and system of piping connecting to them is not known.

Disposal areas

There are two principal disposal areas that are readily identifiable. More may exist in areas that are covered in dense vegetation beyond the current project limits. One disposal area is in the small quarry at the terminus of the old quarry road. Pieces of motor vehicle(s), and numerous domestic debris fill the hole. The other known disposal area is in and around the privies. Metal, ceramics, and plastics fill the holes and are scattered about the area.

Razed buildings

There are two modifications to the terrain near the driveway that may represent the foundations of old buildings that have been destroyed. There are several buildings that are mentioned in historical documents that are not accounted for on the property, including an "ironing house" and "bath house" (Slocumb *et al.* 1999:3-51), an "old wash house" and "new wash house" (Slocumb *et al.* 1999:3-53). In letters dating to prior to 1907 from the principal Miss Balderston to M.S. Andrews on file in the Hawaiian Mission Children's Society Library in Honolulu (Slocumb *et al.* 1999:9-1), "(t)he old wash house and bath house stood where now stands the pile of rocks in the center of the Court" (Slocumb *et al.* 1999:3-53).

This location is slightly contradicted by notes from Bond regarding "engineering the plumbing to extend the water line to the wash house behind the school house" (Slocumb *et al.* 1999:3-53). It may be that "behind the school house" means further *makai* from the old school house/chapel, which is in the location of the possible razed buildings.

The information included in Slocumb *et al.* (1999:3-53) regarding these destroyed buildings is particularly interesting with regard to the relationship of these buildings to a system of water control. "It wasn't until 1875 that Bond brought a pipe with water onto the lot to supply a tap in the girl's school house" (Slocumb 1999:3-53).

Water control

Bond did indeed engineer a great deal in 'Iole. The investigations into the Pali 'Akamoa 'Auwai (discussed in the section on prehistoric resources) indicated that the ancient water channel was headed for the Kohala Girls' School. The closest buildings to that projected water pathway are the existing carriage/wash house, and the potentially razed bath and other wash houses. The connection between these water-needing structures, and the water-supplying 'auwai provides strong circumstantial support for the proposition that these buildings were built in their locations specifically to tap into the channeled water. Additional support for this notion comes from Bond notes.

Three entries in Bond's memo book refer to the project. On April 21, 1876 he notes that he "finished lowering the trench near Sch. House for water pipe." On May 5, 1876 Bond "laid pipe in & cemented the wash house, Seminary". Finally, on June 8, 1876 he "Let the water into our new pipe. Branching fr. The School House pipe" (Damon 1927:225-226 IN Slocumb *et al.* 1999:3-53).

This passage refers to "the trench", and "water pipe" as two distinctly different things. Based on the reference from Dr. Benjamin Bond cited previously regarding the multiple episodes of deepening the old Hawaiian ditches, it is likely that "the trench" in the April 21 note refers to the old *'auwai*. The results of XT 19 indicate that the *'auwai* is near the school house, and is oriented toward the known wash house, and the potential foundations for the other water-related out buildings. This seems especially likely, because the April 21 note mentions the activity of "lowering the trench", which is precisely what Dr. Benjamin Bond has indicated had to be done on multiple occasions to keep the water flowing through the channels.

In contrast, the "water pipe" is something that seems to have been built by Bond specifically for the school complex. This pipe appears to have been a ("branching") system that tapped into the water supplied by the modified *'auwai*.

The first exposure of a pipe-like item was made during the reconstruction work at the base of the dormitory in the summer of 2003. During this activity, several orange bricks were exposed. These were arranged to form a hollow, conduit-like, pipe-like, square in cross-section tube. The *mauka* portion of this short exposed piece was oriented directly towards the east side of the carriage/wash house. The *makai* end was oriented to the northwest. An exploratory test (XT 15) was conducted in the path of the northwesterly projection of the "brick tube" in an attempt to better define the thing and its route (Figure 26).

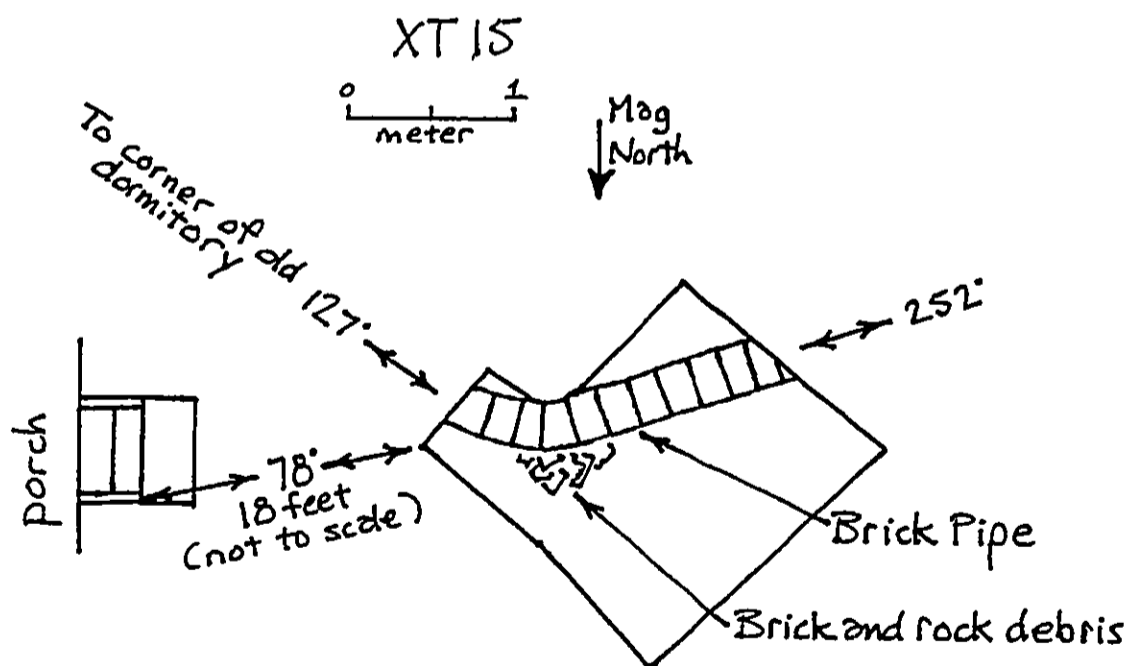


Figure 26. XT 15 plan.

The top of the brick water pipe was encountered at less than 10 cmbs of XT 15. The tube curves from its orientation in connection with its exposure at the dormitory (at 127° Mag North) to an unknown destination further to the west (at 72° Mag North). The bottom of the tube is made up of bricks laid on their longest and broadest surfaces. The longest edges are next to one another. The bricks on the sides of the tube are placed with their longest and thinnest surfaces, so one side brick will rest on two bottom bricks. The bricks on the top are arranged in the same fashion as those on the bottom. All of the bricks are mortared together.

The bricks are orange and lacking any markings. The bricks along the curve of the pipe have been shaped to be long trapezoids to facilitate the gentle curve (Figure 27). Broken brick pieces have been piled against the down-stream side of the curve. These are interpreted as representing a patch or support, to fix or prevent the flow of water from breaking through the tube at this location.

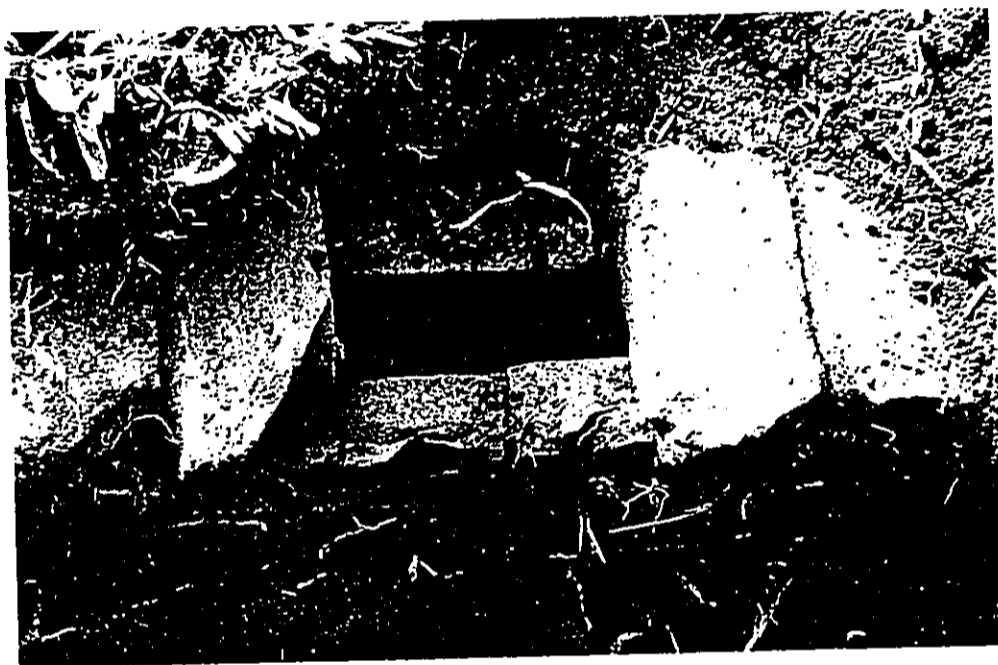


Figure 27. Photograph of Brick "Water Pipe".

The results of XT 15 provide direct evidence of Bond's "water pipe" at the Kohala Girls' School. The Bond notes indicate that the pipe and its branching system tapped directly into the Upper Pali 'Akamoā 'Auwai, as modified by him to enhance the flow of water. Results of XT 19 place the Upper Pali 'Akamoā 'Auwai close to the known wash house, and very close to the suspected locations of the old wash houses, and bath house, as suggested by the surface modifications "behind" the old school house/chapel. What remains to be determined is the full extent of the water pipe system.

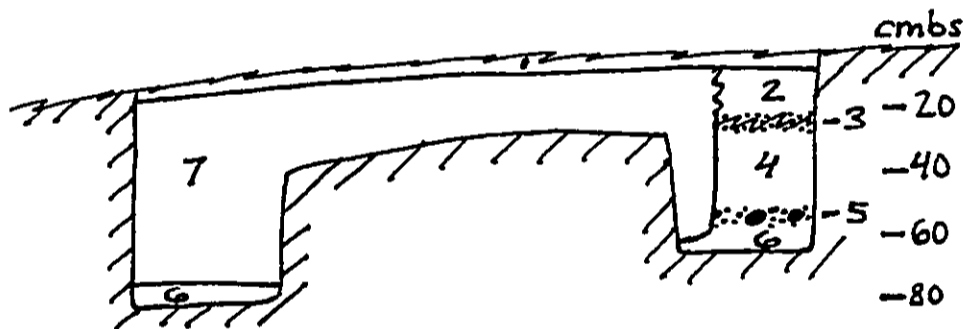
The XT 15 exposure of the pipe indicates that the system is more extensive than Bond represents in his notes. It also suggests that the system involves moving water away from the complex (drainage of excess water and removal of dirty water) as well as into the complex. The field investigations have provided new information on the technology of water control and its changes over time in the Kohala Girls' School, but more work needs to be done to understand the network of that system.

There is a tunnel through the ridge to the east of the Kohala Girls' School that once brought water from Pali 'Akamoa Stream to the little gully that is *mauka* of the lowland *lo'i*. It is presumed that this tunnel was built circa the same time that other tunnels were being built in 'Iole, in the early 1900s. It is worth noting, however, that tunnels may have been built prior to European needs and technologies. Handy and Handy (1991:530) develop a logical argument for the antiquity (prior to the influx of Europeans to the island in the late 1700s) of one particular Kohala tunnel that was first recorded in 1849.

An exploratory test (XT 18) was placed in the little gully and near the outlet of the tunnel to determine whether a *lo'i* had once existed here, that might have been supplied water by that tunnel. The results of that test were inconclusive, but not without some clues as to past activities there. The very thin Layer I humus attests to its very recent creation (Figure 28). A series of strata along the east side of the profile is somewhat suggestive of a "natural" setting. There are multiple layers (2 through 6) that are variously clayey, or crumbly. Some have more rocks in them than others. It is not clear, but this set of data could reflect an environment where water was passing through. The majority of the unit is taken up by Layer 7. This layer has a crumbly loamy soil, but it is difficult to even assess the soil, because at least 80% of the matrix is taken up by rocks (not waterworn). The east edge of Layer 7 clearly cuts into the other layers, indicating that something or someone had removed the multilayered ground to the east. There were a few historical items (brownware fragments, wire, and charred matter) within Layer 7.

XT 18

VIEWER FACING NE



- LAYER 1 BLACK LOAM
- LAYER 2 BROWN CLAYEY LOAM = COMPACT
- LAYER 3 BROWN CLAYEY LOAM = CRUMBLY w/ PEBBLES
- LAYER 4 BROWN CLAYEY LOAM = COMPACT
- LAYER 5 BROWN CLAYEY LOAM = LESS COMPACT w/ ROCKS
- LAYER 6 BROWN CLAYEY LOAM = COMPACT
- LAYER 7 BROWN CLAYEY LOAM = 80% of MATRIX = ROCKS

Figure 28. XT 18 profile.

The precise meaning of the data set in XT 18 is not known. The information does suggest that water may have moved through here at some time in the past, and that the landform has been modified for some unknown reason in the past. Whether these actions were associated with *lo'i* is not known. There is no compelling evidence that this is a *lo'i*, however, as the stratigraphy does not conform to other *lo'i* stratigraphy, and there are no surface indications of terraces in this little gully.

Flumes

There is evidence in the old maps and subtle topographic undulations of the location of the primary flumes that were essential to the harvesting of sugar cane. One of the primary flumes passed through the south part of the project area. Surface survey of this part of the project area indicates that the land here has been filled and graded. There is a 15 by 10 foot soil mound along the line that corresponds to the primary flume on old maps (see Figure 9). The mound is supported on the sides by corrugated metal sheets and an old tire. Considering its correspondence of the mound to the flume pathway (there is no direct evidence of the flume on the ground surface), and the need to move the flumed water over the nearby Pali 'Akamoa Gulch, it is likely that the mound represents the foundation of trestle construction required to flume the water and harvested sugar cane across the gulch.

The grading and filling of this part of the project area has removed any surficial evidence of the Upper Pali 'Akamoa 'Auwai across this area. It is conceivable that subsurface remains of the 'auwai are buried beneath the surface in this area.

Achilles Hotel

One part of the project includes a parking area south of and across the main road from the Kohala Girls' School. The entire 4.0 acre parcel that makes up the Achilles Hotel lot was surveyed at less than 10 meter intervals, and several exploratory tests were conducted. Old maps indicate that the Achilles Hotel existed in the southeast corner of the parcel (see Figure 9).

Debris on the surface, and the stratigraphic profiles and accompanying debris in XT 3, XT 4, XT 5, XT 6, and XT 7 indicate that one of the hotel buildings was situated in the area within a small group of trees to the west of the gazebo beyond the project boundaries (Figure 29). There are several pieces of concrete, and a few broken glass fragments within the tree area. There is a slight drop in elevation into a level space within the trees, which is suggestive of a modified terrain perhaps for a building. XT 3 was situated at the edge of the change in elevation.

The profile (Figure 30) did reveal that the terrain had been dug into on a relatively large scale (broadly, not deep). A thin dark topsoil (Layer 1) covers a natural profile (Layers 2 and 3) to the east, and layers of fill (Layers 4 and 5) in the broad, shallow basin. Burned materials, including partially melted glass, are in accord with the mottling of red (burnt soil) within the Layer 4 matrix. All of the material remains were within the realm of expectation for a domestic residence occupied in the first half of the 20th century. Detailed analysis was not performed on the material remains, because the unit was situated well beyond the project area. The tests in this parcel do confirm that there are archaeological remains of the Achilles Hotel, and that they are situated beyond the project impact area.

