

UNIVERSITY OF HAWAII AT MANOA

Office of Facilities, Grounds, and Safety

June 27, 2005

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

Subject: **Finding of No Significant Impact (FONSI) for Harold L. Lyon Arboretum, University of Hawaii, Conservation District Use Application, TMK (1) 2-9-055:006 and (1) 2-9-055:007, Manoa Valley, Honolulu, Island of Oahu.**

Dear Ms. Salmonson,

The University of Hawaii, Facilities Management Office has reviewed the comments received during the 30-day public comment period which began on May 8, 2005. The agency has determined that this project will not have significant environmental effects and has issued a FONSI. Please publish this notice in the next available OEQC Environmental Notice.

We have enclosed a completed OEQC Publication Form and four copies of the final EA. Please call Mr. George Atta at 441-2103 if you have any questions.

Sincerely,



Kalvin Kashimoto
Director of Facilities and Grounds

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OFC. OF ENVIRONMENTAL
QUALITY CONTROL

Harold L. Lyon Arboretum, University of Hawai'i Conservation District Use Application

TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Mānoa Valley, Honolulu, Island of O'ahu

Final Environmental Assessment

Applicant:

University of Hawai'i
Office of Vice Chancellor for Research and Graduate Education
211 Hawai'i Hall
Honolulu, Hawai'i 96822

Approving Agency:

University of Hawai'i
Facilities Management Office
Physical Plant Building 102
Honolulu, Hawai'i 96822

Prepared By:



Group 70 International, Inc.
Architecture • Planning • Interior Design • Environmental Services
Honolulu, Hawai'i

June 2005

Harold L. Lyon Arboretum, University of Hawai'i Conservation District Use Application

TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Mānoa Valley, Honolulu, Island of O'ahu

Final Environmental Assessment

This environmental document is prepared in accordance with the requirements of Chapter 343, HRS and Hawai'i Administrative Rules, Title 11, Department of Health.

Applicant:

University of Hawai'i
Office of Vice Chancellor for Research and Graduate Education
211 Hawai'i Hall
Honolulu, Hawai'i 96822



Applicant
University of Hawai'i

June 2, 2005

Date

Approving Agency:

University of Hawai'i
Facilities Management Office
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June 2005

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SECTION 1.0

Introduction

1.0 INTRODUCTION

This Draft Environmental Assessment (EA) has been prepared in accordance with the requirements of Chapter 343, HRS and Hawai'i Administrative Rules, Title 11, Department of Health. The proposed action involves the use of public lands owned by the State of Hawai'i, University of Hawai'i.

1.1 PROJECT INFORMATION SUMMARY

Type of Application:	Environmental Assessment (EA)
Applicant:	University of Hawai'i Office of Vice Chancellor for Research and Graduate Education 211 Hawai'i Hall Honolulu, Hawai'i 96822 Contact: Dr. Cliff Morden, Interim Director Phone: (808) 956-9636
Agent:	Group 70 International, Inc. 925 Bethel Street, 5 th Floor Honolulu, Hawai'i 96813 Contact: George Atta Phone: (808) 523-5866, Ext. 103
Accepting Authority:	University of Hawai'i, Facilities Management Office Physical Plant Building 102 Honolulu, Hawai'i 96822 Contact: Calvin Kashimoto, Director Phone: (808) 956-6142
Name of Action:	University of Hawai'i at Mānoa, Lyon Arboretum
Class of Action:	Use of State Land
Project Location:	Mānoa Valley, Honolulu, Island of O'ahu
Tax Map Key:	TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Landowner:	State of Hawai'i, University of Hawai'i at Mānoa
Land Area:	193.5 Acres
State Land Use District:	Conservation District (Subzone: Resource "R")

City / County Zoning:	P-1 Restricted Preservation
City / County Development Plan:	Primary Urban Center: Preservation
SMA:	Not in SMA
Flood Zone:	FIRM Zone X (outside the 100 year flood plain)
Tsunami Zone:	Outside tsunami inundation zone
Special Designations:	Not in a Special Designation
Anticipated Determination:	Finding of No Significant Impact (FONSI)

1.2 OVERVIEW OF THE SUBJECT PARCEL

The subject parcel being reviewed in this Environmental Assessment is the Harold L. Lyon Arboretum. The Lyon Arboretum is a botanical research and instructional unit of the University of Hawai'i. The Arboretum is located within the Resource "R" subzone of the Conservation District. Started in 1918 by the Hawai'i Sugar Planters Association, the Arboretum was turned over to the University of Hawai'i in 1953. Since then, the 193.5 acre Arboretum has developed the subject parcels, identified as TMK: (1) 2-9-055:006 (124 acres) and the adjacent subject parcel TMK: (1) 2-9-055:007 (69.5 acres). The University of Hawai'i (UH) at Mānoa, College of Natural Sciences oversees the maintenance of the Arboretum. The subject parcels are bounded to the south, west, and east by private landowners. Access to the Arboretum is located at the end of Mānoa Road. A location map and Tax Map Key is displayed by Figures 1-1 and 1-2.

1.3 BACKGROUND OF ACTIVITIES AND CDUA

The State of Hawai'i, University of Hawai'i at Mānoa is the owner of the Arboretum and has been charged by the State of Hawai'i Department of Land and Natural Resources (DLNR) with some violations of the Chapter 13-5, Hawai'i Administrative Rules (HAR) and Chapter 183C, Hawai'i Revised Statutes (HRS), which regulate land uses in the Conservation District. On October 14, 2004, the Office of Conservation and Coastal Lands conducted a site inspection of the Arboretum grounds. On December 10, 2004, the agency issued a report to the Board of Land and Natural Resources (BLNR) regarding seven alleged violations of land use statutes and regulations resulting from the University of Hawai'i's failure to obtain the appropriate approvals for:

- Renovations and alterations to cottages "B," "C," "D," "H," and "F" and a wood workshop/garage;
- Construction of the children's learning center;
- All landscaped features (memorial garden, water features, signs, statues, benches, trails and pathways, and drainage);

- Commercial uses of grounds;
- Construction of a visitor kiosk, rain shelter, and pavilion;
- Erection of a prefabricated storage shed; and
- Construction of a “large greenhouse/head house/ shade house/acclimation yard.”

The University of Hawai‘i, College of Natural Science was fined and paid a total of \$10,250 in fines, including \$1,000 for administrative costs, associated with the violations of Section 7 of Chapter 183C, HRS.

As a part of the provisions set by the BLNR, the University is also required to submit and execute an after-the-fact (ATF) Conservation District Use Application (CDUA) and Management Plan for the subject parcels TMK: (1) 2-9-005: 006 and 007. In addition, no further work is allowed to occur on the subject parcel within the Conservation District, without the BLNR approval; Chairman’s approval and/or OCCL approval.

1.4 PURPOSE OF ENVIRONMENTAL ASSESSMENT

This EA results from the provision of the after-the-fact (ATF) Conservation District Use Application (CDUA). In accordance with Chapter 343, Hawai‘i Revised Statutes and the Department of Health’s Hawai‘i Administrative Rules Title 11-200 this EA provides written evaluation of the technical, environmental, social and economic aspects of the Lyon Arboretum. This EA identifies the possible impacts of the unauthorized conservation district uses, which may have occurred, and their significance. Strategies to mitigate those potential impacts have also been developed. This EA then compares all aspects and impacts against 13 significance criteria listed in §11-200-12 to provide determination as to whether an Environmental Impact Statement shall be required or not.

1.5 AGENCIES AND PUBLIC CONTACTED DURING THE PRE-CONSULTATION AND DRAFT EA REVIEW PERIODS

Listed below are the agencies and other parties contacted regarding the proposed project prior to the publication of the Draft EA.

The agencies and organizations contacted during the pre-consultation period include:

State of Hawai‘i Agencies

Department of Business, Economic Development & Tourism, Planning Office

Department of Health

Department of Land and Natural Resources

Department of Land and Natural Resources, Historic Preservation Division

Department of Land and Natural Resources, Na Hele Trail and Access Program

Office of Environmental Quality Control

Office of Hawaiian Affairs

University of Hawai‘i, College of Natural Sciences, Lyon Arboretum

City and County of Honolulu Agencies

Board of Water Supply
Department of Design and Construction
Department of Planning and Permitting
Department of Parks and Recreation
Department of Facility Maintenance
Department of Environmental Services
Police Department
Fire Department

Other Parties and Associations

Garden Club of Honolulu	William McClatchey
Hui Hana Hawai'i	Raymond F. Baker
Hālau Kū Māna Century Public Charter School	Donna Schultz
Lyon Arboretum Association	Jill Laughlin
Mānoa Neighborhood Board	Marian Leong
'Awa Development Council	Liz Huppman

Following the completion of the Draft EA, all those listed below were provided with copies of the Draft EA and were requested to provide comments. Those parties that provided written comments are indicated with an asterisk [*]. Copies of the comments and response letters are provided in Appendix D.