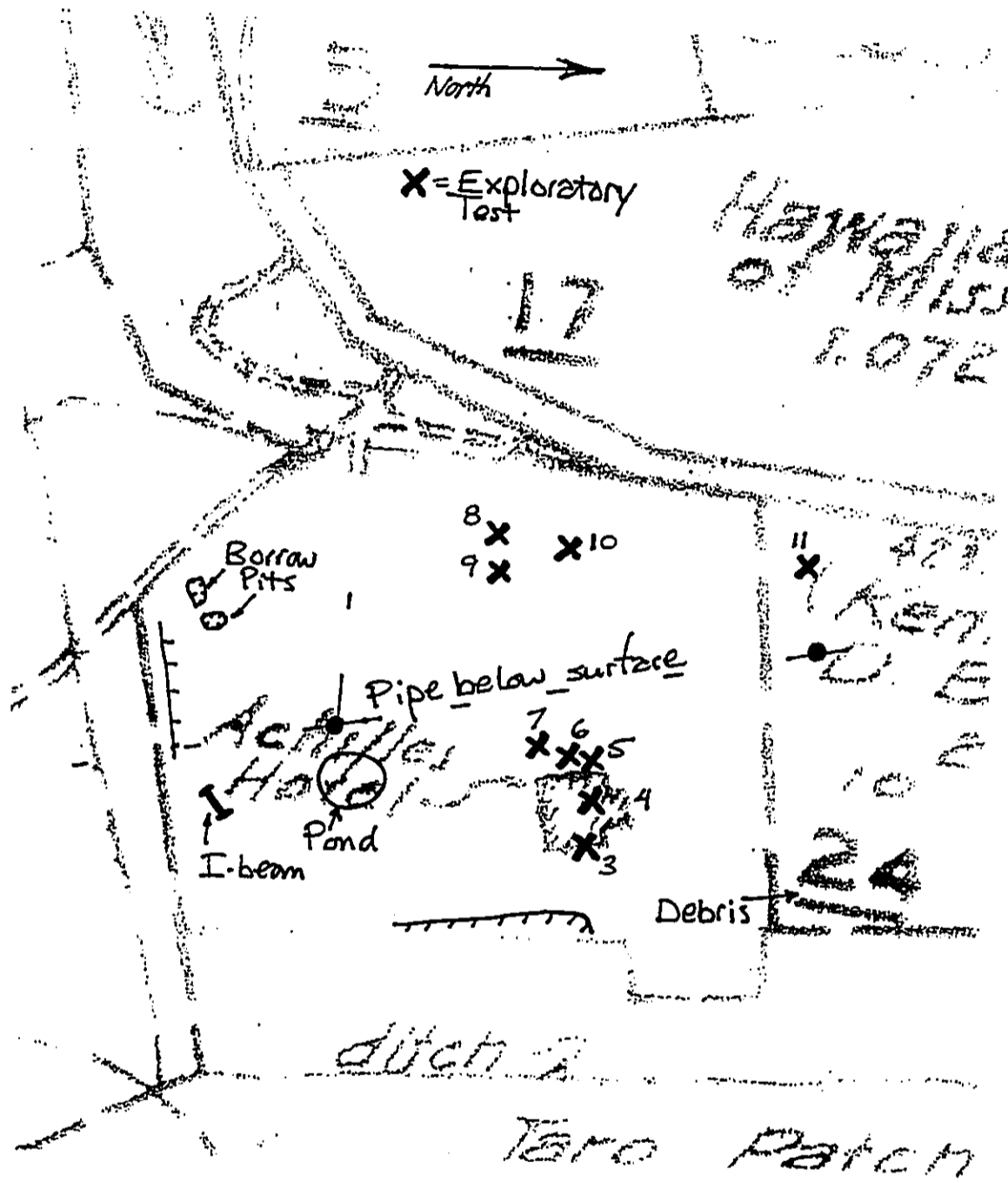


Figure 29. 1949 TMK of Achilles Parcel.

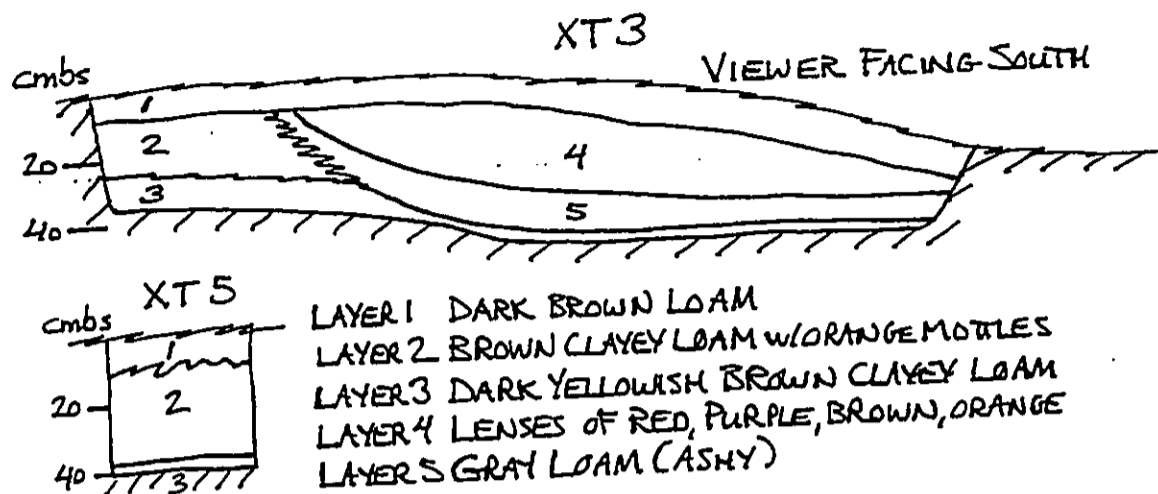


Figure 30. XT 3 and XT 5 profiles.

The XT 3 profile indicates that some of the debris associated with the hotel was left behind after abandonment, and was burned in the shallow pit that probably represents the crawl space of one of the buildings. The limited area exposed in XT 3 is not sufficient to be able to conclude that this was the principal building in the complex, or an out building. Profiles of XT 4, XT 5, XT 6, and XT 7 appear to represent the churned and burned upper soil of sugar fields, and all are similar to that of XT 5 (see Figure 30).

Exploratory tests were conducted within the project area to check for potential prehistoric habitation, trails, and historical use. Profiles of XT 8, XT 9, XT 10, and XT 11 (mostly identical to those shown in Figure 14) indicate that the area was in sugar cultivation, but that no other modifications took place here. Part of the surface was scraped away to the west of XT 8 to trace out the distribution of some cobbles observed there. The pattern of cobbles exposed suggests that this area was the original driveway into the Achilles Hotel parcel (probably to the then house of one of Elias Bond's sons). Close inspection of the landscape around here suggests that there was a circular pathway up to the house/hotel. That driveway and pathway has been abandoned for some unknown length of time, and the current egress is approximately 50 feet (15 meters) to the south.

Other items of note in this parcel of land include: an I-beam under the banyan tree in the south part of the parcel; surface exposures of main water pipes at two locations; borrow pits in the southwest part; modifications to the landscape along the east and south boundaries; a dry dammed pond near the banyan; and a debris concentration on the surface in the northeast corner of the parcel. The significance of these items was not fully explored. This does indicate that there is data contained within this parcel that can address issues of domestic habitation (Bond's son house), local business (Achilles Hotel), technology of land modification (Frank Perez dragged the I-beam behind his tractor to prepare the land for the planting of the nearby macnut orchard), and later historical water control.

The old maps, historical documentation, and personal remembrances provide much information about the activities conducted within the Achilles Hotel parcel. The exploratory tests and inspection of the landscape adds some detail to that story with information on the pathway layout, and observation of the burning at the hotel abandonment.

Others Elements Beyond the Project Area

The contextual approach to the identification and understanding of the prehistoric and historic resources on the property resulted in the examination of other related cultural modifications. These are briefly described here as they relate the understanding of how the old cultural landscape shaped the newer one. Much more detailed investigations would be needed to fully understand these relationships.

There are other indications on the property of Bond modifying the old 'auwai to work for his needs. There is a cement cistern in the pathway of the Lower Pali 'Akamoa 'Auwai with a date of "1919" inscribed into it.

In an interesting development in water control evolution on the property, it appears that Bond not only modified the ancient 'auwai, but that he also built his own. There is a ditch that taps into the main 'auwai that supplies the upland *lo'i* to the east of the Bond Historic District. That connection is at a right angle to the old 'auwai and is supported alongside of a hill by a 2 meter high terracing stone wall. It crosses the main road and passes through a breach in the old stone wall that is marked by large boulders. It is likely that excavations under the pavement here will reveal a stone channel and culvert very similar to that near the upland end of the old quarry road. The ditch takes another right angle and heads downhill directly to the Bond Homestead.

Rather than being an 'auwai style water channel, this ditch may contain another of Bond's "pipes". To provide drinking water to the boys schooling in the Bond Homestead area

(i)n 1863, Bond laid a pipe, about one eighth of a mile long: "[A] slender trickle did make its way through the little pipe and 'running water' was achieved. The faucet in the yard for the use of the school boys was slightly below the level of the kitchen tap, which therefore received no flow when the outer one was open" (citation in italics from Damon 1927 IN Schweitzer 2003:81).

Elements of the ditch that reflect its historic origin include the two right angles in it, and the high stone terrace wall. These characteristics stand in contrast to the older 'auwai that turn with the terrain, and hang on the hillslopes.

There is a cement dam just below the *lo'i*. The pooled water is piped out to supply the fields below the church. Water was directed to this pooled area from the perpetually flowing Pali 'Akamoa Stream via a tunnel built under the ridge to the east. There is a cement check dam to divert the flow of the stream into the tunnel. The dam is designed to be able to completely block the flow of the stream and thus divert it entirely into the tunnel and ultimately the pool above the dam. The channel to the tunnel goes west from the dam. The Lower Pali 'Akamoa 'Auwai originates at the dam and goes to the east. This is highly suggestive of a prehistoric origin for a dam at this location, that was subsequently built over for the tunnel flow.

The Post-contact Landscape

The historic landscape was very dynamic and diverse. Changes occurred rapidly in conjunction with religious settings, educational settings, the homestead and family changes, increase in intensity and types of agricultural products, and the involvement of different ethnic groups, to name just a few factors. Much of the story of these changes can be derived from

written documents of those that participated in them. Those writings, no matter how thorough, are notorious for leaving items out that are important, or at least of interest, to our anthropological perspective to the past.

The archaeological perspective on the post-contact landscape provides fresh insights into certain aspects of the past, and misses others entirely. The rehabilitation work currently being conducted on the buildings will generate new interpretations and understanding regarding post-contact technologies and their sociological elements. The material remains stored on site associated with the various structures might best be evaluated by historians and crafts people. Each of these and other kinds of research and analysis will follow their pathways to that past with concordant results.

The main theme that asserts itself from the archaeological data collected and presented in this report is that the post-contact landscape is intimately tied to the prehistoric landscape. The first missionaries set up their meeting house where the Lower Pali 'Akamoa 'Auwai reaches the uplands. The Kohala Girls' School is situated where the Upper Pali 'Akamoa 'Auwai passes. Bond tapped into the Wainaia 'Auwai to bring water to his homestead and to power his machinery. The early sugar mill and subsequent poi factory continue the age-old agricultural practices in 'Iole. The post-contact uses did not destroy the old technology. On the contrary, the post-contact occupations and agricultural thrived by using, and modifying, the ancient technology.

DISCUSSION

The full story of the prehistory and history cannot be told with the information gathered during this limited inventory survey. This work is simply another step in that process that started with the early chronicle of Damon (1927), the first analytical approach to the data by Morgan (1981), itemization of the buildings and materials in them by Slocumb *et al.* (1999), and the on-the-grounds approach of those working on the property now. The information presented in this report provides data sufficient to create and examine a chronology of events that transpired in 'Iole that can be used to guide future investigations. In the matter of compliance with the applicable cultural resource management regulations, the work conducted here has identified the cultural resources that exist within the project area. The remainder of this report supplies: a brief synthesis of the information in a chronological format; the required evaluation of those resources for compliance needs; and suggestions for how future investigations can contribute to the ongoing process of caring for and understanding those resources.

Patterns of 'Iole Past

The earliest inhabitants on the island of Hawai'i arrived sometime between AD 300 and 800 (Cordy 2000), and concentrated settlement probably at Hilo and Waipio. Those in Waipio likely spread to the east and west settling along the coast and modifying the land to support dryland and wetland agricultural practices. Based on genealogical chronologies and absolute dates from archaeological contexts in western Kohala, windward Kohala was fully settled by 1300 (Cordy 2000). The legends of 'Iole, Pueo, and the semi-legendary account of the battles between Niuli'i and Kukuipahu emphasize that the Kohala coast was a vital and vibrant place in Hawaiian culture during the early centuries of occupation.

The antiquity of the settlements, *lo'i*, and *'auwai* have not yet been established with radiocarbon or other absolute dating techniques. Based on the dates of other such systems on the

island of Hawai'i (Clark and Kirch 1983; Wolforth 1999a), it is likely that those in 'Iole were created as early as AD 1300.

The unusually precise knowledge of the number of settlements (from Bond's recollections) and the size of the *lo'i* (that can be demarcated and measured) in 'Iole provides a unique opportunity to explore the economics and politics of agriculture in the complex chiefdomship that defines the Hawaiian system. Specifically, the size of the *lo'i* could provide a particular volume of produce. The inhabitants of the settlement would require a particular volume of produce. Based on the large size of the *lo'i* and small number of settlements in 'Iole, the volume of produce will likely exceed the volume required sustain the needs of the local population. That extra produce would have gone to local surplus and the subsistence "tributary" to the *kono'hiki*, priestly class, warriors, and *ali'i*. While this kind of overproduction is expected and discussed in many perspectives of Hawaiian prehistory (Earle 1978; Kolb 1991; Sahlins 1958) and global manifestations of complex chiefdoms (Carneiro 1981; Pauketat 1994;), there are seldom such clear opportunities to directly measure this relationship with empirical data from the field.

This opportunity to examine surplus and its ramifications is particularly poignant, because post-contact documentation indicates that these *lo'i* may have been some of Kamehameha's favorites". He did not live here, but he apparently appreciated the produce from these *lo'i* the most. On one level that reinforces the notion that *ali'i* were procuring the surplus of subsistence items within their domain. There may be more to that relationship, however. Why were those "favorites" Is that because they actually tasted the best? Perhaps these *lo'i* supplied the greatest volume of produce, or could be counted to supply produce even in the times of hardship. Maybe there was some nostalgic connection to the place. Perhaps it was the people of 'Iole that were closest to his heart, and he was expressing that by reference to the *lo'i*. There are opportunities to analyze these kinds of data with archaeological techniques, and dialogue with people and histories pertaining to this place.

The data also provides opportunities to study the agricultural technologies, and possibly how they changed over time. For instance, the two smaller *'auwai* (on Pali 'Akamoa Stream) have gradients of 5%, and the longer one (on Wainai Stream) is at 10%. This suggests that the shorter *'auwai* do not need to be as steep to deliver the water to its destination. Steeper gradients may be necessary over longer distances to ensure that the water flows faster than it evaporates. Perhaps there are other factors that contribute to this situation. One gradient type may reflect an earlier or later development. Or one gradient type may have been a preferred or selected technology of one group of people as opposed to that of another group. Does the fact that the two lower gradients being associated with Pali 'Akamoa Stream reflect their creation by people associated with Pali 'Akamoa Stream, as opposed to others associated with Wainai Stream and the higher *'auwai* gradient? These kinds of topics can be explored, and data recovery efforts at 'Iole should be designed to facilitate it.

The first missionaries Bliss and Bailey, came on to a land that was thriving with agriculture (*lo'i* in the uplands and lowlands), industry (flowing water from multiple sources), and settlement (with small concentrations and scattered occupations). They took advantage of that by setting up their meeting place at the outlet of one of the *'auwai*. A man named Aiko built a mill to process the sugar, which was probably already thriving there. But it was Elias Bond that had the skills, insight, and desire to be able to articulate with the social, economic, and natural setting.

During Elias Bond's tenure in 'Iole, there is no archaeological evidence of destruction of

these natural and cultural resources. On the contrary, Bond relied on the network of 'auwai, using it as it existed in some places, and building onto in others. The lo'i continued to function, at least in the uplands as indicated by the poi factory surviving into the mid-1900s, even during the development of the Kohala Sugar Company on these lands. His work in spiritual matters, development of educational opportunities for men and women, and creation of employment possibilities can and continues to be debated within the context of the profound changes that occurred to the native peoples of Hawai'i during the 19th century, and these are not best explored through archaeological means. Nevertheless, the archaeological data do suggest that Bond shared an appreciation, understanding, and care for the resources that began on this land over 1,000 years ago.

Even with the intensification of the modern agricultural practices relying on machines and chemicals, and changes in administration and function of the buildings at the Kohala Girls' School, there are many resources that remain intact below the ground surface. The lo'i in the uplands retain their pollen-bearing sediments in layers of clay. The lo'i in the lowlands retain their shape and fertility. The 'auwai are silted in, but retain their shape over long distances. The vestiges of habitation and trails are not readily apparent in the small portion of the land investigated for this study, but may be present elsewhere.

The earliest post-contact modifications to the Kohala Girls' School vicinity resulted from the quarrying. This activity took place at least by 1855, and perhaps earlier. This archaeological inventory survey added several features to the catalog of items at the Kohala Girls' School, which opened in 1874. The Upper Pali 'Akamoa 'Auwai was used as a primary water source that was distributed around the school complex via a system of subsurface brick water pipes. Privies were probably located in the back of the old carriage house. An old carriage road provided the earliest route to the school from the church area. It was designed to facilitate carriage travel, be aesthetically pleasing with its promenade in the front of the dormitory, and function appropriately for the care of the carriage and the beasts pulling it. The water pipe, privies, and old carriage road became obsolete in the early 1900s with the advent of motor vehicles and metal piping for water control.

Water control changed dramatically with the creation of the Kohala Ditch in the early 1900s. Large and dependable supplies of water were distributed across the sugar fields via permanent flumes. These were supplemented, at least in the instance of the Upper Pali 'Akamoa 'Auwai, with water from the old 'auwai. Sugar cultivation churned and burned the upper foot of soil across the land. With the demise of sugar cultivation in 'Iole in the 1970s, the land was churned one last time, the lo'i were filled in, and the macnut trees were planted.

Significance Assessment

The evaluation of the significance of the resources is confined to those resources that are partly or completely within the project area, or are immediately adjacent to the project area (see Figure 21). The resources identified and discussed in this report that occur at some distance beyond the project area (such as the poi factory, Wainai 'Auwai, and others) were not investigated thoroughly, and consequently, evaluation of those resources here would be premature and inappropriate.

Resource evaluation for this project must take into account that the Bond Historic District is already listed on the National Register of Historic Places. That is a federal designation, so part of this discussion includes reference to federal contexts of significance.

All features that are: 1) are within the 50 acre Bond Historic District, 2) newly identified in this project; and 3) pertain directly to the era of significance for the NRHP District listing (1841 to 1926) are recommended as eligible for listing on the NRHP (Table 3). Whether these are to be actually added to the listing is beyond the scope of this report. Criteria for evaluating significance include:

- A. It must be associated with events that have made a significant contribution to the broad patterns of our history, or be considered a traditional cultural property.
- B. It must be associated with the lives of persons significant in the past.
- C. It must embody distinctive characteristics of a type, period, or method of construction, or represent a significant and distinguishable entity whose components may lack individual distinction.
- D. It must have yielded or may be likely to yield, information important in prehistory or history.

Table 3. Resources within the project area that are directly related to the Bond Historic District NRHP Listing.

Resource	Criterion of eligibility	Recommended Treatment
Water pipe (brick)	A, C and D	Data recovery explorations to connect water pipe system to the Upper Pali 'Akamoa 'Auwai. Monitor during construction to: 1) identify full extent of water pipe system, and 2) identify portions of system to preserve.
Old carriage road	A	Integrate preservation with active use as a foot path.
Privies	D	Preserve as is, or enhance preservation by rehabilitation.
Disposal areas	D	Data recovery excavations to collect material remains that may provide insights into changing patterns of status, ethnicity, function, technologies associated with the people that have lived and worked at the Kohala Girls' School.
Tunnel	A and D	Data recovery to examine tunnel technology and potential for prehistoric origin.

There are other resources within the project area that within the Bond Historic District that do not contribute to the listing's era of significance, but are significant for other reasons (Table 4). Since these are not part of the District, and this project is being reviewed under state, not federal cultural resource management regulations, these resources are evaluated based upon state criteria of significance (Hawai'i Administrative Rules §13-275-6). To be assessed as significant a site must be characterized by one or more of the following five criteria:

- A. It must be associated with events that have made a significant contribution to the broad patterns of our history, or be considered a traditional cultural property.
- B. It must be associated with the lives of persons significant in the past.
- C. It must embody distinctive characteristics of a type, period, or method of construction, or represent a significant and distinguishable entity whose components may lack individual distinction.
- D. It must have yielded or may be likely to yield, information important in prehistory or history.
- E. Have important value to native Hawaiian people or other ethnicities in the state, due to associations with cultural practices and traditional beliefs that were, or still are, carried out.

Table 4. Resources within the project area and within the Bond Historic District NRHP Listing, that are not related to the BHD era of significance, but are eligible for listing independent of the BHD.

Resource	Criterion of eligibility	Recommended Treatment
Lowland <i>lo'i</i>	A and D	Detailed mapping of the <i>lo'i</i> system. Investigate status of possible spring. Limited excavations to extract pollen and datable materials. Further excavations beyond the known <i>lo'i</i> limits to check for additional <i>lo'i</i> .
Upper Pali 'Akamoa 'Auwai	A and D	Data recovery excavations near XT 19 to collect pollen, macrobotanical, and datable materials. Further exploration and identification of the location of the 'auwai into the Kohala Girls' School, and perhaps to the lowland <i>lo'i</i> .
Achilles Hotel	D	No further work

There are several resources that are immediately adjacent to the project area, that could be effected by the undertaking (Table 5), and that area also evaluated under state criteria.

Table 5. Resources beyond the Bond Historic District NRHP Listing, but that are directly related to the era of significance.

Resource	Criterion of eligibility	Recommended Treatment
Old quarry road	A and D	Data recovery excavation to inspect for possible buildings noted on old maps.
Quarry	A	Preserve as is. Preservation could be enhanced with rehabilitation by removing modern road and debris.
Agricultural terraced field with coral in Layer X	A and D	Data recovery excavation to collect pollen, datable materials, and data on terrace morphology. Monitor installation of utility in vicinity of this area.

The proposed development as outlined earlier in this report, will have an effect on the resources included in Tables 3, 4, and 5. The effects to the resources can be mitigated with the recommended treatments included in Tables 3, 4, and 5, and detailed below.

There are two items that are partly within the project area that are not significant cultural resources (Table 6).

Table 6. Resources within the project area that not eligible for listing in the Bond Historic District NRHP Listing, or otherwise.

Resource	Reason for not eligible
Frank's road	Less than 50 years old.
Flume alignments	Not associated with the era of significance for BHD, and there is no physical remains (no integrity) of the flumes.

Cultural Impact Assessment

In all of the discussions conducted by Ms. Bowman, the Kohala Girls School was place referred to most often. The role of the Bond family with regard to the history of North Kohala was the other main topic of discussion. Traditional Hawaiian cultural practices were seldom mentioned; the only reference being to the lowland *lo'i* just east of the Kohala Girls School. That reference did not indicate that the *lo'i* were being used in any way within memory, but that there was a concern about the invasion plant species within that *lo'i*.

Several interviewees have genealogical connections with people known to have lived in 'Iole in the early 1800s, as indicated in recollections of Elias Bond (Damon 1927). Hawaiian Civic Club member Valerie Luhiau-Anjo is a descendant of Reverend Luhiau. Stephanie (Naihe) Cabannis is a descendant of the Naihe family. AhHen Pobre is the daughter of Mr. Fung, the poi man.

Two interviewees mentioned the presence of restless spirits on the Bond property. In one instance the spirits were portrayed as Hawaiians that had been poorly treated. In the other instance, the ethnicity or family of the spirit was not mentioned, but the spirit was inside the homestead and did play the piano, suggesting that this was a spirit connected to the Bond family. Spirits do not show themselves to everyone, as indicated by one resident of the school buildings when they were rented out in the late 1900s.

Based on these discussions, and the historical documentation cited previously in this report, there are no ongoing cultural practices being conducted on, or associated with, the property. The thoughts regarding spirit manifestations are idiosyncratic, and are consequently not cultural expressions.

Recommended Treatments

It is recommended that the resources be treated under provisions to be agreed upon in a detailed mitigation plan that takes into account that the New Moon Foundation will be managing these resources. This property will not be uniformly bulldozed, destroying everything, to make way for the creation of something new. Rather, the much of the development of the new items here are overtly designed to limit impacts to the natural and cultural landscape, which is an integral part of the mission of the New Moon Foundation. Consequently, the cultural resources will be integrated into the place and activities. This is already underway with the rehabilitation and integration of the buildings at the Kohala Girls' School.

Precisely how that will be achieved with the other cultural resources is not certain at this time, however, in part because the identification of those resources has only just been achieved with the writing of this document. The mitigation plan can be devised to:

- Establish a set of procedures to allow for instances when plans change, or for when new plans are devised that might impact the Bond Historic District.
- Itemize what kinds of activities can proceed in and around cultural resources without additional archaeological investigation or SHPD review (such as tree removal, or laying of chips for a pathway).
- Establish a set of procedures to apply monitoring during construction to assist in identifying the full extent of the water pipe system, and to identify portions of that system that could be preserved.

- Establish procedures for future investigations at places that are will not be impacted by development, but could contribute to the understanding of the place (such as the tunnel).
- Establish procedures for dealing with currently unknown resources that may be encountered in the future.
- Establish procedures of how to conduct data recovery at resources not currently to be impacted, but that may be impacted in the future.
- Itemize how foot traffic and motor vehicle traffic can and cannot proceed over and around cultural resources such as the quarry, old carriage road, tunnel, and 'auwai.
- Establish a long term treatment for the potential rehabilitation of the lowland *lo'i*.

The detailed mitigation plan would be carried out without having to repeatedly submit requests for concurrence by SHPD. This should in no way exclude SHPD from the process, and indeed the plan would detail how consultation would be perpetuated. The plan would establish lines of responsibility, communication, and commitment that can be monitored and altered if need be. A data recovery plan would still need to be created, approved by SHPD, and implemented to deal with impacts to resources that are directly associated with the project design as it is currently known.

The specifics of the data recovery effort should be detailed in a data recovery plan. It is recommended that the data recovery plan incorporate these research topics to guide that effort:

- Chronology of creation, use, and abandonment of the *lo'i* and 'auwai.
- Aspects of technological design, implementation, and maintenance of 'auwai during prehistory.
- Carrying capacity of the *lo'i* in relationship to local inhabitants' needs.
- Economic, social, and political aspects of the creation of produce surplus in a complex chiefdom.
- Aspects of technological modifications of 'auwai during historical times.
- Development of, and changes to, the water distribution system in the Kohala Girls' School.

In review, new elements have been identified for the NRHP Bond Historic District. Adverse effects that this development will have on previously identified, newly identified, and currently unknown resources can be mitigated with the procedures outlined in this report. Proposed procedures include data recovery, preservation, and monitoring.

ACKNOWLEDGEMENTS

The archaeological investigations at the New Moon Foundation benefited greatly from the input of a number of individuals. The breadth and depth of the knowledge and understanding of the place shared by these folks led me to the pleasant perspective that the goals of the project were being formulated by those familiar with the place, and that the archaeological work was an opportunity to test and expand on those insights. The project was truly a group effort that incorporated a diverse set of information.

Thanks to some of the people that were involved early on during this project, Denise Hill, David Rose, Bill Moore, and Joanne Galliot for getting the process rolling. I learned a great deal from the people that have spent time with the buildings and their revitalization, Todd, Brett, Kaleo, Ronny, Oly, and Kurt van der Heyden, as they freely shared their experiences and knowledge, and made a notable contribution to the success of the archaeological endeavor by discovering the brick "pipe". Suzan Keris rounded up old maps, and Elisa Juanqueira assisted in field work. Ron Terry, Lani Bowman, and Duane Cravalho also contributed to this task. I am thankful for the timely publication of Sophia Schweitzer and Michael Gomes' book *Kohala 'Aina*. And thanks to Betsy Garties and Susan Lofton for keeping the process rolling.

Special thanks to three people that have an intimate understanding of, and feeling for, the land of 'Iole. I feel especially lucky and privileged to have spent time on the property with Bennett Dorrance, Roy Oness, and Frank Perez. Their intimacy with the place and willingness to share their knowledge and ideas not only helped to guide the archaeological work, but was the central reason that this project was so enjoyable and productive.

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ENVIRONMENTAL ASSESSMENT

**NEW MOON FOUNDATION
CONTEMPLATIVE EDUCATION CENTER IN THE
BOND HISTORIC DISTRICT**

APPENDIX 5

BISHOP MUSEUM BIOLOGICAL SURVEY [PARTIAL]

**BIOLOGICAL SURVEY OF THE
BOND HISTORIC DISTRICT,
NORTH KOHALA, ISLAND OF HAWAI'I**

by

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and Keith T. Arakaki, B.S.**

FINAL REPORT

Submitted to

**New Moon Limited Liability Corporation,
Hawaii**

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**Hawaii Biological Survey, Department of Natural Sciences, Bishop Museum, 1525 Bernice Street, Honolulu,
Hawaii 96817-2704, USA**

4. METHODS

Surveys took place 31 August–1 September 1999 and were undertaken by trained and experienced professional biologists with expertise in the groups to be investigated, i.e., vertebrates (birds, reptiles, mammals), mollusks (slugs, snails), arthropods (insects and related organisms), and plants. The survey work broadly covered the entire 20 hectare [50 acre] area and included all major habitats, i.e., forest, macadamia nut orchards, roadside vegetation, areas in the vicinity of the Bond Homestead, Kalahikiola Church, and Kohala Girls School, Pali Akamoa gulch, and freshwater habitats (streams, ponds).

The following methods were used for each of the different kinds of plants and animals surveyed.

4.1. Vertebrates

Vertebrates were surveyed qualitatively by slowly walking through the entire BHD and noting all vertebrates seen or heard. Birds were identified with binoculars or by their calls. Amphibians and reptiles were also searched for by turning over logs and looking under exfoliating tree bark, etc. Information was also obtained from local residents. Species were ranked as uncommon or common based on these observations.

4.2. Snails

Quantitative sampling stations were located throughout the BHD so as to broadly and evenly cover the 20 hectare [50 acre] area (Fig. 1). A total of 13 stations was surveyed and constituted the main, quantitative survey. Incidental samples were taken at each of three additional stations.

Randomized quadrat sampling, that is, collecting all snails in a pre-determined, randomly identified fixed area, is inappropriate for this kind of inventory survey of snails, especially for small species such as many of those that constitute the Hawaiian fauna, because of their extremely localized micro-distribution patterns. Instead, timed sampling (collecting all snails found in a fixed time period at a number of places identified by an experienced individual as likely to harbor snails within a relatively broadly circumscribed area) has generally been found to be more appropriate (e.g., Cowie, Nishida *et al.*, 1995; Emberton *et al.*, 1996; Tattersfield, 1998) and was the approach adopted in this survey. At each sampling station an area approximately 30 m in diameter was searched by an experienced snail biologist for 15 minutes. All snails, including dead shells, and slugs were collected. All material was returned to the Bishop Museum (Honolulu) for sorting and identification by comparison with the Museum's extensive Hawaiian collections, including holotype and paratype material, and by reference to appropriate literature. Live specimens were preserved in 75 % ethanol. All material is deposited in the Hawaii Biological Survey collections (Malacology) at the Bishop Museum (accession number 1999.093) and data associated with the collections entered into the collection database. Field notes are archived at Bishop Museum.