State of Hawai'i Agencies

Department of Business, Economic Development & Tourism, Office of Planning
Department of Health*
Department of Land and Natural Resources
Department of Land and Natural Resources, Historic Preservation Division
Department of Land and Natural Resources, Na Hele Trail and Access Program*
Office of Environmental Quality Control*
Office of Hawaiian Affairs
University of Hawai'i, College of Natural Sciences, Lyon Arboretum
University of Hawai'i, Environmental Center*

City and County of Honolulu Agencies

Department of Design and Construction	Board of Water Supply
Department of Planning and Permitting*	Police Department*
Department of Parks and Recreation	Fire Department*
Department of Facility Maintenance*	
Department of Environmental Services	

Other Parties and Associations

Garden Club of Honolulu	William McClatchey
Hui Hana Hawai'i*	Raymond F. Baker*
Hālau Kū Māna Century Public Charter School	Mānoa Public Library
Lyon Arboretum Association	'Awa Development Council
Mānoa Neighborhood Board	Hawai'i State Library

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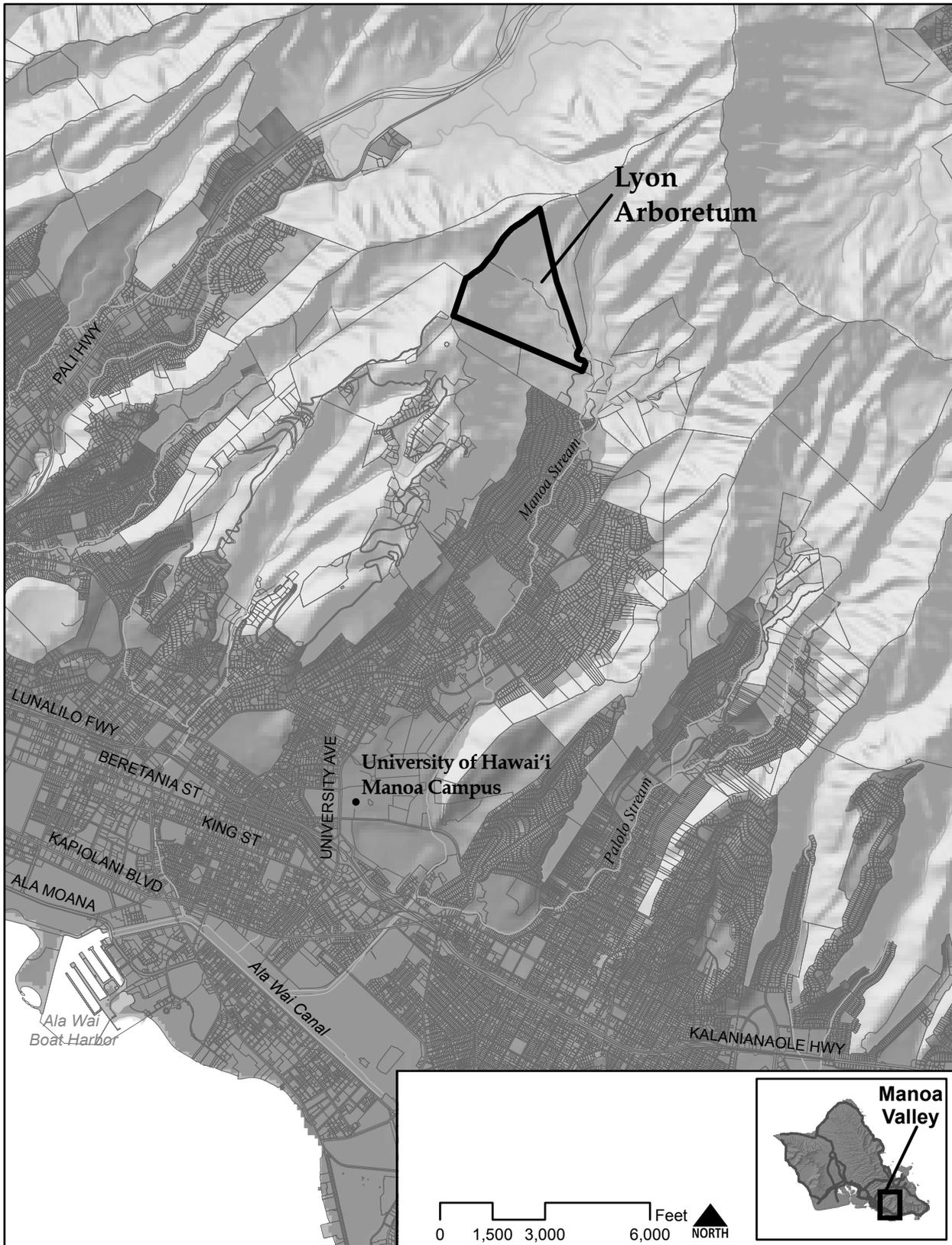


Figure 1-1: Lyon Arboretum Location

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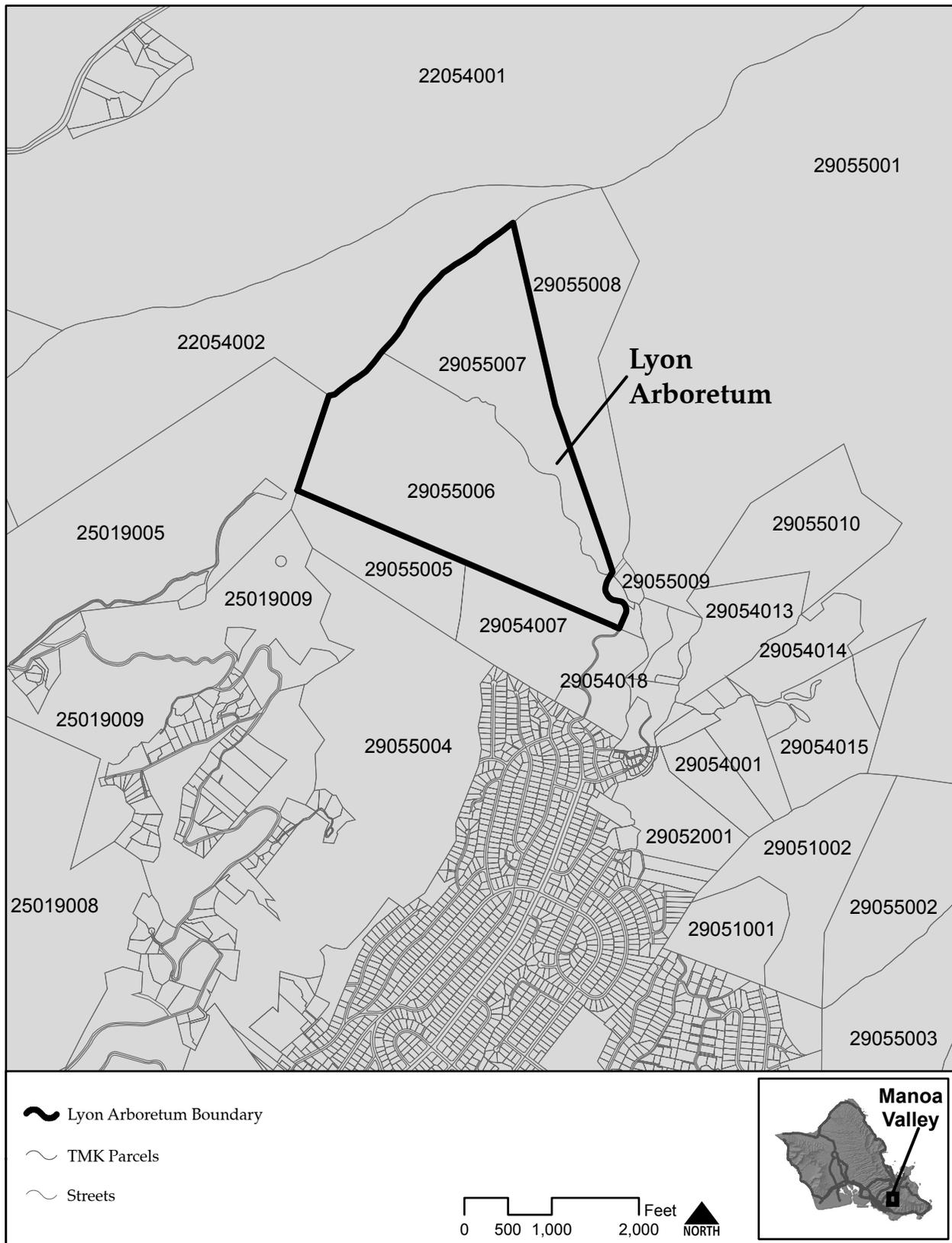


Figure 1-2: Tax Map Key

SECTION 2.0

Project Description

2.0 DESCRIPTION OF THE ACTIONS

2.1 SITE LOCATION

The Lyon Arboretum is located in the Mānoa Valley of Honolulu on the Island of O‘ahu. The Arboretum consists of 193.5 acres, identified as TMK: (1) 2-9-055:006 (124 acres) and the adjacent subject parcel TMK: (1) 2-9-055:007 (69.5 acres). The site is primarily bounded by conservation land uses and the residential area of Mānoa to the south. Additional urban areas, in proximity to the site, include the commercial district of Mānoa, the University of Hawai‘i Campus at Mānoa, and the beginnings of downtown Honolulu and Waikīkī. Access to the Arboretum is located at the end of Mānoa Road. The subject parcel is located in the State Land Use (SLU) Conservation District, Resource Subzone.

2.2 SITE HISTORY

In 1918 the site of the Lyon Arboretum, now occupied by lush vegetation, was a wasteland of grasses and thickets. The Lyon Arboretum was established in 1918 as a forest-restoration project by the Hawaiian Sugar Planter's Association Experiment Station (HSPA) on land that was denuded by cattle. The HSPA acquired 124 acres of land and put Dr. Harold L. Lyon, a young botanist from Minnesota, in charge. Dr. Lyon brought in and planted some 2,000 or so tree species on the grounds. The facility came to be known as the Mānoa Arboretum.

The Arboretum was obtained by the University as a gift from the HSPA on July 1, 1953 under the condition that the University, “maintain and preserve the granted premises as an Arboretum and botanical garden only”. This means that the Arboretum should be used as a botanical garden for research, education, and public service. When Dr. Lyon passed away in 1957, the Board of regents renamed the facility the Harold L. Lyon Arboretum in honor of the man who founded it and nurtured its growth for nearly four decades. Today, a bronze plaque in the upper part of the Arboretum commemorates Dr. Lyon.

After the University took over, the emphasis shifted from forestry to horticulture. During the last thirty years nearly 2,000 ornamental and economically useful plants have been introduced to the grounds. More recently the Arboretum has dedicated itself to becoming a center for the rescue and propagation of rare and endangered native Hawaiian plants. The Lyon Arboretum conducts research, reaches out to the public through its educational program, and serves the public in numerous ways. The Lyon Arboretum Association (LAA) was formed in 1974 to assist and support the Lyon Arboretum to attain its goals. Today, LAA members continue to volunteer and work at the Arboretum and provide lectures, workshops, guided tours, plant sales, and commodity gardens for the public.

2.3 LYON ARBORETUM DESCRIPTION

As a branch of the University of Hawai'i at Mānoa, the Lyon Arboretum serves as a research unit of the University. When the University of Hawai'i received the Lyon Arboretum from the Hawai'i Sugar Planters Association, the focus of its management expanded from that of a large experiment in watershed restoration to include general horticultural and botanical research. Since then, the Arboretum has expanded from research alone to include educational and community service activities. In recent years this expansion has included being open to the public and development of a diverse range of training and educational opportunities for students of all ages and the general public. A number of different small scale commercial activities have been conducted, including the popular "plant sales". All commercial activities have been used to generate funding to support on-going Arboretum programs.

It has recently been brought to the attention of the Arboretum directors, staff and University upper administration that the Arboretum is deficient in its adherence to the regulations of the Department of Land and Natural Resources (DLNR) for the Conservation District. This section is intended to describe the activities of the Arboretum, particularly as they relate to decisions about facilities that have been made over the last 40 years.

2.3.1 Land Usage

The Arboretum lands, as shown by Figure 2-1, presently consist of over 190 acres made up of three management areas:

1. About 20 acres of landscaped lower grounds with parking, paved roads, and buildings for grounds maintenance, research, education, and visitor information and activities that to a large extent have functioned as a botanical garden (hereafter called "lower grounds");
2. About 160 acres of artificial forest composed of collections of alien trees, shrubs, vines, and herbs arranged in research plots, (hereafter called "research section"); and
3. About 10 acres of native forest in the steep, higher elevation parts of the Arboretum (hereafter called "restoration section").

These lands have been managed loosely in the above three categories with greatest effort focused in the lower grounds and research sections and only minor effort in the restoration section. Although there has been no formal management plan, efforts by the staff have generally centered on:

- Maintenance and development of the diversity of research collections growing in the grounds
- Maintenance of landscaping in the lower grounds
- Reduction of the density and distributions of invasive species
- Improvement of elements of Hawaiian cultural landscape such as the lo'i, and improvement of research and production capacity to work with native plant species for restoration and other conservation activities.
- Horticultural activities such as greenhouse propagation, micro-propagation, and seed storage.

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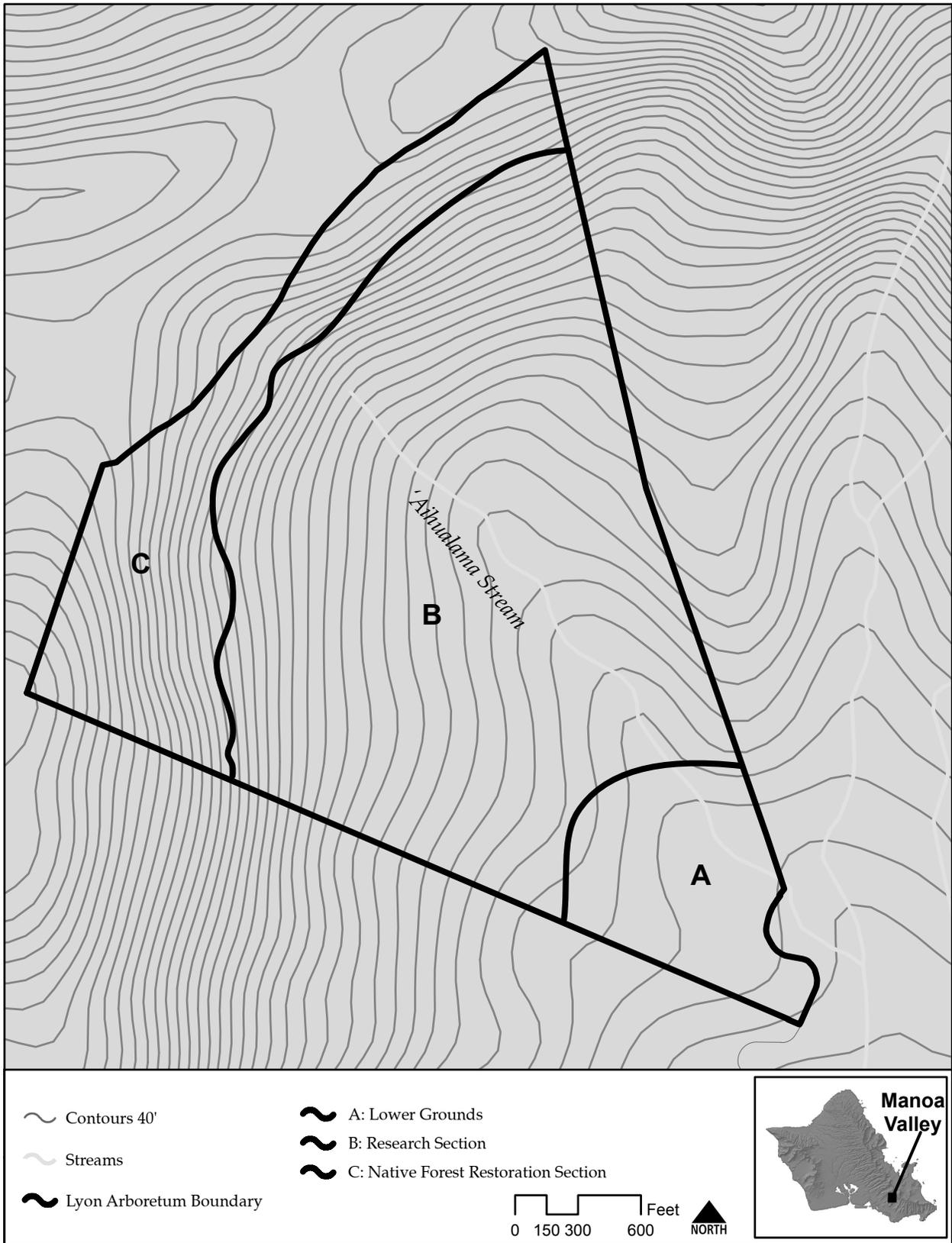


Figure 2-1: Land Management Areas.

Maintenance includes control of invasive species such as palm grass that has been heavily reduced with herbicides. The lower grounds of the Arboretum is maintained in a landscaping plan that includes lawns, displays of native and introduced species, and thematic gardens (such as a spice garden) intended to provide visitors with the opportunity to learn about plants and plant environments. The research section is largely managed as a set of 10 valleys. Maintenance in the research section has been extended to include all of the valleys below the restoration section. Restoration areas in the upper parts of the Arboretum have been partially surveyed and promoted as sites for restoration research projects.

The Arboretum has been increasingly used as a community facility for meetings and activities of groups not directly connected with the University. University use has also greatly increased in recent years with many courses being taught in part in the Arboretum with field trips, research activities, meetings, etc. University activity has involved faculty and students from several campuses, Leeward, Windward, Honolulu, Kapi'olani and Mānoa.

2.3.2 Facilities and Structures

The Arboretum facilities include buildings originally designed to house sugar cane plantation workers, as well as equipment sheds and barns. In addition, greenhouses, rain shelters, environmental monitoring stations, and open air educational buildings have been constructed since the University took over management of the grounds. Although the buildings vary in their quality and level of maintenance, all (except a seismographic station) have been in recent use.

Although there have been several plans for facilities that have been developed over the years, none of these have been advanced for approval by the University and appropriate state agencies. Instead, management of the facilities has shifted over the years from most of the facility space (cottages) being used as rentals to support the Arboretum budget, to research and education activities focused primarily in three areas: 1. Horticultural development, 2. Native plant conservation, and 3. Adult, university, and children's (K-8) environmental education.