4.3. Insects and other arthropods

A complete survey of the great diversity of arthropods potentially occurring in the BHD was beyond the scope of this study. However, various collecting methods were employed in order to

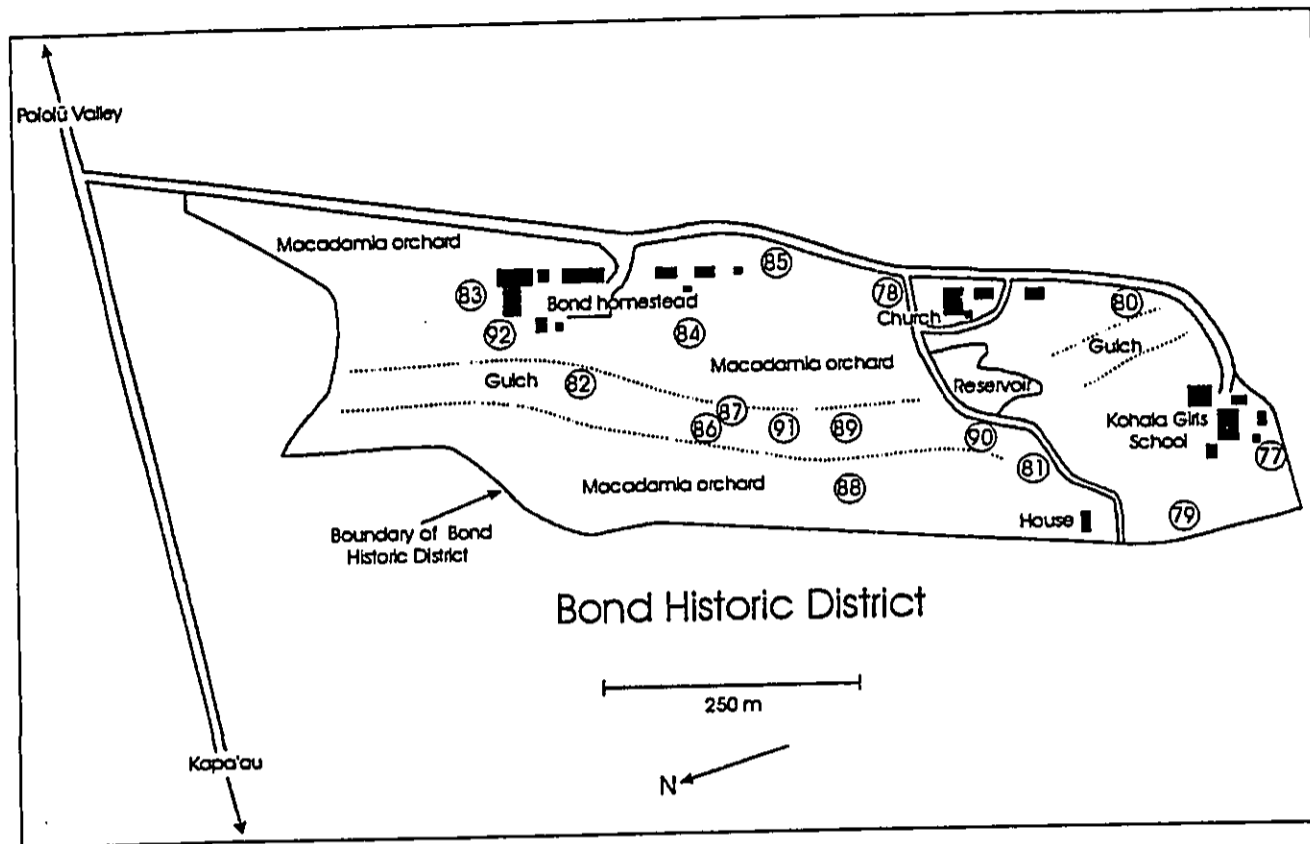


Fig. 1. Sketch map of the Bond Historic District showing locations of stations sampled for land snails. Station numbers are field numbers of R.H. Cowie (omitting the "99" prefix—see Appendix 2).

ensure as complete a survey as possible. The main collecting techniques were use of a sweep net, use of a beating sheet, visually searching vegetation, and searching among leaf litter and probing the remains of rotting wood. These techniques were used wherever the survey team was working or as the team walked between locations, but specifically at the following locations (all indicated on the map in Fig. 1): in and around the grounds of the Kohala Girls School, along the roadway adjacent to Kalahikiola Church, in vegetation along the track between the church and the reservoir and alongside the reservoir, between the reservoir and the house the other side of the gulch, in the gulch between the Girls School and the reservoir, around the lily pond below the Bond homestead, in vegetation around the homestead, in and along the perimeter of the macadamia orchard adjacent to the homestead parking lot, in the citrus grove north of the macadamia orchard above the gulch, in the gulch between the lower end of the macadamia orchard and the reservoir. In addition, two yellow pan traps were placed on the grounds of the Girls School, two on the stream bank in the gulch just below the school, and one at the perimeter of the macadamia orchard near the homestead complex. A pitfall trap was also set on the stream bank below the school. Each method and examples of types of arthropods collected by them are explained in Appendix 1.

All samples were sorted to species and most were determined as native or introduced (for some species this was not possible). Identification was by reference to available literature and

collections. Priority was given to identifying the arthropods for which the Bishop Museum had expertise and good comparative collections. Other arthropods were identified as far as possible. Many groups of arthropods are still not known well taxonomically or do not have keys for their identification. Wherever possible, identification was to species level. However, in many of these cases it was not possible to provide a species name, so identification was to morphospecies, indicated by "species 1", "species 2", etc. In other cases, specimens could not be assigned to a family, genus or species and the identification for those taxa is given as "Family: Genus species", "Genus species" or "species". Voucher specimens of all reported taxa are held in the Hawaii Biological Survey collections within the J. Linsley Gressitt Center for Entomological Research, Bishop Museum, Honolulu. Names of all taxa follow Nishida (1997). Additional information on the natural history of native Hawaiian arthropods, including illustrations of representative species can be found in the *Insects of Hawaii* volumes (University of Hawai'i Press), the *Fauna Hawaiiensis* series (1899-1913) and in Howarth & Mull (1992).

4.4. Plants

The botanical assessment was conducted using a walk-through method. All parts of the 20 hectare [50 acre] area were surveyed, including cultivated areas around the buildings, the macadamia nut orchards, and roadside weedy zones. Particular attention was paid to the gulch and stream habitat, which was deemed the most likely to contain remnants of native vegetation.

Collections of plant specimens were made selectively. Specimens that could not be identified with confidence in the field were collected for later laboratory identification. Some collections of special interest (e.g., those that may be new island or state weed records) will be placed on deposit in the Bishop Museum's Herbarium Pacificum.

Collected specimens were compared with those deposited in the Bishop Museum's Herbarium Pacificum to secure correct identification. In association with the *Manual of Flowering Plants of Hawai'i* (Wagner *et al.*, 1990, 1999b) and the pending publication of *Tropical Garden Flora* (Staples & Herbst, in preparation) (both Bishop Museum publications), practically the entire collection of Hawaiian plant specimens (ca. 120,000) has been critically examined and identified according to the latest taxonomic standards. Thus, the Bishop Museum's collections serve as an outstanding source of current names for plants collected in the Hawaiian Islands. Unfortunately, several of the specimens collected during the present survey were either sterile (without flowers or fruits) or produced flowers or fruit out of reach of collection, and the identity of these remains tentative until fertile material can be procured at a future time. In none of these cases, however, does the material in question represent an endangered taxon.

5. SURVEY LIMITATIONS

A number of factors limited the thoroughness of the assessments. Based on two days of field work, it was not possible to map in detail the precise distributions of all species collected or observed. Species that occur in highly localized patterns of distribution may not have been recorded if the survey sites did not correspond to those distributions. Many species of insects and

other arthropods, and conceivably snails, are seasonal in their life cycles, activity patterns and abundances. The survey took place in August/September; certain species (including those specific to seasonal hosts) may not have been encountered. Also, if certain arthropods, and possibly snails, were inactive because of weather or other environmental factors during the survey, they may not have been recorded. Also, many species are cryptic, live in hidden habitats, or are well camouflaged. Thus, the fact that a particular species was not found during this survey of the BHD does not necessarily mean that it is not present there. Limitations specific to the various kinds of plants and animals surveyed are detailed below.

5.1. Vertebrates

Many of the vertebrate species expected to occur in the Bond Historic District are nocturnal and are not easily detected during brief, observational surveys. These species are most effectively surveyed using live-capture traps, mist-nets and other trapping methods. In addition, many species of birds are migratory and occur in the Hawaiian Islands only during the winter so this brief survey in summer would have missed these species.

5.2. Snails

Land snail sampling techniques often include collection of litter and soil samples; these allow recording of some of the extremely small species that might be missed by simple hand picking in the field. However, sifting litter/soil samples is extremely labor-intensive and a decision was made to rely on careful hand picking in the field. It has been shown elsewhere in the tropics that this is the most time-efficient approach to land snail surveying and that most species will be detected, although the smallest species may be under-represented (Emberton *et al.*, 1996). With unlimited time and resources, analysis of soil and litter samples in addition to careful hand picking would have allowed more accurate estimation of the species' relative abundances.

5.3. Insects and other arthropods

Because of the great diversity of arthropods, a comprehensive faunal survey was not possible. Such a survey would have required the use of many different trapping and collecting methods throughout the survey area and this was beyond the scope of the project. For instance, because of weather conditions (too rainy) during the field work period, a Malaise trap was not set up. Under good conditions such a trap would yield a large number of specimens, including material belonging to species not collected by other techniques. Sticky traps (yellow cards covered with glue) suspended from branches to capture flying insects and Berlese funnels to sample the leaf litter and soil fauna were not used. Light trapping of nocturnal organisms (predominately moths) was not conducted.

Coverage of the various groups of insects and other arthropods collected was uneven. In some cases up to date keys are not available or knowledge of the particular taxa is poor; for others, adults of a particular sex are needed for positive identification, and the collected material included only the wrong sex or immature individuals. Identification of insects and other arthropods is heavily dependent on the background knowledge, experience, and skill of the scientist, and on the

resources available to the scientist, including in particular, adequately identified materials in a museum entomological collection with which the collected material may be compared. Therefore, selected groups, particularly those for which Bishop Museum has expertise and collection resources, were focused upon. In many cases identification to species level was nevertheless beyond the scope of the project and although separated to "morphospecies" many of these could not be identified.

Coverage of the various habitats was uneven. Accessible habitats most likely to harbor native species were selected for sampling based on past experience. For instance, the tree canopy and associated epiphytes could not be sampled within the scope of the project. In addition, many insects are seasonal and so extensive survey work throughout the year would be required to collect such species.

The current survey results must therefore be considered only a very general indicator of the insect and other arthropod fauna overall, and do not represent a complete listing of all arthropod species present in the BHD.

5.4. Plants

Because the entire Bond Historic District was not thoroughly and comprehensively covered, some plant taxa may have been overlooked. And because the emphasis was on determination of the presence or absence of endangered plant taxa, survey efforts were concentrated on sites where the vegetation appeared least modified by humans—the gulch bottom and slopes and the freshwater pond margins. As noted above (section 4.4.), some plants were difficult to identify because they were not flowering or fruiting at the time of the survey.

6. FAUNA AND FLORA RECORDED

6.1. Vertebrates

No amphibians, one species of reptile, 13 birds, and three species of mammals were recorded (Table 9). One of the birds, the 'io (Hawaiian hawk), is listed as endangered by the (USFWS). Only one other, the black-crowned night-heron was native; the rest were alien species. It is also likely that the the pueo (short-eared owl) occurs in the area although it was not observed during the survey; this species is currently listed by USFWS as a species of concern. It is also possible that the nene (Hawaiian goose) might occasionally visit the area. And it is highly probable that the Hawaiian hoary bat, which is listed as endangered by the USFWS, occurs in the area.

Brief notes are given below for each of the vertebrate species recorded in the Bond Historic District.

Table 9. Vertebrate species recorded in the Bond Historic District.

Scientific name	Common name(s)
MAMMALS	
<i>Herpestes aurouunctatus</i>	Indian mongoose
<i>Sus scrofa</i>	Pig
<i>Felis catus</i>	Domestic cat
BIRDS	
<i>Nycticorax nycticorax hoactii</i>	Black-crowned night-heron
<i>Lophura leucomelanos</i>	Kalij pheasant
<i>Buteo solitarius</i>	Hawaiian hawk, 'io
<i>Streptopella chinensis</i>	Spotted dove
<i>Geopelia striata</i>	Zebra dove
<i>Garrulax canorus</i>	Melodious laughing thrush, hwamei
<i>Acridotheres tristis</i>	Common myna
<i>Zosterops japonicus</i>	Japanese white-eye
<i>Carpodacus mexicanus</i>	House finch
<i>Passer domesticus</i>	House sparrow
<i>Lonchura punctulata</i>	Nutmeg mannikin
<i>Paroaria capitata</i>	Yellow-billed cardinal
<i>Cardinalis cardinalis</i>	Northern cardinal
REPTILES AND AMPHIBIANS	
<i>Hemidactylus frenatus</i>	House gecko

MAMMALS

Herpestes aurouunctatus Indian mongoose

The status of the mongoose in the BHD is unknown but on account of the large number of cats in the area it is probably uncommon. The presence of this species was confirmed by Jim and Joan Hutchinson.

Sus scrofa Pig

The status of pigs in the BHD is unknown. None was seen during the survey but several seemingly active wallows were present in the area. Pigs often migrate up and down mountains and may not have been present in the area when we conducted our survey.

Felis catus Domestic cat

Cats, many of them probably feral, were common, especially around buildings.

In addition to the three mammal species recorded a number of other species are probably present in the BHD. These include three species of rats, as well as the house mouse, all of which are common throughout the Hawaiian Islands and are very likely present. These rodents are nocturnal and trapping is generally required to reliably document their presence. They are: the roof rat (*Rattus rattus*), the Norway rat (*Rattus norvegicus*), the Polynesian rat (*Rattus exulans*), and the house mouse (*Mus domesticus*).

The Hawaiian hoary bat (*Lasiurus cinereus semotus*) may occur in the area. Tomich (1986)

mentioned that the species has been found in macadamia orchards, that it has apparently adapted to alien vegetation, and that it is apparently most common in west Hawaii Island. However, it generally occurs in low numbers and can be difficult to find. It was not observed during the survey but more intensive survey efforts would probably record it in the BHD. The subspecies found in the Hawaiian Islands, *Lasiurus cinereus semotus*, is endemic and is listed as endangered by the USFWS (USFWS list of 14 October 1998).

BIRDS

Nycticorax nycticorax hoactii Black-crowned Night-Heron

This species is indigenous to the Hawaiian Islands and widespread throughout much of the Pacific. It is uncommon in the BHD; a single individual was observed adjacent to the reservoir.

Lophura leucomelanos Kalij pheasant

This alien species is spreading throughout the Island of Hawai'i. It commonly occurs in secondary forest such as that in the gulch. It was not seen during the survey but is reported from the area by Jim and Joan Hutchinson. Its status as uncommon or common in the BHD is unknown.

Buteo solitarius Hawaiian hawk, 'io.

This native species is listed as endangered by the USFWS. Individuals range over wide areas. During the survey, a single bird was observed soaring over the Bond homestead. Jim and Joan Hutchinson mentioned that hawks sometimes perch in the trees in the macadamia orchards. This species is endemic to the Island of Hawai'i and may be increasing in numbers. It is uncommon in the BHD.

Streptopelia chinensis Spotted dove

The spotted dove is an alien introduction from South-east Asia and is now one of the most common species of birds occurring in the Hawaiian Islands. It was common in the BHD.

Geopelia striata Zebra dove

Originally from the Indo-Australian region, this species was introduced to O'ahu in 1922 and has subsequently spread throughout most of the Hawaiian Islands. It was common in the BHD.

Garrulax canorus Melodious laughing thrush, hwamei

Several flocks were heard and briefly seen in thick underbrush near the Bond homestead. A native of China, this species is easily identified by its loud, continuous calls in the early morning; it is generally silent during the rest of the day. It was common in the BHD, but inconspicuous.

Acridotheres tristis Common myna

This species is originally from southern Asia. It is gregarious and its loud, raucous calls can be heard for a considerable distance, particularly when the birds are settling down to roost in the evening. Large flocks were observed throughout the BHD.