The primary facilities of the Arboretum, as displayed by Figure 2-2, are:

Eight Cottages: The eight cottages, A-H, were constructed from 1920 to 1929 adjacent to the driveway as former homes for the sugar plantation workers. The cottages were renovated after Dr. Lyon passed away to support the Arboretum's budget. Some cottages have served as rental units, and some cottages currently serve as offices, Cottage H serves multiple functions; visitor center, classroom buildings, garden club and Arboretum offices. Currently, Cottage A, B, C, E, and G are closed. Offices have been relocated to the visitor's center. Cottage D is used for micro-propagation and seed storage. Cottage F is the resident manager's house and Cottage H is open but not ADA accessible.

Greenhouses: Six greenhouses are located adjacent to the main driveway, and to the cottages. They vary in size, and structure, and function: 1) the two snail greenhouses (behind Cottage A); 2) conservation greenhouse (between Cottages C and D); 3) 1930 greenhouse (adjacent to Cottage F); 4) certified plant greenhouse (behind Cottage F and G); 5) large greenhouse (main

parking lot); and 6) teaching greenhouse (behind Cottage H). A prefabricated storage shed (located behind Cottage C) is being used for greenhouse activities.

Children's Learning Center: The children's learning center is located between Cottages A and B; servicing children in grades pre-K-12. The building is intended to serve as a site for teaching children in conjunction with the adjacent Children's Garden. The building is an open-air rain shelter facility used for children and adult education, community meetings, and is not presently ADA accessible.

Roads and Parking Lot: Access to the Arboretum has been almost exclusively via the main entrance road. The access road has been widened, paved, and drainage improvements were placed where needed. The parking lot on the first Arboretum ridge was widened and paved. Other roads have not been significantly improved although drainage trenches and pipes have been installed along the jeep trail.

Rain Shelters: Rain shelters include the Fern Valley rain shelter and the Spice Garden Pavilion.

Garages and Work Sheds: Three garage/workshops are located on the mauka side of the driveway: a re-constructed wood workshed/storage shed located across from Cottage B; a garage/storage shed located across from Cottages D and E; and the "stone" garage located across from Cottage A.

Visitor Kiosk: A visitor kiosk is located at the Arboretum's entrance. The kiosk's intent is to provide information, control traffic flow, increase visitor safety, and collect donations. The kiosk also serves as a security measure to control the flow of visitors into the grounds, provide security for staff and plants, and prevent theft and/or vandalism at the Arboretum.

Herbarium: The herbarium serves as a reference collection for plants that are growing in the gardens, as a focal point for researchers conducting work on plants, and as a community educational resource. The herbarium facility is presently condemned. A new facility is needed for effective research at the Arboretum with critical features, such as air conditioning and humidity control for the collections (See Appendix E).

ADA Facilities: Existing ADA accessible routes have been eliminated due to the closure of Cottage A and deterioration of the pathways. Cottage A, housing the education offices, herbarium, and library was closed in February 2004. The open air basement under Cottage A served as the accessible route for wheel chairs to the Children's Learning Center (CLC) building and the Children's Garden. The CLC has been the only wheel chair accessible building at the Arboretum. The closing of Cottage A resulted in no wheelchair accessibility at the Arboretum. Several students, instructors, and visitors used this route, so repairs to Cottage A or an alternative route are essential to the Arboretum's activities. An ADA architect from UH has recommended building a deck/walkway around the rear of Cottage A as an alternative route and would likely provide a more efficient solution than waiting for scheduled repairs to Cottage A.

Cottage H, the main office building and visitor center with two public classrooms, is no longer ADA accessible due to deterioration of the pathways. The walk way surface, in the memorial

garden, has deteriorated to the extent that wheelchairs cannot easily navigate the walkway leading to Cottage H. The pathway has never been ADA compliant, and needs curbing and a proper (legal slope) ramp installed near the gift shop entrance.

Recommendations for construction of ADA ramps and pathways, with proper curbing and legal slope, have been requested. Designated pathways need to be identified as ADA access routes and the Arboretum will provide compliant ADA accessibility as much as possible.

Toilet Facilities: The Arboretum has one active large capacity cesspool, which services Cottages D and E. In compliance with the U.S. Environmental Protection Agency regulations the large capacity cesspool has been closed. The Arboretum has two other cesspools that have been connected to multiple structures: the visitor center (Cottage H) cesspool, which was upgraded with a septic tank in 2003, and the cesspool for Cottages A and B. The septic system for Cottage A, the Children's Learning Center, and Cottage B was closed in July of 2004. Until a new system is installed to replace it, there is no available toilet facility for these buildings or for visitors of the lower grounds. Portable toilets have been brought in for short periods of time. It will be essential to evaluate options for upgrading the wastewater system and have an ADA compliant toilet facility.

2.3.3 Landscape Features

Landscaped features include: informative signage, statues, sundials, memorial markers, and benches. Water features include the Hong Yip Young Memorial Garden pond and fountain and a lo'i located east and west of 'Aihualama Stream. The Young Memorial Garden was constructed in the 1990's and includes a stone wall, walkways, pond, and pavilion. The west side lo'i has been used for growing kalo, ko, 'uala, mai'a, and was constructed by Bea Krauss and Silver Piliwale in mid-1970. The east side lo'i contains the presence of ancient pre-historic lo'i walls and 'auwai.

A restoration of a portion of these lo'i, for the purposes of cultural perpetuation and education, has begun under a partnership with Hālau Kū Mana New Century Public Charter School. The lo'i are spring fed and restoration work is not altering the path of stream water. The restoration work will concentrate in the first three or four lo'i below the spring. Restacking of the walls may be necessary, but will not be done without an archaeological survey. Once functioning, the lo'i will also be used as a tool to demonstrate traditional resource management methods of the ancient Hawaiians.

The ancient lo'i located along the east side of 'Aihualama Stream have been only loosely maintained as adjacent large banyan trees have grown large enough to shade them. Periodic, limited efforts have been made to reopen these through removal of branches of adjacent trees and removal of smaller weedy trees to the south of the lo'i. Ditches that had been constructed to drain the lo'i have not been maintained, while small efforts have been made to restore old lo'i walls and 'auwai. Refer to Section 3.10 and 3.11 for further discussion.

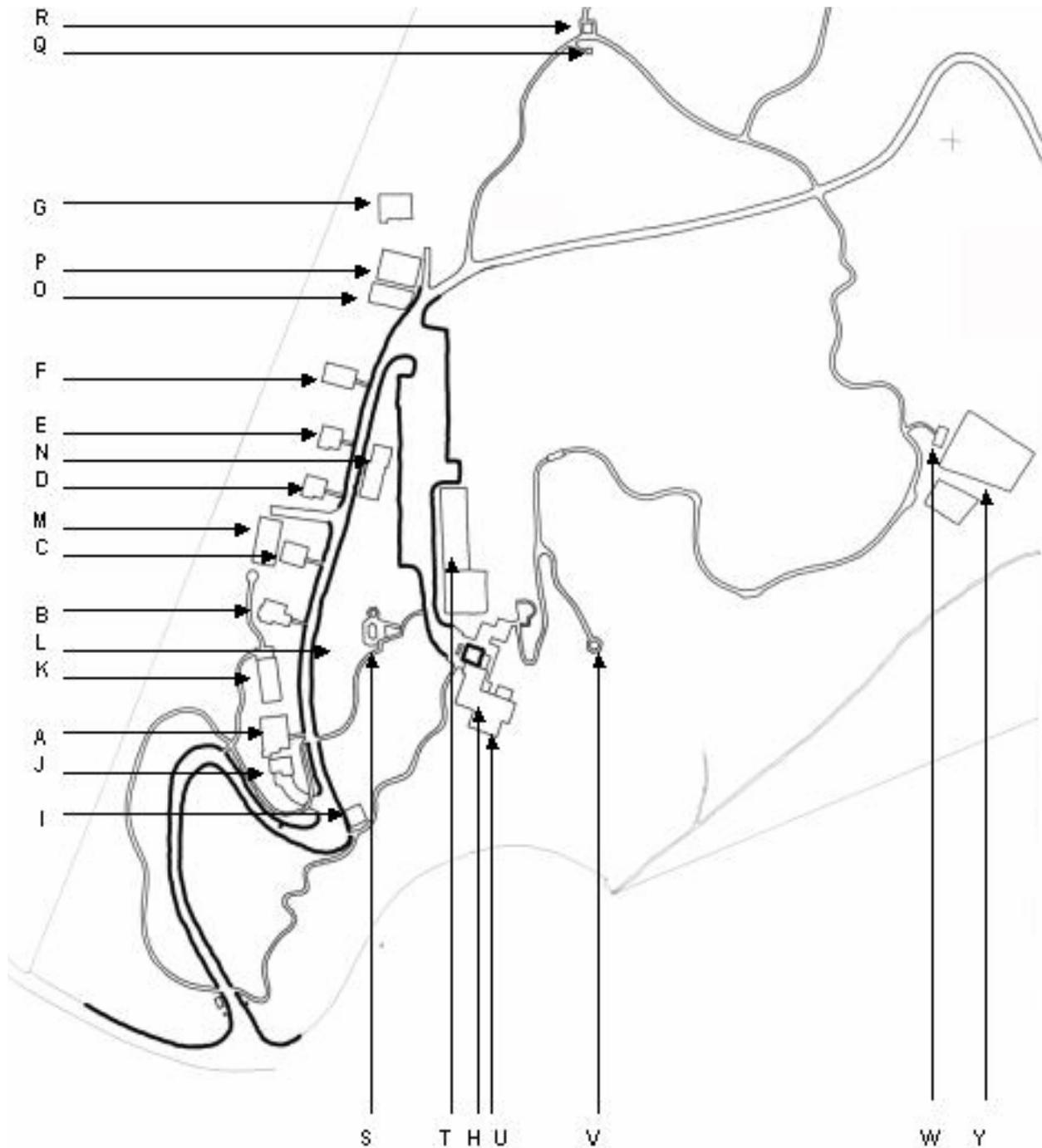


Figure 2-2: Lyon Arboretum Facilities, 2004. A-H Cottages A-H. I Stone Garage. L, N Garages/Workshops. J, M, O, P, T, U Greenhouses. K Children's Learning Center. Q Walking Buddha. R, S, V, W Existing & planned rain shelters. Y Lo'i.