Zosterops japonicus Japanese white-eye

This small insectivorous bird from Japan is common in the BHD where it occurs in all major habitat types.

Carpodacus mexicanus

House finch

This species, introduced to the Hawaiian Islands from North America, occurs in the more open areas of the BHD and is particularly common in open, grassy areas where it often feeds on the ground.

Passer domesticus

House sparrow

This species, originally from Europe, has similar habits to the House finch, but is more prone to occur on the ground. It was common in the BHD.

Lonchura punctulata

Nutmeg mannikin

Small flocks of this South-east Asian species were observed feeding on grass seeds in open areas throughout the BHD. It was common in the BHD.

Paroaria capitata

Yellow-billed cardinal

This finch species was not recorded during the survey, but Jim and Joan Hutchinson mentioned that it commonly comes to their bird feeder during the winter months. It generally prefers drier habitat and is common in the drier parts of the Kona Coast. Its status (common or rare) in the BHD is therefore unknown.

Cardinalis cardinalis

Northern cardinal

Cardinals were particularly conspicuous in the morning when males call from perches high up in trees. This species is a seed eater and was also commonly observed feeding on the ground. It was introduced to the Hawaiian Islands from eastern North America. It was common in the BHD.

REPTILES AND AMPHIBIANS

Hemidactylus frenatus

House gecko

This gecko is common throughout the Hawaiian Islands where it occurs in houses and in secondary forests. It was common in the BHD.

Three other species of geckos would be expected to occur in the area but were not recorded during the survey. They are: *Gehyra mutilata*, *Lepidodactylus lugubris*, and *Hemiphyllodactylus typus*. All are originally from South-east Asia.

6.2. Snails

A total of 143 snail and slug specimens was collected during the survey (two additional specimens were recorded but not collected). This material included 9 species (Table 10), all of which are alien introductions in the Hawaiian Islands. No *Partulina* tree snails were seen, nor were any amastrid snails (e.g., *Leptachatina* spp.). The number of specimens of each species, collected alive or as dead, empty shells, at each station are provided in Appendix 2.

Brief notes are provided regarding each of the species. Additional information and references to additional relevant literature can be found in Cowie (1997).

Table 10. Snail (and slug) species collected in the Bond Historic District.

For each species, all of which are alien in the Hawaiian Islands, the following is indicated: whether it was recorded alive or only as dead shells, and the number of stations it was recorded from. Nomenclature and taxonomic placement follow Cowie (1997).

Family and species	Live/dead	Number of stations
LAND SNAILS AND SLUGS		
VERONICELLIDAE		
<i>Vaginulus plebeius</i> Fischer, 1868	live	1
SUBULINIDAE		
<i>Allopeas clavulinum</i> (Potiez & Michaud, 1838)	live	13
<i>Paropeas achatinaceum</i> (Pfeiffer, 1846)	live	9
ACHATINIDAE		
<i>Achatina fulica</i> Bowdith, 1822	live	1
SPIRAXIDAE		
<i>Euglandina rosea</i> (Férussac, 1821)	dead only	6
HELICARIONIDAE		
<i>Liardetia doliolum</i> (Pfeiffer, 1846)	dead only	1
<i>Ovachlamys fulgens</i> (Gude, 1900)	live	4
FRESHWATER SNAILS		
VIVIPARIDAE		
<i>Cipangopaludina chinensis</i> (Griffith & Pidgeon, 1834)	live	1
PHYSIDAE		
Unidentified physid	live	1

FAMILY VERONICELLIDAE

Vaginulus plebeius Fischer, 1868

This neotropical alien slug is widely distributed on Pacific islands. It was first recorded in the Hawaiian Islands in 1978 and is now known from the islands of O'ahu and Hawai'i (Cowie, 1997). It is often reported in the literature (e.g., Cowie, 1997) as "*Vaginula plebeia*" but this appears to be incorrect (Cowie, 1998c). It was found at just a single station (99.80), so is not considered abundant in the study area. [For location of stations see Fig. 1, above.]

FAMILY SUBULINIDAE

Allopeas clavulinum (Potiez & Michaud, 1838)

A. clavulinum sensu stricto was first recorded in the Hawaiian Islands in 1906, from the Island of Hawai'i. However, Pilsbry (1906-1907) considered the subspecies *hawaiiense* Sykes "scarcely separable" from *clavulinum s.s.* Modern revision would probably synonymize them. The subspecies *hawaiiense* has been recorded from the islands of Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i, the first record being in 1900. The present material is simply considered as *A. clavulinum*, without regard for subspecies. *A. clavulinum* probably originates in tropical East Africa (Kerney *et al.*, 1979). This species was recorded in 13 out of the 14 terrestrial samples and was the most widespread and common snail species found.

Paropeas achatinaceum (Pfeiffer, 1846)

This is a widespread species, especially in the tropical Indo-Pacific. It probably originates from South-east Asia (Pilsbry, 1906–1907), where it is widely distributed (Naggs, 1994). It was first recorded from the Hawaiian Islands in 1904 (Cowie, 1997). It has now been recorded from the Islands of Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i, but is probably on all the main islands and perhaps some of the northwestern Hawaiian Islands. This species was recorded in nine of the 14 terrestrial samples and is the second most common snail in the survey area.

FAMILY ACHATINIDAE

Achatina fulica Bowdich, 1822

This species, the giant African snail, has been introduced widely in the humid tropics, frequently becoming an agricultural and garden pest and general nuisance. It was first reported in the Hawaiian Islands in 1936, subsequently spreading rapidly throughout the islands (Cowie, 1997, 1998a). Its pest and nuisance status has led to the introduction of predatory snails, both in the Hawaiian Islands and elsewhere, in attempts at biological control (see Spiraxidae, below). *A. fulica* is now declining in the Hawaiian Islands, a pattern also seen elsewhere following initial explosion (Civeyrel & Simberloff, 1996; Cowie, 1992; Howarth, 1985; Waterhouse & Norris, 1987). However, there is no convincing evidence that this decline is a result of predation by the introduced biocontrol species (Christensen, 1984), some of which have become serious predators of native species (e.g., Hadfield, 1986; Hadfield *et al.*, 1993). During the survey *A. fulica* was recorded at only a single incidental station in the gulch (99.91), so is not considered abundant in the BHD.

FAMILY SPIRAXIDAE

Euglandina rosea (Férussac, 1821)

This carnivorous snail (sometimes known as the "cannibal snail" or "rosy wolf snail") has been widely introduced, from its native Florida, throughout the tropics and subtropics, putatively for control of *Achatina fulica*. It was first introduced to the Hawaiian Islands in 1955. It is now recorded from all the main islands except Ni'ihau, Lāna'i, and Kaho'olawe. However, there is no good evidence that it has provided effective control of *A. fulica*, despite some claims to the contrary, but there is ample evidence of its devastating effects on native land snail faunas, especially in the Pacific (Civeyrel & Simberloff, 1996; Cowie, 1992, 1997; Hadfield, 1986; Hadfield *et al.*, 1993; Murray *et al.*, 1988). It will even go under water to attack freshwater snails (Kinzie, 1992). It has probably been a major contributor to the decline of native snail populations in the Hawaiian Islands (Hadfield, 1986; Hadfield *et al.*, 1993). Its continued presence poses an ongoing threat to the remaining native snail species, especially the slow-growing and slow-reproducing achatinellines. This species was recorded in six of the 14 terrestrial survey samples, though no live individuals were seen. It does, however, seem moderately common and may be surviving largely by feeding on the common subulinids (*Allopeas clavulinum*, *Paropeas achatinaceum*—see above).

FAMILY HELICARIONIDAE

Liardetia doliolum (Pfeiffer, 1846)

The first realization (Cowie, 1999) that this tiny (3 mm) arboreal land snail was present in the Hawaiian Islands resulted from its interception in 1997 by officials of the State of Arizona Department of Agriculture on a shipment of horticultural plants from a nursery near Hilo (Hawai'i Island). Subsequently it has also been intercepted by State of California Department of Food and Agriculture officials, on a shipment from the same nursery. Earlier unidentified interceptions (1989, 1994) on horticultural products from Hawai'i (island unknown) shipped to California have also now been identified as this species. It has also been recorded on O'ahu, on 'ōhi'a lehua (*Metrosideros polymorpha*) growing in a greenhouse, supplied by a nursery in Honolulu. Its natural distribution appears to be the western Pacific (Philippines, Marianas Islands, Caroline Islands) (Baker, 1938) but it may well be more widespread. The likelihood of its further spread is strong because of its apparent association with the horticultural trade. A single live individual was found at one sample station (99.77), so it is not considered common in the study area.

Ovachlamys fulgens (Gude, 1900)

This species was first recorded in the Hawaiian Islands in 1999 on the Islands of Hawai'i (Howarth *et al.*, 1999) and O'ahu (Cowie *et al.*, 1999). The identification remains tentative (D. Robinson, personal communication). Described from the Ryukyu Islands of Japan, *O. fulgens* has been transported around the world, frequently via the orchid trade, from Japan, through Thailand, and to Costa Rica, where it is now a horticultural pest (D. Robinson, personal communication). It is increasingly regularly intercepted entering the U.S., on a wide variety of plants (such as *Croton*, *Codiaeum*, *Dracaena*, etc.). It has recently been found in American Samoa (Cowie & Cook, in preparation). Whether it will increase in abundance is unknown, but it will likely expand its distribution, probably to include the other islands of the archipelago, especially if inadvertently assisted by human activities. Its impacts or likely impacts are unknown, but in American Samoa it appears to be becoming a major component of the arboreal snail fauna (Cowie & Cook, in preparation). This species was found in four of the 14 terrestrial samples, so although not common it is sporadically distributed in the study area.

FAMILY VIVIPARIDAE

Cipangopaludina chinensis (Griffith & Pidgeon, 1834)

This eastern Asian freshwater species (Cowie, 1997) is common in many freshwater systems in the Hawaiian Islands. It has been widely introduced around the world, probably both as a human food source (Cowie, 1998a) and via the aquarium trade. It was found in the lily pond behind the main house (99.83). It may also be in the reservoir in the center of the study area, although it was not found there.

FAMILY PHYSIDAE

Unidentified physid

Physid freshwater snails in the Hawaiian Islands are very poorly documented and their identifications are uncertain. There may be more than one species. All are introduced. Unidentified

physids have been recorded previously from the island of Hawai'i (Cowie, 1997). To identify the specimens collected would require extensive taxonomic research beyond the scope of this report. They were found at a single sampling station attached to rocks in the stream in the gulch (99.86). However, they are probably more widespread in freshwater habitats within the BHD.

6.3. Insects and other arthropods

No proposed or candidate species (Table 6) or species of concern (Table 7) have been identified in the collected material. Neither were any of the species listed in Table 5 as previously known from Kohala collected. However, absence of these species in the survey samples does not rule out the possibility that they may be present (see above, section 5.3.).

The collected material comprised 250 specimens representing 94 species (Table 11). Of these, 61 species were identified (most to named species, a few only to genus). Three of these 61 are endemic, one is possibly endemic, one is indigenous, and 56 are non-native (four of which were purposely introduced). The remaining 33 species were distinguished as morphospecies but could not be identified further within their family or order. Among the identified species the high proportion of non-natives (92 %) reflects the highly modified habitat of the BHD. Because of the large number of species collected, notes are provided (below) only for the five native (four endemic or possibly endemic, one indigenous) species.

ORDER ODONATA

FAMILY LIBELLULIDAE

Pantala flavescens (Fabricius, 1798)

This species is one of the most widespread and common species of dragonflies in the world, and has a circumtropical distribution. It is found on nearly every Pacific Island, including throughout Polynesia. The adaptability of this species is remarkable. It can exploit ephemeral rain puddles and habitats with poor water quality. It is the most widespread and abundant dragonfly species in the Hawaiian Islands (Williams, 1936), and adults are commonly observed even in urban situations and in the driest leeward areas of the islands. Females are frequently observed ovipositing in small rainwater puddles or any other available aquatic habitat. This species is abundant in both disturbed and pristine habitats. During the survey it was observed along the margin of the reservoir and around the lily pond below the homestead complex.

ORDER DIPTERA

Information regarding the following species of flies has been obtained from Hardy (1960) and Nishida (1997).

FAMILY CHIRONOMIDAE

Orthocladius species

This genus of midges is widespread. The nine Hawaiian species are all endemic to the Hawaiian

Table 11. Arthropod species observed or collected in the Bond Historic District.
 Status of each species appears in the first column: Adv.—Adventive (inadvertently introduced); End.—endemic (occurs only in the Hawaiian Islands); Ind.—Indigenous (occurs naturally in the Hawaiian Islands, but also elsewhere); Pur.—purposeful (deliberately introduced by humans); NSR—new state record (not previously known to occur in the Hawaiian Islands); NIR—new island record (not previously known to occur on the Island of Hawai'i); ?—unknown status. Common names are given if they are known.

PHYLUM ARTHROPODA		ARTHROPODS
CLASS ARACHNIDA		MITES, SPIDERS AND RELATIVES
ORDER ACARI		MITES
?	Family: Genus species 1	
?	Family: Genus species 2	
ORDER ARANEAE		SPIDERS
	Family Araneidae	
Adv.	<i>Argiope</i> species [observed only]	
?	Family: Genus species 1	
?	Family: Genus species 2	
?	Family: Genus species 3	
?	Family: Genus species 4	
CLASS INSECTA		INSECTS
ORDER COLLEMBOLA		SPRINGTAILS
?	Family: Genus species 1	
?	Family: Genus species 2	
?	Family: Genus species 3	
ORDER ODONATA		DRAGONFLIES, DAMSELFLIES
	Family Coenagrionidae	Narrow-winged damselflies
Adv. NIR	<i>Ischnura posita</i> (Hagen)	Forktailed damselfly
	Family Libellulidae	Common skimmers
Ind.	<i>Pantala flavescens</i> (Fabricius) [observed only]	Globe skimmer
Adv.	<i>Tramea lacerata</i> Hagen [observed only]	Raggecy skimmer
ORDER BLATTODEA		COCKROACHES
	Family Blattellidae	
Adv.	<i>Blattella lituricollis</i> (Walker)	False German cockroach
ORDER DERMAPTERA		EARWIGS
?	Family: Genus species 1	
?	Family: Genus species 2	
ORDER ORTHOPTERA		GRASSHOPPERS, KATYDIDS, CRICKETS
	Family Acrididae	Short-horned grasshoppers
Adv.	<i>Oxyva japonica</i> (Thunber)	Japanese grasshopper
	Family Pyrgomorphidae	
Adv.	<i>Atractomorpha sinensis</i> Bolivar	Pink-winged grasshopper
	Tettigoniidae	Long-horned grasshoppers
Adv.	<i>Conocephalus saltator</i> (Saussure)	
Adv.	<i>Elimaea punctifera</i> (Walker)	Narrow-winged katydid
Adv.	<i>Phaneroptera furcifera</i> Stal	Philippine katydid
ORDER PHASMATODEA		WALKING STICKS
Adv.	Family: Genus species	
?NSR		

continued...

Table 11. continued.

ORDER PSOCOPTERA		BARK LICE
?	Family: Genus species	
ORDER HETEROPTERA		TRUE BUGS
	Family Mesovelidae	Water treaders
Adv.	<i>Mesovelia mulsanti</i> White	
	Family Plataspidae	
Adv.	<i>Coptosoma xanthogramma</i> (White)	Black stink bug
	Family Reduviidae	Assassin bugs, kissing bugs
Adv.	<i>Zelus renardii</i> Kolenati	
ORDER HOMOPTERA		LEAFHOPPERS, PLANTHOPPERS
	Family Aphididae	Aphids, plant lice
?	Family: Genus species	
	Family Cicadellidae	Leafhoppers
?	Genus species	
	Family Delphacidae	Delphacid planthoppers
Adv.	<i>Megamelus davisii</i> Van Duzee	Waterlily delphacid
Adv.	<i>Perkinsiella saccharicidae</i> Kirkaldy	Sugarcane delphacid
	Family Flatidae	Flatid planthoppers
Adv.	<i>Melormenis basalis</i> (Walker)	West Indian flatid
ORDER NEUROPTERA		LACEWINGS, ANTLIONS
	Family Hemerobiidae	Brown lacewings
Pur.	<i>Micromus timidus</i> Hagen	Australian brown lacewing
ORDER COLEOPTERA		BETTERLES
	Family Anthribidae	Fungus weevils
Adv.	<i>Araecerus varians</i> Jordan	
Adv.	<i>Mauia satelles</i> (Boheman)	
	Family Cerambycidae	Longhorn beetles
Adv.	<i>Curtomerus flavus</i> (Fabricius)	
Adv.	<i>Sybra alternans</i> (Wiedemann)	
	Family Chrysomelidae	Leaf beetles
Adv.	<i>Chaetocnema confinis</i> Crotch	Sweetpotato flea beetle
	Family Coccinellidae	Ladybird beetles
Pur.	<i>Nephus bilucernarius</i> (Mulsant)	
?	<i>Stethorus</i> species	
Pur.	<i>Sticholotis ruficeps</i> Wicse	
	Family Cucujidae	Flat bark beetles
Adv.	<i>Cryptomorpha desjardinsi</i> (Geurin-Meneville)	
Adv.	<i>Psammoechus insularis</i> (Sharp)	
	Family Nitidulidae	Souring beetles
Adv.	<i>Conotelus mexicanus</i> Murray	
	Family Ptiliidae	
Adv.	<i>Acrotrichis</i> species	
ORDER LEPIDOPTERA		BUTTERFLIES, MOTHS
	Family Hesperidae	Skippers
Adv.	<i>Hylephila phyleus</i> (Drury)	Fiery skipper

continued...

Table 11. continued.

	Family Lycaenidae	Gossamer-winged butterflies
Adv.	<i>Lampides boeticus</i> (Linnaeus)	Bean butterfly
	Family Nymphalidae	Brush-footed butterflies
Adv.	<i>Agraulis vanillae</i> (Linnaeus) [observed only]	Passion vine butterfly
ORDER DIPTERA		
	Family Asteiidae	Asteiid flies
Adv.NSR	<i>Sigaloessa</i> species	
	Family Calliphoridae	Blow flies
Adv.	<i>Lucilia ?cuprina</i> (Wiedemann)	
	Family Chironomidae	Midges
Adv.	<i>Chironomus crassiforceps</i> (Keiffer)	
End.	<i>Orthocladus</i> species	
	Family Chloropidae	Chloropid flies
Adv.	<i>Chlorospina citrivora</i> Sabrosky	
	Culicidae	Mosquitoes
Adv.	<i>Aedes albopictus</i> (Skuse)	Asian tiger mosquito
	Dolichopodidae	Long-legged flies
Adv.	<i>Chrysotus longipalpus</i> Aldrich	
	Family Drosophilidae	Pomace flies
Adv.	<i>Drosophila kikkawai</i> Burla	
?	<i>Drosophila</i> species	
	Family Lauxaniidae	Lauxaniid flies
Adv.	<i>Homoneura hawaiiensis</i> (Grimshaw)	
Adv.	<i>Poecilominettia sexseriata</i> Hendel	
	Family Muscidae	Muscid flies
Adv.	<i>Atherigona ?orientalis</i> Schiner	
	Family Neriidae	
Adv.	<i>Telostylinus lineolatus</i> (Wiedemann)	
	Family Otitidae	Picture-winged flies
Adv.	<i>Euxesta annonae</i> (Fabricius)	
	Family Phoridae	Humpback flies
?End.NIR	<i>?Chonocephalus</i> species	
Adv.	<i>Diplonerva peregrina</i> (Wiedemann)	
Adv. NIR	<i>Megasella setaria</i> (Malloch)	
	Family Psychodidae	Moth flies
?	Genus species	
	Family Sciaridae	Dark winged fungus gnats
?	Genus species	
	Family Sphaeroceridae	Small dung flies
End.	<i>Pterogramma brevivenosum</i> (Tenorio)	
	Family Syrphidae	Flower flies, hoverflies
Adv.	<i>Syrpitta</i> species	
	Family Tipulidae	Craneflies
End.	<i>Limonia ?swezevi</i> (Alexander)	

continued...

Table 11. continued.

ORDER HYMENOPTERA		WASPS, BEES, ANTS
	Family Agaonidae	Fig wasps
?	Genus species 1	
?	Genus species 2	
	Family Anthophoridae	Carpenter bees
Adv.	<i>Xylocopa sonorina</i> Smith	Sonoran carpenter bee
	Family Braconidae	Braconids
?	?Subfamily Doryctiinae: Genus species	
Pur.	<i>Meteorus laphygmae</i> Viereck	
?	?Subfamily Microgastrinae: Genus species	
	Family Encyrtidae	
?	Genus species 1	
?	Genus species 2	
?	Genus species 3	
	Family Eurytomidae	Eurytomids
Adv.	<i>Sycophila</i> species	
	Family Formicidae	Ants
Adv.	<i>Anoplolepis longipes</i> (Jerdon)	Longlegged ant
Adv.	<i>Pheidole megacephala</i> (Fabricius)	Bigheaded ant
Adv.	<i>Solenopsis</i> species	
Adv.	<i>Tapinoma melanocephala</i> (Fabricius)	Tiny yellow house ant
Adv.	<i>Technomyrmex albipes</i> (Smith)	
	Family Ichneumonidae	Ichneumon wasps
?	Genus species	
	Megaspilidae	
?	? <i>Dendrocerus</i> species	
	Mymaridae	Fairyflies
?	Genus species	
	Sphecidae	Sphecid wasps
Adv.	<i>Pison thospes</i> Smith	
CLASS CRUSTACEA		CRUSTACEANS
SUBCLASS MALACOSTRACA		CRABS, SHRIMP AND RELATIVES
ORDER AMPHIPODA		SCUD, SANDHOPPERS
?	Family: Genus species	
ORDER ISOPODA		PILL BUGS, SLATERS
?	Family: Genus species	
CLASS CHILOPODA		CENTIPEDES
ORDER GEOPHILOMORPHA		
?	?Family Geophilidae: Genus species	
ORDER LITHOBIOMORPHA		
?	?Family Lithobiidae: Genus species	
ORDER SCOLOPENDROMORPHA		
	Family Scolopendridae	
Adv.	<i>Scolopendra subspinipes</i> Leach	
CLASS DIPELOPODA		MILLIPEDES
?ORDER		
?	Family: Genus species	

Islands. They occur in wet areas from sea level to high elevations. The larvae of at least one species feed on aquatic algae. Adults tend to swarm around damp places and are sometimes attracted to lights at night. Because of the complexity of this group the specimens collected could not be identified to species. Not much is known about the distribution and abundance of these species in the Hawaiian Islands and because of the uncertain identification of the present material it is not possible to speculate on its status as common or rare. It was collected along the track from Kalahikiola Church to the reservoir.

FAMILY PHORIDAE

?*Chonocephalus* species

This genus occurs throughout the Pacific and includes two Hawaiian species that are questionably endemic (they may occur elsewhere but this is not known with certainty). One of these species occurs on O'ahu, the other on O'ahu and Kaua'i. None has previously been reported from the Island of Hawai'i. Adults are scavengers, living in rotting plant and animal materials. They have been reported from leaf axils of pandanus and in rotting stumps of papaya. The Hawaiian species are abundant, and have been noted especially on rotting breadfruit and vegetable humus. During the survey, this tentatively identified species was recorded at the edge of the macadamia orchard near the Bond homestead and alongside the stream below the Girls School.

FAMILY SPHAEROCERIDAE

Pterogramma brevivenosum (Tenorio, 1968)

This identification is tentative. Additional taxonomic work beyond the scope of this report would be necessary to make a definitive identification. *P. brevivenosum* is endemic to the Hawaiian Islands and occurs on all the main islands. It is found in leaf litter in forests and has also been recorded on animal dung. It is considered fairly common. In the survey it was found alongside the stream below the Girls School.

FAMILY TIPULIDAE

Limonia ?swezeyi (Alexander, 1919)

This genus contains about 14 endemic species in the Hawaiian Islands and one or perhaps two adventive species. Many of the Hawaiian species are widely distributed across the island chain. *L. swezeyi* has been recorded from most of the islands. It is associated with dense vegetation in wet areas. The material collected exhibited some morphological variation and hence without additional taxonomic study beyond the scope of this report cannot be definitively identified. It is considered fairly common and was recorded at the edge of the macadamia orchard near the Bond homestead, alongside the stream below the Girls School, and in the gulch below the reservoir.

6.4. Plants

A total of 200 taxa (Table 12) were noted during the survey: six indigenous, 133 naturalized, six originally introduced by Polynesians, and 55 cultivated. Thus, only 3 % of all plant taxa seen were native (six of 200); even after excluding all purely cultivated taxa, only 4 % (six of 145) were

Table 12. Vascular plant species recorded in the Bond Historic District.

Plants are divided into four main groups: ferns, gymnosperms, dicots, and monocots. Within each group, taxa are arranged alphabetically by family, genus, and species. Each entry includes common name (Hawaiian or English, if available), biogeographic status (see key below), and presence or absence in the two vegetation communities (urban, gulch). Taxonomy, common names, and biogeographic status follow Wagner *et al.* (1999b) for native and naturalized dicots and monocots, Staples & Herbst (in press) for cultivated plants, and Palmer (in preparation) for ferns.

Biogeographic Status (modified from Wagner *et al.*, 1999b):

- ind. Indigenous: native, occurring naturally in the Hawaiian Islands but also elsewhere.
 ?ind. Questionably indigenous: probably indigenous, possibly naturalized.
 pol. Polynesian introduction: introduced originally by Polynesian settlers, either intentionally or unintentionally, and now naturalized.
 ?pol. Questionably a Polynesian introduction: possibly introduced by Polynesians, but possibly also since Western contact (1778).
 nat. Naturalized: introduced to the archipelago directly or indirectly by humans since Western contact and reproducing and spreading vegetatively or by seed.
 ?nat. Questionably naturalized: probably naturalized, possibly indigenous.
 cult. Cultivated.

Family and species	Status	Common name	Urban	Gulch
FERNS				
BLECHNACEAE				
<i>Blechnum occidentale</i> L.	nat.			x
DENNSTAEDTIACEAE				
<i>Microlepia strigosa</i> (Thunb.) C. Presl	ind.	palapalai		x
NEPHROLEPIDACEAE				
<i>Nephrolepis multiflora</i> (Roxb.) F. M. Jarrett ex C. V. Morton	nat.	Asian sword fern	x	x
POLYPODIACEAE				
<i>Lepisorus thunbergianus</i> (Kaulf.) Ching	ind.	pakahakaha		x
<i>Phlebodium aureum</i> (L.) J. Sm.	nat.	laua'e haole	x	x
<i>Phymatosorus grossus</i> (Langsd. & Fisch.) Brownlie	nat.	laua'e	x	
PTERIDACEAE				
<i>Adiantum capillus-veneris</i> L.	nat.	Venus'-hair fern	x	x
<i>Adiantum hispidulum</i> Sw.	nat.	rough maidenhair	x	x
<i>Pityrogramma austroamericana</i> Domin	nat.	gold fern		x
<i>Pityrogramma calomelanos</i> (L.) Link	nat.	silver fern		x
<i>Pteris vittata</i> L.	nat.	Chinese brake		x
THELYPTERIDACEAE				
<i>Christella dentata</i> (Forssk.) Brownsey & Jermy	nat.	downy wood fern		x
<i>Christella parasitica</i> (L.) Leveille	nat.			x
<i>Macrothelypteris torresiana</i> (Gaudich.) Ching	nat.	wood fern		x
GYMNOSPERMS				
ARAUCARIACEAE				
<i>Araucaria columnaris</i> (G. Forst.) J. D. Hook.	cult.	Cook pine	x	
CYCADACEAE				
<i>Cycas revoluta</i> Thunb.	cult.		x	
<i>Cycas</i> sp.	cult.		x	

continued...

Table 12. continued.

Family and species	Status	Common name	Urban	Gulch
PINACEAE				
<i>Pinus</i> sp.	cult.		x	
DICOTS				
ACANTHACEAE				
<i>Hemigraphis alternata</i> (Burm. f.) T. Anderson	nat.	metal-leaf		x
<i>Justicia betonica</i> L.	nat.	white shrimp plant	x	x
<i>Thunbergia fragrans</i> Roxb.	nat.	white thunbergia	x	x
AMARANTHACEAE				
<i>Alternanthera tenella</i> Colla	cult.	joyweed	x	
<i>Amaranthus spinosus</i> L.	nat.	spiny amaranth	x	
ANACARDIACEAE				
<i>Mangifera indica</i> L.	nat.	mango	x	x
<i>Schinus terebinthifolius</i> Raddi	nat.	Christmas berry	x	
ANNONACEAE				
<i>Artabotrys hexapetalus</i> (L. f.) Bhandari	cult.	climbing ylang-ylang	x	
APIACEAE				
<i>Centella asiatica</i> (L.) Urb.	nat.	Asiatic pennywort, gotukola	x	
<i>Cyclosporum leptophyllum</i> (Pers.) Sprague	?nat.	fir-leaved celery	x	
ARALIACEAE				
<i>Polyscias filicifolia</i> (E. Fourn.) L. H. Bailey	cult.	fern-leaf aralia	x	
<i>Schefflera actinophylla</i> (Endl.) Harms	nat.	octopus tree, umbrella tree	x	
ASTERACEAE				
<i>Ageratum conyzoides</i> L.	nat.	maile hohono	x	
<i>Bidens alba</i> (L.) DC. var. <i>radiata</i> (Sch. Bip.) Ballard ex Melchert	nat.	Spanish needle, beggartick	x	
<i>Bidens pilosa</i> L.	nat.	Spanish needle, beggartick	x	
<i>Chrysanthemum segetum</i> L.	cult.	corn chrysanthemum	x	
<i>Conyza bonariensis</i> (L.) Cronquist	nat.	hairy horseweed	x	
<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	nat.		x	x
<i>Cyanthillium cinereum</i> (L.) H. Rob.	nat.	little ironweed	x	
<i>Galinsoga parviflora</i> Cav.	nat.		x	
<i>Montanoa hibiscifolia</i> Benth.	nat.	tree daisy	x	x
<i>Pluchea carolinensis</i> (Jacq.) G. Don	nat.	sourbush		x
<i>Senecio madagascariensis</i> Poir.	nat.		x	
<i>Sigesbeckia orientalis</i> L.	nat.	small yellow crown- beard		x
<i>Sonchus oleraceus</i> L.	nat.	sow thistle	x	
<i>Sphagneticola trilobata</i> (L.) Pruski	nat.	wedelia	x	
<i>Synedrella nodiflora</i> (L.) Gaertn.	nat.	nodeweed	x	
<i>Tithonia diversifolia</i> (Hemsl.) A. Gray	nat.	tree marigold	x	
<i>Youngia japonica</i> (L.) DC.	nat.	Oriental hawksbeard	x	
BALSAMINACEAE				
<i>Impatiens wallerana</i> Hook. f.	nat.	busy lizzy	x	

continued...

Table 12. continued.