The Arboretum has numerous benches provided for visitors and staff to use when in the gardens. Benches are of wood and concrete. Many of the benches are memorial markers, which have been placed in the garden as a part of a program where donors make a one time donation to the Arboretum. The gift funds the purchase of a bench, the installation of the bench, and a small plaque attached to the bench, and also provides revenue that supports the maintenance of the area. Currently, the Arboretum has 20 memorial benches on site.

The memorial tree program is a one time gift to the Arboretum that designates one of the existing Arboretum trees as a memorial tree. A 6" to 12" bronze plaque is installed at the base of the tree. Funds from the program provide maintenance for the sign and the area. Currently, the Arboretum has 24 trees with bronze memorial markers, and 14 trees with plastic markers. There are also several plaques that have been donated for individual areas or gardens. These donations provide signage to label the plants, and funds to maintain the collections.

As a botanical garden and public facility, the need for signage is apparent for directional, informational, locational, plant labels, wayfinding, warning, traffic, etc. Larger information signs are placed at the Arboretum entrance, at each end of the parking lot, at the beginning of major trails, and in some of the garden display areas. Thousands of smaller plant identification signs are located next to, or attached to, species for identification by visitors. Current signage will eventually need to be replaced and new signage installed. Occasionally temporary banners are used to inform the public about special events or temporary conditions. Educational signage is essential to the mission of the Arboretum.

Permanent artwork in the Arboretum includes one statue (walking Buddha near the rain shelter), one fountain with a bronze lotus bowl (in the spice garden/Young Memorial Garden area), an orchid stand (near cottage H), a sundial in the Herb Garden, carved stone bowls in several memorial gardens, and memorial markers. Memorial markers are scattered throughout the lower grounds area.

Small, semi-temporary educational exhibits are on display in the children's garden, including a model of an earthworm, compost bin, rain-gauge, mailbox thermometers etc. These are small displays that have been installed as educational activities that provide hands-on educational experiences. It is expected that existing features would be maintained and the need for new temporary features and educational activities would grow with the garden.

A site has been chosen and blessed for a planned traditional hale for the Ethnobotany garden, the land has been dug out by hand and graded flat, the construction materials have been brought in from outside and stored at the Arboretum for over a year. A traditional hale builder has also been arranged to construct the hale.

A round low wall has been constructed at the terminus of a side trail in the new Hawaiian Ecosystem Garden. Holes have been dug to accommodate the posts of a small, rustic rain shelter.

2.3.4 Plant Collection

The Arboretum research plant collections include roughly 1,500 native accessions and 15,000 accessions of alien species, including palms, bromeliads, aroids, figs, ancient Hawaiian cultivars, and others listed below. The “lower ground” and “research section” contain the thematic sections, some of which are displayed by Figure 2-3. Thematic sections in the lower grounds and research section include:

- Spice and Herb collection
- Children’s garden
- Hawaiian Ethnobotany garden
- Caum’s gulch South Pacific plant collection
- Ornamental ti collection
- Native Hawaiian plant collection
- Hawaiian Ecosystem demonstration garden
- Ginger collection
- Heliconia collection
- Economic plant display
- Marantaceae collection
- Bromeliad collection
- Palm collection
- Cycad collection
- Green Pharmacy garden
- Hui Hana lei garden (Behind Cottage E)

The “research section” has been extended to include all the valleys below the “restoration section”. These are being managed with special care taken to eradicate any parts of the alien plant collections with tendencies to becoming invasive. Research collections also include species of native plants growing in native forest, in experimental restoration areas, in educational displays, in greenhouses, and in tissue culture. The research collections are spread across all three areas of the grounds. Plant collections in the “restoration section” are separated by the ten valleys:

Valley 1: Fern and cycad collections/displays;

Valley 2: Aroids undeveloped;

Valley 3: Native Hawaiian plants;

Valley 4: African and Madagascar palms;

Valley 5: Asian and American Palms;

Valley 6: Pacific Palm section and ‘Aihualama Falls; and

Valley 7-10: Miscellaneous Tree Collection.

Although no formal plan for management of research collections has been approved by the University, there has been consistent emphasis by the staff on expansion of species diversity and development of greater opportunities for horticultural, taxonomic, biochemical, ecological, and conservation researchers. The result of decades of steady work by the staff is a collection of plants that is not equaled anywhere else in the United States.

2.3.5 Trail System

The Arboretum has many miles of trails that vary in quality from easily accessible gravel pathways, to steep, narrow “pig trails”. Trails are based on: former agricultural activity trails; access roads to houses; paths cut to older plant projects; and access to current collections of plants and are displayed by Figure 2-4. The trails in the lower grounds area have been managed for easy access by educational groups and general visitors, with educational signs next to plants along the pathways. Trails in the research section have been managed for access to the plant collections and for hiking by visitors, specifically those wanting to visit some of the waterfalls, other land features, view points, and unusual collections of plants. Trails in the restoration section have limited access and are poorly maintained. (Exceptions to this are the Mānoa Cliffs trail that passes through part of the Arboretum native forests and the upper ‘Aihualama trail. These sections are maintained by Na Ala Hele.) All of the present day hiking trails are displayed by Figure 2-5.

No formal trail management plan has been approved by the University or other state agencies, but staff, students, and volunteers have steadily worked to improve overall trail quality and to maintain accessibility for researchers and visitors. Trail improvements in the lower grounds include surfacing with gravel and lining trails with trex. Steep trails in the research section include dug-out steps lined with trex and reinforced to prevent erosion. DLNR staff of the Na Ala Hele Trails and Access Program (NAH) has been consulted about material and design considerations prior to trail construction. The NAH will continue to be consulted on trail management activities and collaborated with the Arboretum on special projects such as the Volunteer Service Network. The NAH has committed to help the Arboretum establish a formal Memorandum of Agreement for the management of those segments of state forestry trail that traverse through the Arboretum property. A landscape architect with a specialty in ADA accessibility issues was consulted about trails in the children’s garden area. Accessible routes for ADA compliance need to be established for access to the facilities, including Cottage H and the Children’s Learning Center. As trails have been maintained, new trails have been added where new collections are being out-planted.

2.3.6 Educational and Visitor (General Public & Tourists) Activities

The Arboretum educational and visitor activities include classes of pre-K-12 children, adults, teachers, University courses, tourists, and small ecotourism groups learning about plants, the cultural use of plants, plant environments, biodiversity, and conservation issues. Visitors not associated with the University have been asked to provide a donation each time they visit or to become annual members of the Lyon Arboretum Association. As a public service and to fulfill its mission of education, the Arboretum provides walking tours of the grounds to visitors. In the past, it has been a free public service, with donations accepted, but it is possible that the public tours will need to be fee based. A public tour program has been proposed to the University by the Arboretum. Presently, public tours have been cancelled until the UH administration approves the proposed public tour program.