Family and species	Status	Common name	Urban	Gulch
BIGNONIACEAE				
<i>Macfadyena unguis-cati</i> (L.) A. H. Gentry	nat.	cat's-claw climber	x	x
<i>Spathodea campanulata</i> P. Beauv.	nat.	African tulip tree	x	x
BRASSICACEAE				
<i>Cardamine flexuosa</i> With.	nat.	bittercress	x	
CAMPANULACEAE				
<i>Hippobroma longiflora</i> (L.) G. Don	nat.	star-of-Bethlehem	x	
CACTACEAE				
<i>Hylocereus undatus</i> (Haw.) Britton & Rose	cult.	night-blooming cereus	x	
CARICACEAE				
<i>Carica papaya</i> L.	nat.	papaya	x	
CARYOPHYLLACEAE				
<i>Drymaria cordata</i> (L.) Willd. ex Roem. & Schult. var. <i>pacifica</i> M. Mizush.	nat.	pipili	x	x
CASUARINACEAE				
<i>Casuarina equisetifolia</i> L.	nat.	common ironwood	x	x
CHENOPODIACEAE				
<i>Chenopodium</i> sp.	nat.		x	
COMBRETACEAE				
<i>Terminalia catappa</i> L.	nat.	tropical almond, false kamani	x	x
CONVOLVULACEAE				
<i>Ipomoea alba</i> L.	nat.	moon flower		x
<i>Ipomoea indica</i> (Burm.) Merr.	ind.	koali 'awa	x	x
<i>Ipomoea ochracea</i> (Lindl.) G. Don	nat.		x	x
<i>Merremia tuberosa</i> (L.) Rendle	nat.	wood rose	x	x
<i>Poranopsis paniculata</i> (Roxb.) Roberty	nat.	snow creeper	x	
CRASSULACEAE				
<i>Kalanchoe pinnata</i> (Lam.) Pers.	nat.	air plant	x	
CUCURBITACEAE				
<i>Momordica charantia</i> L.	nat.	balsam pear	x	
EUPHORBIACEAE				
<i>Acalypha wilkesiana</i> Müll-Arg.	cult.	beefsteak plant	x	
<i>Aleurites moluccana</i> (L.) Willd.	pol.	kukui	x	
<i>Breynia disticha</i> J. R. Forst. & G. Forst.	cult.	snowbush	x	
<i>Chamaesyce hirta</i> (L.) Millsp.	nat.	hairy spurge	x	
<i>Chamaesyce hypericifolia</i> (L.) Millsp.	nat.	graceful spurge	x	
<i>Chamaesyce hyssopifolia</i> (L.) Small	nat.		x	
<i>Codiaeum variegatum</i> (L.) Blume	cult.	croton	x	
<i>Phyllanthus debilis</i> Klein ex Willd.	nat.	niruri	x	
<i>Ricinus communis</i> L.	nat.	castor bean	x	
FABACEAE				
<i>Canavalia cathartica</i> Thouars	nat.	maunaloa	x	x
<i>Chamaecrista nictitans</i> (L.) Moench var. <i>glabrata</i> (Vogel) H. S. Irwin & Barneby	nat.	partridge pea	x	
<i>Crotalaria micans</i> Link	nat.	rattlepod	x	
<i>Desmodium incanum</i> DC.	nat.	Spanish clover	x	

continued...

Table 12. continued.

Family and species	Status	Common name	Urban	Gulch
<i>Desmodium tortuosum</i> (Sw.) DC	nat.	Florida beggarweed	x	
<i>Desmodium triflorum</i> (L.) DC	nat.		x	
<i>Indigofera suffruticosa</i> Mill.	nat.	indigo	x	
<i>Leucaena leucocephala</i> (Lam.) de Wit	nat.	koa haole, ekoa	x	x
<i>Lonchocarpus</i> sp. (?)	cult.		x	
<i>Mimosa pudica</i> L. var. <i>unijuga</i> (Duchass. & Walp.) Griseb.	nat.	sensitive plant	x	
<i>Pithecellobium dulce</i> (Roxb.) Benth.	nat.	'opiuma	x	
<i>Samanea saman</i> (Jacq.) Merr.	nat.	monkeypod	x	x
<i>Senna siamea</i> (Lam.) H. S. Irwin & Barneby	nat.	kassod tree		x
<i>Tamarindus indicus</i> L.	cult.	tamarind	x	
<i>Trifolium repens</i> L. var. <i>repens</i>	nat.	white clover	x	
FLACOURTIACEAE				
<i>Dovyalis hebecarpa</i> (Gardner) Warb.	nat.	Ceylon gooseberry	x	
LAMIACEAE				
<i>Hyptis pectinata</i> (L.) Poit.	nat.	comb hyptis	x	
LAURACEAE				
<i>Cinnamomum verum</i> J. Presl	nat.	cinnamon tree	x	x
<i>Persea americana</i> Mill.	nat.	avocado	x	x
LYTHRACEAE				
<i>Lagerstroemia speciosa</i> (L.) Pers.	cult.	queen's crepe myrtle	x	
MAGNOLIACEAE				
<i>Michelia</i> sp. (?)	cult.		x	
MALVACEAE				
<i>Abutilon grandifolium</i> (Willd.) Sweet	nat.	hairy abutilon	x	
<i>Hibiscus rosa-sinensis</i> L.	cult.	red hibiscus	x	
<i>Malvaviscus arboreus</i> Cav. var. <i>arboreus</i>	nat.	sobon	x	
<i>Sida acuta</i> N. L. Burm. ssp. <i>carpinifolia</i> (L. f.) Borss. Waalkes	?nat.		x	x
MELIACEAE				
<i>Melia azedarach</i> L.	nat.	Chinaberry		x
MORACEAE				
<i>Artocarpus altilis</i> (Parkins. ex Z) Fosb.	cult.	breadfruit		x
<i>Ficus carica</i> L.	cult.	common fig	x	
<i>Ficus microcarpa</i> L. f.	nat.	Chinese banyan	x	x
<i>Ficus pumila</i> L.	nat.	creeping fig	x	
MYRTACEAE				
<i>Eucalyptus citriodora</i> Hook.	nat.	lemon-scented gum	x	x
<i>Eugenia uniflora</i> L.	nat.	Surinam cherry	x	
<i>Psidium cattleianum</i> Sabine	nat.	strawberry guava		x
<i>Psidium cattleianum</i> Sabine f. <i>lucidum</i> Degener	nat.	yellow strawberry guava	x	
<i>Psidium guajava</i> L.	nat.	common guava	x	x
<i>Syzygium cumini</i> (L.) Skeels	nat.	Java plum	x	x
<i>Syzygium jambos</i> (L.) Alston	nat.	rose apple	x	x
NYMPHAEACEAE				
<i>Nymphaea</i> sp.	cult.	waterlily	x	

continued...

Table 12. continued.

Family and species	Status	Common name	Urban	Gulch
OLEACEAE				
<i>Olea europaea</i> L. ssp. <i>europaea</i>	nat.	olive	x	
OXALIDACEAE				
<i>Oxalis corniculata</i> L.	?pol.	yellow wood sorrel	x	
<i>Oxalis corymbosa</i> DC.	nat.	pink wood sorrel		x
PASSIFLORACEAE				
<i>Passiflora edulis</i> Sims	nat.	passion fruit		x
<i>Passiflora laurifolia</i> L.	nat.	yellow granadilla		x
<i>Passiflora pulchella</i> Kunth	nat.	two-lobed passion flower		x
PHYTOLACCACEAE				
<i>Rivina humilis</i> L.	nat.	coral berry	x	x
PIPERACEAE				
<i>Piper methysticum</i> G. Forst.	cult.	'awa	x	
PLANTAGINACEAE				
<i>Plantago major</i> L.	nat.	common plantain	x	
PLUMBAGINACEAE				
<i>Plumbago auriculata</i> Lam.	cult.	plumbago	x	
POLYGONACEAE				
<i>Antigonon leptopus</i> Hook. & Arn.	nat.	Mexican creeper	x	
<i>Homalocladium platycladum</i> (F. Muell.) L. H. Bailey	cult.	ribbon plant	x	
PROTEACEAE				
<i>Grevillea robusta</i> A. Cunn. ex R. Br.	nat.	silk oak, silver oak	x	x
<i>Macadamia integrifolia</i> Maiden & Betche	cult.	macadamia	x	x
ROSACEAE				
<i>Rosa</i> sp.	cult.	rose	x	
<i>Rubus rosifolius</i> Sm.	nat.	thimbleberry	x	x
RUBIACEAE				
<i>Coffea arabica</i> L.	nat.	Arabian coffee	x	x
<i>Gardenia</i> sp.	cult.	gardenia	x	
<i>Spermacoce assurgens</i> Ruiz & Pav.	nat.	buttonweed	x	
RUTACEAE				
<i>Citrus limon</i> (L.) N. L. Burm.	cult.	lemon	x	
<i>Citrus sinensis</i> (L.) Osbeck	cult.	orange	x	
<i>Citrus x tangelo</i> J. Ingram & H. E. Moore	cult.	tangelo	x	
SAPINDACEAE				
<i>Dimocarpus longan</i> Lour.	cult.	longan	x	
SAPOTACEAE				
<i>Chrysophyllum oliviforme</i> L.	nat.	satin leaf		x
SOLANACEAE				
<i>Solanandra maxima</i> (Sessé & Moçiffo) P. S. Green (?)	cult.	chalice vine	x	
<i>Solanum americanum</i> Mill.	?ind.	glossy nightshade	x	
URTICACEAE				
<i>Pilea microphylla</i> (L.) Liebm.	nat.	artillery plant	x	
VERBENACEAE				
<i>Holmskioldia sanguinea</i> Retz.	cult.	cup-and-saucer plant	x	

continued...

Table 12. continued.

Family and species	Status	Common name	Urban	Gulch
<i>Lantana camara</i> L.	nat.	lantana	x	
<i>Stachytarpheta dichotoma</i> (Ruiz & Pav.) Vahl	nat.	owi, oi	x	
<i>Stachytarpheta urticifolia</i> (Salisb.) Sims	nat.		x	x
MONOCOTS				
AGAVACEAE				
<i>Cordylle fruticosa</i> (L.) A. Chev.	pol.	ti	x	x
<i>Dracaena fragrans</i> (L.) Ker Gawl.	cult.	corn plant	x	
<i>Dracaena marginata</i> Lam.	cult.	money plant	x	
<i>Sansevieria trifasciata</i> Prain	cult.	mother-in-law's tongue	x	
ARACEAE				
<i>Alocasia cucullata</i> (Lour.) G. Don	cult.	Chinese taro	x	
<i>Dieffenbachia seguine</i> (Jacq.) Schott	cult.	dumb cane	x	
<i>Epipremnum pinnatum</i> (L.) Engl.	nat.	taro vine, pothos	x	
<i>Monstera deliciosa</i> Liebm.	cult.	monstera	x	
<i>Philodendron</i> sp.	cult.		x	
<i>Philodendron</i> sp.	cult.		x	
<i>Pistia stratiotes</i> L.	nat.	water lettuce	x	
<i>Xanthosoma</i> sp.	nat.		x	x
ARECACEAE				
<i>Attalea cohune</i> Martius (?)	cult.	cohune palm	x	
<i>Cocos nucifera</i> L.	pol.	coconut	x	
<i>Dyopsis lutescens</i> (H. Wendl.) Beentje & J. Dransf.	cult.	areca palm	x	
<i>Hyophorbe lagenicaulis</i> (L. H. Bailey) H. E. Moore	cult.	bottle palm	x	
<i>Livistona chinensis</i> (Jacq.) R. Br. ex Mart.	nat.	Chinese fan palm	x	x
<i>Phoenix roebelenii</i> O'Brien	cult.	dwarf date palm	x	
<i>Ptychosperma elegans</i> (R. Br.) Blume	cult.	solitaire palm	x	
<i>Rhapis excelsa</i> (Thunb.) Rehder	cult.	rhaps palm		x
<i>Roystonea regia</i> (HBK) O. F. Cook	cult.	royal palm	x	x
CANNACEAE				
<i>Canna indica</i> L.	nat.	Indian shot	x	x
COMMELINACEAE				
<i>Commelina diffusa</i> Burm. f.	nat.	honohono	x	x
<i>Dichorisandra thyrsiflora</i> Mikan	cult.	blue ginger	x	
<i>Tradescantia spathacea</i> Sw.	cult.	oyster plant	x	
COSTACEAE				
<i>Costus speciosus</i> (J. König) Sm.	cult.	spiral flag	x	
CYPERACEAE				
<i>Cyperus involucratus</i> Roxb.	nat.	umbrella sedge	x	
<i>Kyllinga brevifolia</i> Rottb.	nat.	kili'o'opu	x	
<i>Kyllinga nemoralis</i> (J. R. Forst. & G. Forst.) Dandy ex Hutch. & Dalziel	nat.	kili'o'opu	x	
<i>Pycneus polystachyos</i> (Rottb.) P. Beauv. ssp. <i>holosericeus</i> (Link) T. Koyama	ind.		x	
HELICONIACEAE				
<i>Heliconia bihai</i> (L.) L.	cult.	lobster-claw heliconia	x	

continued...

Table 12. continued.

Family and species	Status	Common name	Urban	Gulch
HYDROCHARITACEAE				
<i>Egeria densa</i> Planch.	nat.		x	
LILIACEAE				
<i>Crinum</i> sp.	cult.	spider lily	x	
<i>Hippeastrum striatum</i> (Lam.) H. E. Moore	cult.	Barbados lily	x	
<i>Ophiopogon japonicus</i> (L. f.) Ker Gawl.	cult.	mondo grass	x	
MUSACEAE				
<i>Musa xparadisica</i> L.	pol.	banana	x	x
POACEAE				
<i>Brachiaria mutica</i> (Forssk.) Stapf	nat.	California grass		x
<i>Coix lachryma-jobi</i> L.	nat.	Job's tears	x	
<i>Cynodon dactylon</i> (L.) Pers.	nat.	Bermuda grass	x	
<i>Digitaria ciliaris</i> (Retz.) Koeler	nat.	Henry's crabgrass	x	
<i>Digitaria setigera</i> Roth	?ind.	itchy crabgrass	x	
<i>Echinochloa colona</i> (L.) Link	nat.	Jungle rice	x	
<i>Eleusine indica</i> (L.) Gaertn.	nat.	Wiregrass	x	x
<i>Oplismenus hirtellus</i> (L.) P. Beauv.	nat.	Basket grass		x
<i>Panicum maximum</i> Jacq.	nat.	Guinea grass	x	x
<i>Paspalum conjugatum</i> Bergius	nat.	Hilo grass	x	x
<i>Phyllostachys nigra</i> (Lodd.) Munro	nat.	black bamboo	x	
<i>Sacciolepis indica</i> (L.) Chase	nat.	Glenwood grass	x	
<i>Schizostachyum glaucifolium</i> (Rupr.) Munro	?pol.	'ohe, Hawaiian bamboo	x	
<i>Setaria palmifolia</i> (J. König) Stapf	nat.	palmgrass	x	x
<i>Setaria parviflora</i> (Poir.) Kerguelen	nat.	yellow foxtail	x	
<i>Sporobolus africanus</i> (Poir.) Robyns & Tournay	nat.	smutgrass	x	
PONTEDERIACEAE				
<i>Eichhornia crassipes</i> (Mart.) Solms	nat.	water hyacinth	x	
STRELITZIACEAE				
<i>Ravenala madagascariensis</i> Sonnerat	cult.	traveler's palm	x	
ZINGIBERACEAE				
<i>Alpinia purpurata</i> (Vieill.) K. Schum.	nat.	red ginger	x	
<i>Alpinia zerumbet</i> (Pers.) Burt & R. M. Sm.	nat.	shell ginger	x	
<i>Hedychium</i> sp.	nat.			x

native. (For definitions of biogeographical terms see Table 12.) Not only were there very few native species, but these species were also uncommon.

For the purposes of this survey, plants noted were allocated to one of two vegetation communities, "urban" and "gulch", characterized below.

Urban. This vegetation community includes all areas of the BHD except the gulch and reservoir habitats. Included here are all cultivated areas surrounding existing buildings, lawns, roadside vegetation, macadamia orchards, and overgrown areas bordering cultivated sites but not in the gulch or waterway habitat. There are many large, old trees on the property, including rows of stately royal palms (*Roystonea regia*), monkeypod (*Samanea saman*), tamarind (*Tamarindus*

indicus), breadfruit (*Artocarpus altilis*), crepe myrtle (*Lagerstroemia* sp.), Cook pine (*Araucaria columnaris*), and Chinese banyan (*Ficus microcarpa*). Macadamia nut orchards (*Macadamia integrifolia*) occupy some of the property. Other common cultivated plants include croton (*Codiaeum variegatum*), a variety of *Citrus* species, shell ginger (*Alpinia mutans*), taro vine (*Epipremnum pinnatum*), and busy lizzy (*Impatiens wallerana*). Common weedy species along roadsides and bordering cultivated areas include white thunbergia (*Thunbergia fragrans*), maile hohono (*Ageratum conyzoides*), hairy horseweed (*Conyza bonariensis*), nodeweed (*Synedrella nodiflora*), wood rose (*Merremia tuberosa*), and maunaloa (*Canavalia cathartica*). Of interest, the large tree in the front yard to the east of the main Bond house appears to be longan or dragon-eye (*Dimocarpus longan*), not water apple (*Syzygium aqueum*) as indicated by Wadden (1991). Fertile material was unavailable at the time of the survey, but foliage characters matched longan specimens at the Bishop Museum. Also of note is a clump of Hawaiian bamboo or 'ohe (*Schizostachyum glaucifolium*), a thin-walled, clumping, Polynesian-introduced bamboo, located west of the main Bond house and south of the macadamia orchard. *Senecio madagascariensis*, only uncommonly seen during the survey, has spread rapidly in recent years in pasturelands of South Kohala and Waimea and is considered a noxious weed species by the State Department of Agriculture.

Gulch. This community includes the gulch bottom and slopes, as well as the reservoir margin behind Kalahikiola Church. A small stream runs through the gulch, which in the survey area starts just before the Kohala Girls School and continues diagonally across the property, passing behind the church and continuing downslope along the western margin of the study site. The gulch is not very deep and is dominated by a tall overstory of various trees that create an interlocking canopy allowing little sunlight to reach the ground. The dominant overstory trees include monkeypod (*Samanea saman*), false kamani (*Terminalis catappa*), Chinese banyan (*Ficus microcarpa*), Java plum (*Syzygium cumini*), rose apple (*S. jambos*), an unidentified tree (possibly a member of the ginseng family, Araliaceae), and cinnamon tree (*Cinnamomum verum*). Chinese fan palm (*Livistona chinensis*) was common in the midlayer, and there were large patches of white shrimp plant (*Justicia betonica*) and rhaps palm (*Rhapis excelsa*) in one part of the gulch. The ground layer was sparse, with a variety of germinating tree seedlings and occasional ferns. Cat's-claw climber (*Macfadyena unguis-cati*) was common in some areas, spreading across the ground and twining up trees and shrubs. The reservoir margin was dominated by California grass (*Brachiaria mutica*), mixed with a variety of weedy herbaceous species and backed by weedy shrubs and trees.

The six native (or possibly native) taxa, all commonly occurring in the Hawaiian Islands, are briefly characterized below. The Hawaiian names of these plants (if known) are given in parentheses following the scientific names.

***Microlepia strigosa* (Thunb.) C. Presl. (*palapalai*)**

This species has large, many-divided fronds favored by *hula halau* for adornment of dancers. It is native from Japan to India and Polynesia, including the Hawaiian Islands (Staples & Herbst, in press). It is common in open, wooded areas throughout the Hawaiian Islands. Two separate clumps were noted growing streamside in the gulch bottom.

Lepisorus thunbergianus (Kaulf.) Ching (*pakahakaha*)

This species ranges from at least Southeast Asia and Japan to the Hawaiian Islands (Hovenkamp, 1998). Its long, narrow fronds are commonly seen growing epiphytically on trees and rocks throughout the Hawaiian Islands. During the survey a clump was seen growing epiphytically on a fallen tree branch in the gulch bottom.

Ipomoea indica (Burm.) Merr. (*koali 'awa, koali 'awahia, or koali pehu*)

This pantropical, blue- or purple-flowered morning-glory vine is common in the Hawaiian Islands in dry lowland, often disturbed sites. The roots and leaves were used medicinally by native Hawaiians to treat wounds, sores, and broken bones, and the seeds were used as a cathartic (Wagner *et al.*, 1999b). During the survey it was occasionally seen twining in open vegetation bordering the macadamia orchard.

Solanum americanum Mill. (*popolo*)

Glossy nightshade is widely distributed in tropical and warm temperate areas and is often found in human-disturbed sites. A small shrub with small, glossy black berries, it can often be found locally in disturbed, open sites in the Hawaiian Islands from sea level to subalpine woodlands. It is considered possibly indigenous to the Hawaiian Islands because seeds of this species were discovered at the Mauna Kea adze quarry complex, which was abandoned prior to Captain Cook's arrival in Hawai'i. The plant was used locally for sore throats and ailments of the digestive tract (Wagner *et al.*, 1999b). It was not common in the BHD, where it was found along the border of the macadamia orchard, growing with other weedy species.

Pycreus polystachyos (Rottb.) P. Beauv. ssp. *holosericeus* (Link) T. Koyama

Native to tropical and subtropical regions worldwide, this small sedge is common throughout the Hawaiian Islands, often seen in open grassy, disturbed areas from coastal sites up to the wet forest zone (Wagner *et al.*, 1999b). In the BHD it was found in lawns but was uncommon.

Digitaria setigera Roth (*kukaepua 'a*)

This species, itchy crabgrass, is an annual grass either indigenous to the Hawaiian Islands or introduced very early on. It has been collected on all the main islands except for Kaho'olawe, preferring disturbed sites such as fields, pastures, and roadsides (Wagner *et al.*, 1999b). During the present survey of the BHD it was found occasionally in lawns.

7. CONCLUSION

The present fauna and flora of the Bond Historic District is almost entirely dominated by alien species. Among the vertebrates recorded, only two species (Hawaiian hawk, black-crowned night heron) are native. The hawk is endemic to the Hawaiian Islands and is listed as endangered by the USFWS, but the heron is widespread throughout much of the Pacific. All the snails and slugs recorded are alien; no natives were seen. Most of the insects (over 90 % of the species) recorded and identified are also alien, although a few native species were recorded. There were no native plant communities and very poor representation of native plant elements (four indigenous species, another two possibly indigenous). That the site has been much-modified by human activities in the

past is reflected in this dominance by alien plants.

Overall, the Bond Historic District is a highly human-modified environment in which almost no native plants or animals now occur. Apart from the Hawaiian hawk, no federally listed endangered or threatened species, proposed or candidate endangered or threatened species, or species of concern were recorded during the survey. The few other native species recorded are not considered rare or threatened. From a conservation perspective, the area is of virtually no concern and therefore no conservation action is recommended.

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9. GLOSSARY

Adventive: relating to organisms introduced to an area by means other than purposeful.

Alien: (see also **Adventive, Introduced, Nonindigenous, or Non-native**) relating to a species that is not native, i.e., one introduced accidentally or purposefully by humans. In Hawai'i, these include Polynesian introductions (such as kukui, coconut, pig, rat, and jungle fowl) and many post-contact (1778) introductions (such as guava, Christmas berry, mosquitoes, pigs, goats, cattle, deer, and sheep). See **Endemic, Indigenous, Native**.

Arthropod: insects and related invertebrate animals that have an external hard skeleton and jointed legs.

Canopy: the highest vegetation cover of a community. In a forest, the canopy is made up of the tallest and most numerous trees. In a shrubland, the canopy is the tallest shrub layer. Closed canopies are those where the foliage interlocks to form a continuous layer over the underlying vegetation or ground. Open canopies are those where there are gaps in the foliage, and more light may reach the lower vegetation layers or ground.

Ecosystem: a discrete assemblage of animals and plants and its interaction with the environment.

Endangered: a species officially recognized by federal or state officials to be in immediate danger of extinction.

Endemic: naturally restricted to a locality. Most native Hawaiian plants and animals are endemic (restricted) to the Hawaiian Islands. Many are restricted to a single island, mountain range, or even gulch. See **Alien, Native, Indigenous**.

Endemism: the extent to which the species of a region are unique to that region. See **Endemic**.

Fauna: the animals of a specified region.

Feral: formerly domesticated animals reverted to wild state or living in wild habitat.

Flora: the plants of a specified region.

Holotype: the single specimen (only if so designated) on which a species was originally described. The remainder of the series of specimens used by the original author in describing the

species are termed **paratypes**. If no single specimen is designated as such, the original series of specimens upon which the species was described are termed **syntypes**. The term **type** or **type material** is an informal general term relating to all the above.

Immature: the stage of an animal that is not an adult.

Indigenous: naturally occurring in a given area as well as elsewhere. Indigenous Hawaiian taxa also occur naturally outside of the Hawaiian Islands (e.g., the long-legged fly genus *Campsicnemus* is indigenous to Hawai'i, but is also found naturally in French Polynesia and continental land masses above the equator). See **Alien**, **Endemic**, **Native**.

Introduced: See **Alien**.

Invertebrate: animals without backbones, including such groups as insects, spiders, shrimps, and snails. Some Hawaiian invertebrates are rare and endangered.

Larva/larval: an immature stage of an insect.

Litter: usually, plant and other mixed organic debris found on the surface of a substrate such as rock or soil; often harboring small organisms.

Lowland: one of five elevation zones used to classify Hawaiian natural communities. The Hawaiian lowland zone lies above the coastal zone, up to about 1000 m. [approx. 3300 feet] elevation. There is lowland zone on all of the main islands.

Malacology: the branch of zoology dealing with mollusks, including snails.

Malaise: a type of flight intercept trap using a fine mesh net to collect flying insects.

Mollusk: invertebrates in the phylum Mollusca. Common representatives are snails, slugs, mussels, clams, oysters, squids, and octopuses.

Morphospecies: specimens grouped together based on similar appearance. This type of sorting is usually done as a preliminary step to more detailed analysis using other examination and identification techniques.

Native: found naturally in an area, not introduced accidentally or purposefully by humans; includes both indigenous and endemic taxa. See **Alien**, **Endemic**, **Indigenous**.

Nocturnal: active or most apparent at night.

Nonindigenous: See **Alien**.

Non-native: See **Alien**.

Paratype: see **Holotype**.

Predatory: the state of being a predator; preying on other animals for food requirements.

Protected: legally dedicated to the perpetuation of native resources and managed to mitigate or remove threats to those resources, if necessary. Areas lacking either legal protection or management are considered incompletely protected.

Purposefully introduced: organisms that are brought into an area for a specific purpose; often as biological control agents in the control of unwanted plants or animals. See **Alien**.

Rare: threatened by extinction because of low numbers. Any plant, animal, or natural community that can be immediately threatened by such factors as alien invasion, direct destruction, or loss of habitat.

Species of concern: rare or threatened species not formally listed as endangered, threatened, or as candidates but given this designation by USFWS. Generally includes species considered rare but for which additional information is sought before a formal listing proposal can be made. See **Federal Status**.

sp.: abbreviation for species.

spp.: abbreviation for more than one species.

- Subspecies:** (abbreviated ssp.) a taxonomically distinguishable geographic or ecological subdivision of a species. See **Variety**.
- Synonym:** in the context of this report, one of two scientific names given independently to the same real species.
- Taxon** (plural = **Taxa**): a group of plants or animals making up one of the categories or formal units in taxonomic classification. In this report a taxon can be a phylum, order, family, genus, species, subspecies, variety, or form. This distinction is important because certain species have endemic Hawaiian subspecies and varieties that are considered rare.
- USFWS:** United States Fish and Wildlife Service.
- Vagile/vagility:** endowed with or having freedom of movement; wandering.
- Variety:** (abbreviated var.) a taxonomically distinguishable subdivision of a species or subspecies. See **Subspecies**.
- Vertebrate:** an animal with a backbone; native vertebrate species in Hawai'i include fish, birds, a bat, and a seal. See **Invertebrate**.
- Voucher specimen:** specimen deposited in a recognized collection that can be used as a reference in future studies.

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APPENDIX 1—Collecting methods for insects and other arthropods.

The following methods used during the survey are described in detail and examples of those insects collected by each method are given.

Sweep nets—This method is the most common and general method of collecting insects in the field. A fine mesh net was used and the net was swept across plants, leaf litter, rocks, etc. to collect any flying, perching or crawling insects that may have been there. Transfer from the net was done either manually, by aspiration, or placement of the contents of the net into a temporary holding container for later sorting, processing, and identification.

Main types of arthropods collected: most flying and perching species.

Beating sheets—This type of collecting method uses a sheet or pan and a beating stick. The stick is used to beat shrubbery, moss, trees, branches, etc. whereupon the insects loosened from their perches, or those that instinctively drop to escape predators, fall into the pan or sheet where they are aspirated or hand collected. This method is employed to collect insects that are plant feeders and are species-specific in their feeding habits.

Main types of insects collected: true bugs, certain beetles, flightless insects.

Visual search of plants—A variety of potential host plants were sampled by visual searches as well as by sweeping with an insect net (see above).

Main types of insects collected: plant-feeding and perching arthropods, including leaf- and plant-hoppers, true bugs, spiders, beetles, and some flies.

Manual search of leaf litter and rotting wood—Leaf litter and rotting wood is investigated by hand. This includes turning over leaves, searching the litter-soil interface, and probing into and breaking apart fallen logs and other pieces of wood. This method is employed to search for cryptic and burrowing or boring ground- or wood-dwelling species.

Main types of insects collected: cockroaches, certain beetles, termites, millipedes, centipedes.

Yellow pan traps—Small yellow-colored bowls (15–30 cm in diameter) of water with a surfactant added are placed at various locations. The yellow color or the water in the traps attracts certain types of invertebrates, which then hop, fly, fall, or crawl into the water where they sink to the bottom and drown. Trapped organisms are transferred into a fluid preservative and taken back to the laboratory for examination and identification.

Main types of invertebrates collected: aquatic insects and those attracted to water or yellow color, including beetles, flies (including flightless flies), moths, wasps, bees, ants, aphids, true bugs, etc.

Pitfall traps—Small, steep-sided jars with fluid preservative (such as ethylene glycol) and baited with food attractive to insects. The trap is placed upright with the rim flush with the substrate. Arthropods attracted to the bait tumble in and drown.

Main types of insects collected: scavenging and predatory arthropods, including crickets, spiders, springtails, and flies.

APPENDIX 2—Numbers of each snail and slug species found at each station.

Sample numbers are field numbers of Robert H. Cowie. "99" indicates the year (1999). The second number is the sample station. Numbers in brackets indicate snails recorded but not collected

Sample	Species	Live	Dead	Total
99.77	<i>Allopeas clavulinum</i>	1	5	6
	<i>Euglandina rosea</i>	-	1	1
	<i>Liardetia doliolum</i>	-	1	1
99.78	<i>Allopeas clavulinum</i>	-	4	4
	<i>Paropeas achatinaceum</i>	1	3	4
	<i>Euglandina rosea</i>	-	1	1
	<i>Ovachlamys fulgens</i>	-	1	1
99.79	<i>Allopeas clavulinum</i>	1	1	2
	<i>Ovachlamys fulgens</i>	1	-	1
99.80	<i>Vaginulus plebeius</i>	1	-	1
	<i>Allopeas clavulinum</i>	-	3	3
	<i>Paropeas achatinaceum</i>	-	1	1
99.81	<i>Allopeas clavulinum</i>	2	3	5
	<i>Paropeas achatinaceum</i>	2	11	13
	<i>Euglandina rosea</i>	-	2	2
	<i>Ovachlamys fulgens</i>	-	1	1
99.82	<i>Allopeas clavulinum</i>	3	1	4
	<i>Paropeas achatinaceum</i>	-	5	5
	<i>Euglandina rosea</i>	-	3	3
	<i>Ovachlamys fulgens</i>	-	2	2
99.83	<i>Cipangopaludina chinensis</i>	3	-	3
99.84	<i>Allopeas clavulinum</i>	1	5	6
99.85	<i>Allopeas clavulinum</i>	3	5	8
	<i>Paropeas achatinaceum</i>	-	1	1
99.86	unidentified Physidae	4	1	5
99.87	<i>Allopeas clavulinum</i>	-	5	5
	<i>Paropeas achatinaceum</i>	-	1	1
	<i>Euglandina rosea</i>	-	3	3
99.88	<i>Allopeas clavulinum</i>	2	10	12
	<i>Paropeas achatinaceum</i>	1	6	7
99.89	<i>Allopeas clavulinum</i>	5	3	8
	<i>Paropeas achatinaceum</i>	5	2	7
99.90	<i>Allopeas clavulinum</i>	2	7	9
99.91	<i>Achatina fulica</i>	[2]	1	[2] + 1
99.92	<i>Allopeas clavulinum</i>	1	1	2
	<i>Paropeas achatinaceum</i>	-	1	1
	<i>Euglandina rosea</i>	-	3	3