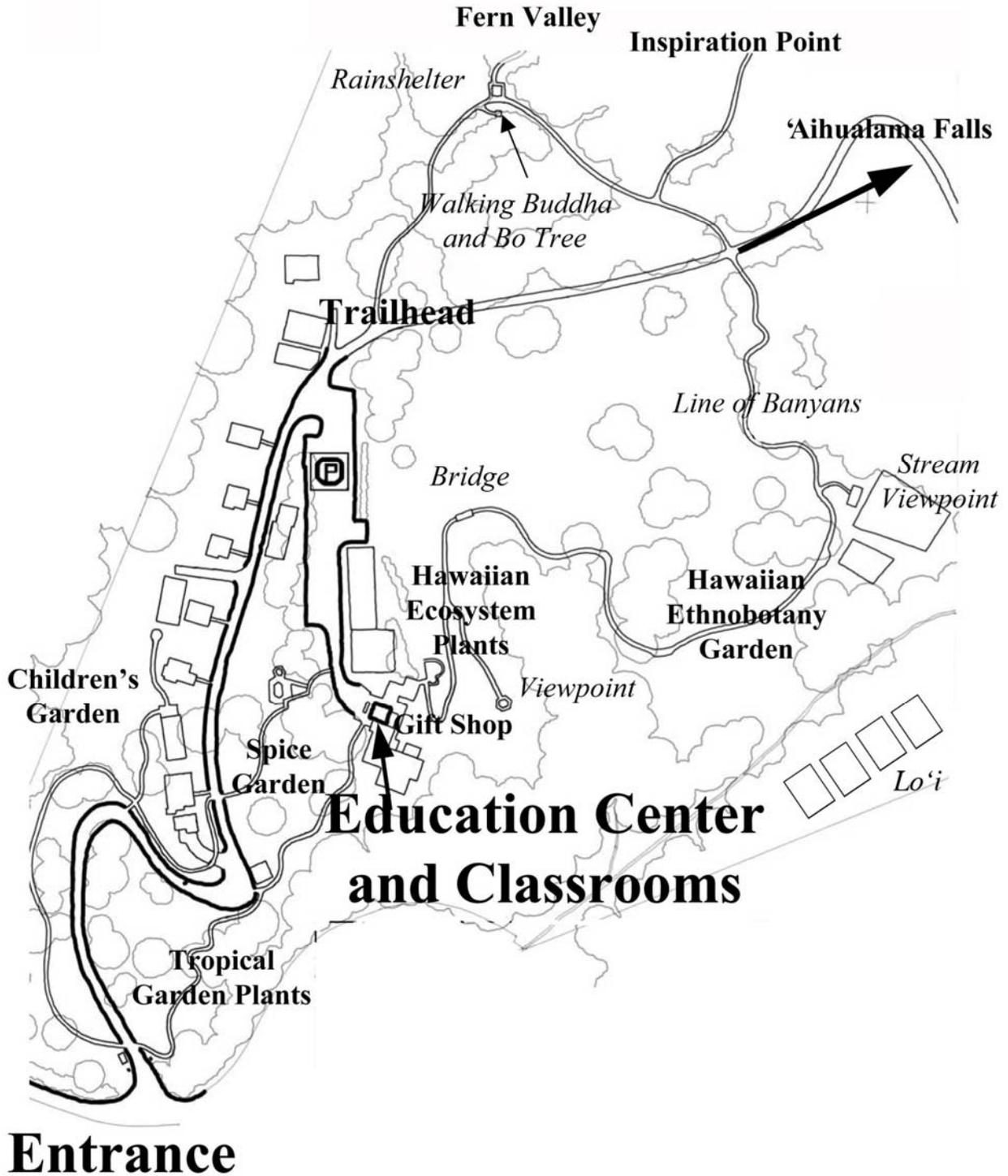


Figure 2-3 Lyon Arboretum Thematic Plant Collections and Lower Grounds, 2004.

The Arboretum offers a range of K-12 teacher training courses, courses for children, and adult education courses dealing with topics tightly or loosely associated with plants. Most students in most courses have been asked to pay a tuition fee. Tuition and donations have been used to pay for grounds maintenance and education staff and for improvements in the lower grounds. Educational and visitor programs of all types are limited in scale by the small size of the Arboretum parking lot, limited classroom facilities, and number of available staff members.

Typically over 4,000 children and teachers visit the Arboretum each year. Children's education programs usually have involved a nominal fee of ~\$3 per child for school field trips that are activity-based (the vast majority). This covers the costs of materials and equipment replacement. The Arboretum does not charge anything for self-guided school tours or for groups that provide their own instructional materials and equipment (probably about 2% of the school field trips are self-guided). Since August 2004, the Arboretum has had to deny access to more than 1,500 students who were scheduled for field trips.

No formal education development plan has been approved by the University. However, consistent efforts by the staff have developed the Arboretum curriculum as a major resource for environmental science education of local school children. To fulfill its mission of outreach, since the 1970's the Arboretum has sponsored classes to the general public; usually horticulture, crafts, plant conservation, nature studies, photography, cooking etc. In a typical year 150 adult classes were offered. In 2003 roughly \$25,000 was paid in tuition fees for Arboretum classes. This revenue is essential to the operation of the Arboretum and there is great potential for growth, for instance in the last 6 years, revenue from the children's summer classes has grown from \$2,000 to \$15,000. Currently, no classes have been approved for summer 2005.

A restoration of a portion of these lo'i, for the purposes of cultural perpetuation and education has begun under a partnership with Hālau Kū Mana New Century Public Charter School and be incorporated into the Hawaiian Ethnobotanical Garden. The ancient lo'i located along the east side of 'Aihualama Stream have been only loosely maintained. Once functioning, this lo'i would also be used as a tool to demonstrate traditional resource management methods of the ancient Hawaiians. It will function as an integral part of the education program which is "place-based" and "culturally relevant," and fits well into the Arboretum goal of becoming a "Hawaiian place of learning."

Periodically the public has used the Arboretum for large gatherings. The largest of these was the 'Awa Festival held in October 2003. This event involved an estimated 2250 people visiting the Arboretum in one day. Additional public gatherings at the Arboretum have included memorial services, which the Arboretum has provided free of service.

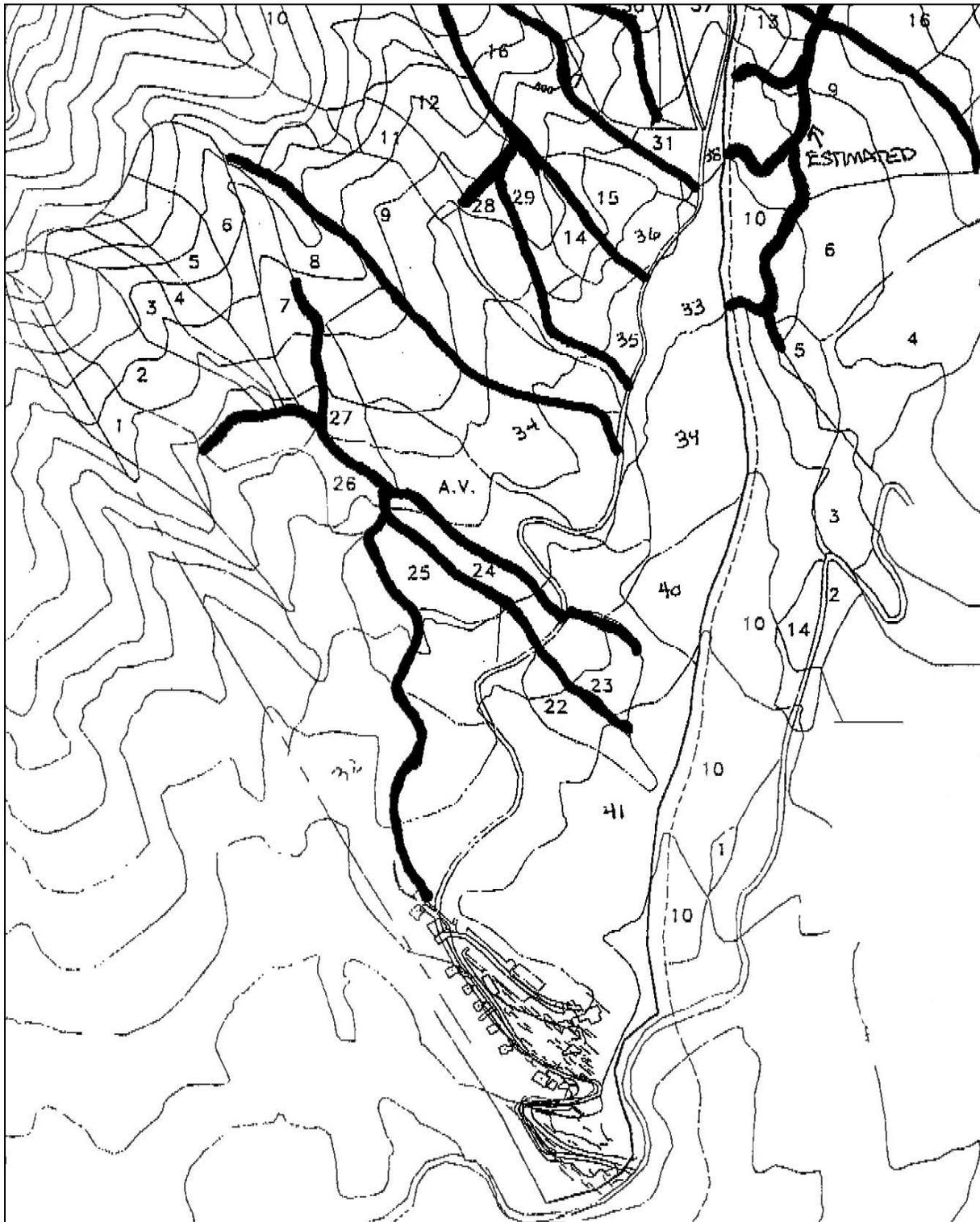
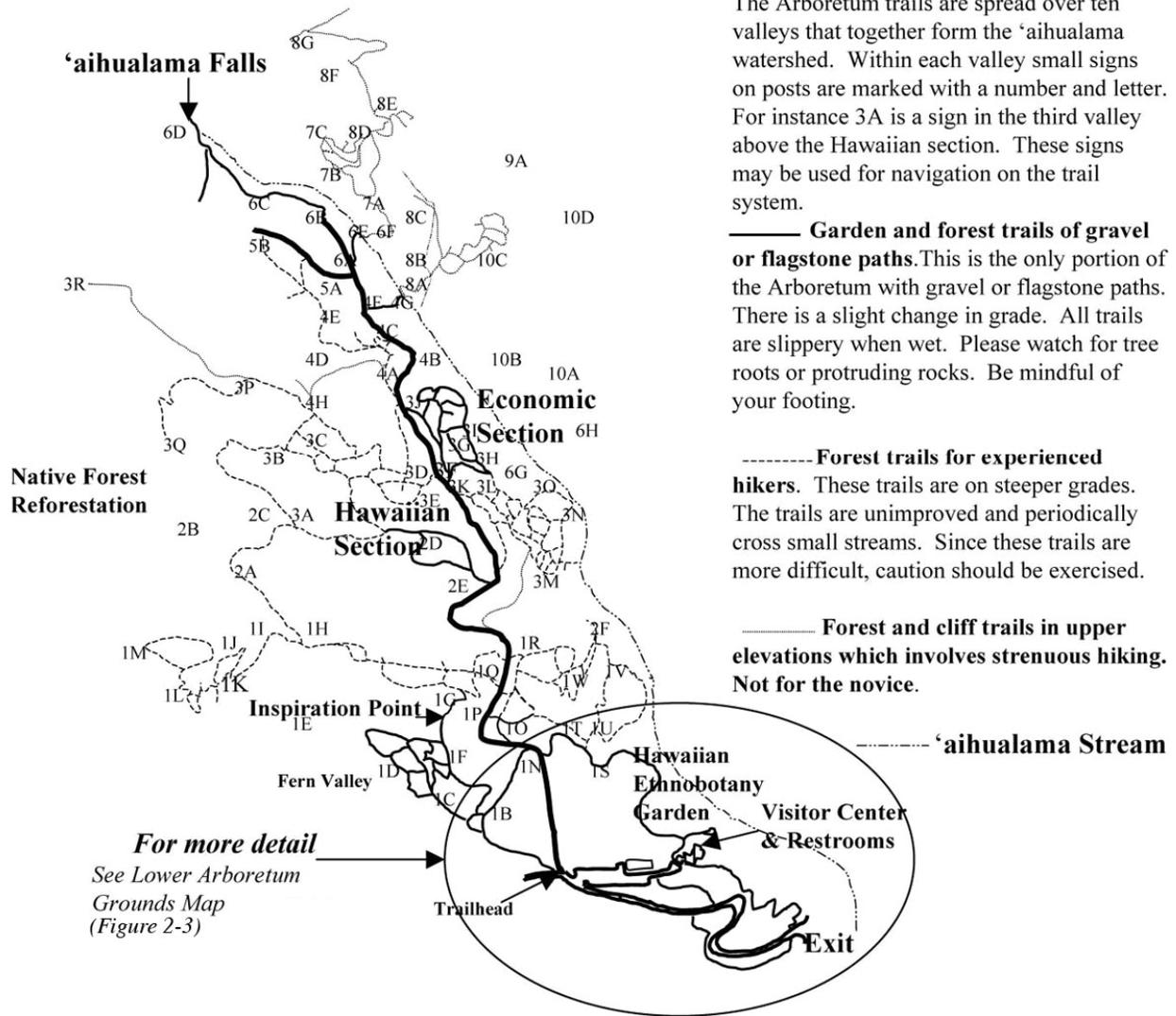


Figure 2-4: Lyon Arboretum Main Trails Pre-1964.

Upper Arboretum Hiking Trail Map



The Arboretum trails are spread over ten valleys that together form the 'aihualama watershed. Within each valley small signs on posts are marked with a number and letter. For instance 3A is a sign in the third valley above the Hawaiian section. These signs may be used for navigation on the trail system.

——— Garden and forest trails of gravel or flagstone paths. This is the only portion of the Arboretum with gravel or flagstone paths. There is a slight change in grade. All trails are slippery when wet. Please watch for tree roots or protruding rocks. Be mindful of your footing.

----- Forest trails for experienced hikers. These trails are on steeper grades. The trails are unimproved and periodically cross small streams. Since these trails are more difficult, caution should be exercised.

..... Forest and cliff trails in upper elevations which involves strenuous hiking. Not for the novice.

Figure 2-5: Lyon Arboretum Hiking Trail Map, 2004.

2.3.7 Commercial Activities

Although the Arboretum is not established for commercial purposes, some activities have been conducted that are commonly done at botanical gardens and arboreta elsewhere in order to support the costs of maintaining plant collections. Prior to 1964 and after, Cottages A-H were rented as a primary source of revenue. Since then, commercial activities have been important for the support of staff and programs.

The Lyon Arboretum Association (LAA), a non-profit volunteer organization incorporated in 1976 to assist Lyon Arboretum with its mission in education, conservation and research. A community of volunteers, LAA supports Arboretum programs by working directly with the staff, creating Island-famous jams and crafts, and sponsoring the Book and Gift Shop, a series of Plant-Sales and other special events. Membership in the LAA helps fund staffing, adult and children education programs, special research projects, summer interns, cultural festivals, and grounds/facilities/equipment upgrades and additions. The following is a list of activities and projects for which the Lyon Arboretum Association requests permission to hold on the Arboretum grounds. This list is not meant to be all-inclusive but rather to list the types of activities/projects in which LAA anticipates involving itself.

These include:

- Establishment of a visitor gift shop for distribution of books and other items of botanical interest, as well as gifts and curios, including the sale of cut flowers/foilage, wood benches, oshibana, seed jewelry, pottery, kadomatsu, and lei.
- Sale of jams & jellies made for the benefit of the Arboretum, the sale of which supports the activities of the Arboretum.
- Growing plants for sale to the public including new cultivars, ornamental varieties, and native species. The primary purpose of this activity is to make new plant materials available to the public and to promote conservation activities.
- Sale of plants with commercial vendors providing the bulk of the plants for sale.
- Sale of seeds and cut flowers.
- Community education courses, most of which involve some kind of plant, nature, or environmental education component. The classes partially support the educational mission of the Arboretum, and fees charged for these classes cover the cost of class materials, an honorarium for the instructor, and the remainder is used to fund and support Arboretum educational programs and events.
- Hui Hana Groups activities including lei-making, oshibana, and crafts.
- Events such as the Open Houses, Plant Sales, and Festivals including the 'Awa Festival sales of plants, shirts, food, etc by commercial vendors.
- Public relation activities and fund raising events such as book signings, silent auctions, LAA workshops and lectures, and ADA accessible brick walk.
- Weddings.
- Commercial films and photography. Non-commercial films have also been produced in the Arboretum for HVCB ads, DOH water quality ads, and many educational productions done by students and NGO's.
- Commercial tours by eco-tour companies and/or Arboretum docents.

After many years of illegal tour operators using the Arboretum, a “Commercial Tour Policy” based on the DLNR Na Ala Hele Program has been proposed. The Na Ala Hele staff was consulted, and DLNR approved and permitted tour operators were invited to submit an application for commercial tours at the Arboretum. Tour operators must provide proof of their permits, carry \$1M insurance, name the Arboretum in their policy, sign a written agreement with the Director, and have a commercial carrier (PUC) license. Commercial tours were regulated by the Arboretum Director and very limited in number. The Arboretum should be able to manage, control, and generate revenue from future commercial tour operations on Arboretum land. Presently, commercial tours are allowed entry to the Arboretum and handled as routine public visitors. Regulation of commercial operators has been determined to be the responsibility of DLNR, so commercial tour operators are allowed to come and go freely. Donations from the commercial operators are accepted, but are not required.

2.3.8 Infrastructure

The following infrastructure facilities supporting the Arboretum include access and parking facilities, septic and disposal system, water supply, drainage system, a non-potable water system, and other utility systems (See Section 3.0 for a further description of existing utilities and infrastructure).

2.3.9 Planting Plan

As part of the management of the Arboretum a Planting Plan for the lower grounds is related to its land management areas (see Figure 2-1). These three areas in the land use plan: A: Public Botanical Garden, B: Research Section, and C: Native Forest Restoration Section which each have smaller subsections with greater specificity of plantings. Detailed plans for the subsections are being developed. Appendix G is an example of a planting plan for the Ethnobotany Subsection.

The planting plan includes a site development concept and a species maintenance plan. Site development includes clearing and ground preparation for expansion of plantings of thematic groups of species in the properly designated areas.

The management plans are intended to help candidate species grow and thrive throughout their life cycle. It includes mulching and occasional fertilizing when needed. It also includes pruning unwanted weedy species and cutting surrounding trees that may create excessive shade on the species in the program. The removal of invasive alien species and pruning needed for species growth and protection of rare plants is also part of the management plan. The ATF CDUA request includes the practices identified in this planting plan. Appendix I is a “work-in-progress” management plan for the Arboretum.

2.3.10 Accessibility

Much of the Arboretum is currently inaccessible and out of compliance with policies and guidelines of the Americans with Disability Act (ADA). Currently, some small steps have been taken such as the provision of accessible toilet facilities by the use of portable toilets. Over the years some ramps and pathways have made parts of the Arboretum accessible. The closure of

Cottage A cut off ADA accessibility to the Children's Learning Center and the deterioration of the pathways at Cottage H cut off ADA accessibility, as well.

While the entire site does not need to be ADA accessible an overall accessibility plan is needed, which will identify areas of accessibility in the Arboretum. This plan will be developed when the Long Range Development Plan (LRDP) for the Arboretum is developed. Until then, smaller, segmented, improvements may be needed to ensure safety and accessibility.

2.4 VIOLATIONS (UNAUTHORIZED USES AT THE LYON ARBORETUM)

Recent land use proposals at the Arboretum have brought certain regulatory violations to the attention of the Department of Land and Natural Resources, Office of Conservation and Coastal Lands, the agency that administers land use requirements for the conservation district. The Arboretum sits on parcels that were classified as part of a conservation district on October 1, 1964. Use of and activities on Arboretum lands are thus subject to Chapter 13-5, Hawaii Administrative Rules (HAR) and Chapter 183C, Hawaii Revised Statutes (HRS). Land uses in the Conservation District are regulated by identifying a list of uses that may be allowed by Conservation District Use Permit. These statutes and rules generally provide for the regulatory requirements, such as permits and site plan approvals, applicable to land uses in conservation districts. Chapter 13-5, HAR defines "land use" in part as: the placement or erection of any solid material on land or the grading, removing or dredging of any material or natural resource on land.

On October 14, 2004, the Office of Conservation and Coastal Lands (OCCL) conducted a site inspection of the Arboretum grounds. On December 10, 2004, the agency issued a report to the Board of Land and Natural Resources (BLNR) regarding seven alleged violations of land use statutes and regulations resulting from the University of Hawaii's failure to obtain the appropriate approvals for:

- Renovations and alternations to cottages "B," "C," "D," "H," and "F" and a wood workshop/garage;
- Construction of the children's learning center;
- All landscaped features (memorial garden, water features, signs, statues, benches, trails and pathways, and drainage);
- Commercial uses on the grounds;
- Construction of a visitor kiosk, rain shelter, and pavilion;
- Erection of a prefabricated storage shed; and
- Construction of a "large greenhouse/head house/shade house/acclimation yard."

According to OCCL, modifications to older non-conforming structures include:

1. Cottages C and D constructed decking;
2. Cottages B, C, D, and F were excavated to add a bottom floor;
3. Cottage H increased the maximum developable area (MDA) for a covered lanai and classrooms; and
4. the garage across from Cottage B was renovated into a wood workshop/storage shed.

According to OCCL, the following structures and land uses were constructed and/or renovated after 1964 without the proper authorizations:

1. the Children's Learning Center (1999-2002);
2. the Hong Yip Young Memorial Garden (1990);
3. the prefabricated storage shed (1997);
4. the large greenhouse/head house (1967) (the shade house/acclimation yard was subsequently added later);
5. the visitor kiosk;
6. the Fern Valley rain shelter, and the Spice Garden Pavilion; and
7. the landscaped features (memorial garden, water features, signs, statues, benches, trails and pathways, and drainage)

In addition, unauthorized commercial use of the property represents another set of violations cited. Commercial activities, established to support and maintain the Arboretum, cited by OCCL include: the establishment of a visitor gift shop; non-commercial and commercial plant sales; education classes; Awa Festival; cottage rentals; weddings; memorial services; commercial and non-commercial ventures; commercial tours by eco tour companies; and the sale of small items (pottery, wood benches, seed jewelry, lei, jams, jellies, flowers, etc.).

2.5 RESOLUTION OF VIOLATIONS

The renovations and land uses constructed after 1964, and commercial use of the subject parcel without the DLNR and/or BLNR's approval constituted in violations. Pursuant to Chapter 183C, HRS, the maximum fine for a Conservation District violation is \$2,000 per violation in addition to administrative costs, costs associated with the land and/or habitat restoration, if required, and damages to state land. Each of the structures or features constructed after 1964 constituted a separate violation. Modifications to older non-conforming structures including Cottages B, C, D, H, and F as well as the old garage constituted additional violations. In addition, unauthorized commercial use of the property represented another violation.

The University of Hawai'i was held accountable for the following violations that occurred at Lyon Arboretum, and the following fines have been paid:

- \$2,000 for the renovations and alterations to the wood workshop/garage, and Cottages B, C, D, H, and F;
- \$2,000 for the construction of the Children's Learning Center;
- \$2,000 for all landscaped features (memorial garden, water features, signs, statues, benches, trails and pathways, drainage);
- \$2,000 for the commercial uses taking place;
- \$500 for the construction of the visitor kiosk, rain shelter, and pavilion;
- \$500 for the prefabricated storage shed; and
- \$250 for the construction of the large greenhouse/head house/shade house/acclimation yard.

As a part of the violations, the BLNR recommended that UH-Mānoa, Lyon Arboretum submit and expedite an After-the-Fact (ATF) CDUA and Environmental Assessment for: 1) the structures constructed after 1964; 2) for the renovated cottages and wood workshop/garage; 3) for the landscaped features; and 4) commercial activities within six (6) months of the date of the Board's action. A Management Plan, discussing the management of the Arboretum is also required, pursuant to HAR, Section 13-5-23.

A Master Plan will be developed for the Arboretum. The Master Plan will include a management plan for the native forests, a plan for restoring native forests in other parts of the Arboretum, a plan for managing the research collections, a plan for managing the lower grounds, an overall forest management plan for water shed improvement, a plan for eradication and control of alien weedy species, a plan for managing Hawaiian cultural landscapes in the Arboretum, a plan for conservation of water resources, and a plan for management of soil resources.

The Master Plan will also include a set of goals for restoration of some buildings, demolition of some buildings, and construction of replacement facilities that are more suitable for modern educational and research activities. The plan will also address targeted levels of researchers, students in courses, and visitors on the grounds as well as means for minimizing traffic while maximizing usage of limited parking. Preparation for the plan will involve consideration of options such as placing some facilities underground, incorporation of energy conservation technologies, incorporation of recycling and recycled materials, and determination of ideal locations for each facility. Since funding has not been secured for major changes, this plan will be in flux and serve as a goal subject to change and revised approval by DLNR and the University of Hawai'i.

The Master Plan will also include a trail management plan with detailed maps of existing trails and expectations for removal of some trails and construction of others. The plan will be articulated with trail plans for the adjacent properties controlled by DLNR and the City and County of Honolulu as part of a partnership that addresses parking, human waste management, levels of usage, and environmental/cultural education.

The Master Plan will include plans for management of the plant collections as biological resources of the University and State of Hawai'i. Plans will be developed for the broad range of research activities particularly those related to native plant conservation and native ecosystem restoration. Schedules will also be designed for periodic review and update of the research plants.

The Master Plan will finally include plans for improving the quality of environmental, conservation, native species, and cultural educational activities conducted in the Arboretum. The plan will include strategies for collaboration with other agencies and private ventures to creatively educate, tourists, teachers, and university students. Appendix I is a "work-in-progress management plan for the Lyon Arboretum.

2.6 TECHNICAL, ECONOMIC, SOCIAL, AND ENVIRONMENTAL CHARACTERISTICS

This Environmental Assessment and ATF-CDUA requests the use of the Conservation Land, Resource Subzone by UH-Mānoa for the purposes set forth by the Lyon Arboretum's mission and including the activities cited for violations which aid the Arboretum in its functions. This action will allow UH-Mānoa to protect, preserve, and perpetuate the natural and cultural resources of this area, and allow them to be used for educational, recreational, and scientific purposes on a controlled basis. This Environmental Assessment and ATF-CDUA evaluates the impacts of the activities and uses cited for violations and other routine ongoing activities for an after-the-fact approval from the BLNR for:

- The structures constructed after 1964.
- Unauthorized renovations of cottages and wood workshop/garage; and
- Specified unauthorized landscaped features.

By approving this request, the BLNR will allow for the continued use of these features and activities by the Arboretum and resolve existing violations.

2.6.1 Technical Characteristics

Technically this action will allow UH-Mānoa to:

- a. Establish, develop, operate, and maintain for the benefit of the people of Hawai'i an educational and scientific center in the form of a tropical botanical garden/Arboretum designed especially for the preservation of plants of the Hawaiian mesophytic and lowland rain forests, varieties of traditional Hawaiian ethnobotanical plants, and rare and endangered species of global nativity, and other plants of botanical interest in an area naturally suited to their cultivation.
- b. Maintain for the purposes of research and education a natural area of approximately 193.5 acres for the preservation of the flora and fauna native to the area.
- c. Provide a beneficial facility which will contribute to the education, instruction, and recreation of the people of Hawai'i; and instruct them in the purposes of this site.
- d. Construct the infrastructure needed to support Lyon Arboretum.
- e. Submit final construction plans for the necessary infrastructure as funding becomes available, rather than at the issuance of the CDU Permit.
- f. Provide the public, on a controlled basis, a chance to experience the educational, recreational, and research opportunities available at the Lyon Arboretum.
- g. Manage the 193.5 acres of the Lyon Arboretum in a manner that will be most beneficial for the native biota, through an active effort to control the most noxious of the alien plants and herbivores.
- h. Protect, preserve, and study the 'Aihualama Stream; and to use the stream as an educational tool to instruct the public about fragile balance which exists in Hawaiian Streams.
- i. Stabilize, protect, preserve, and study the archaeological sites within the Lyon Arboretum; and to use these sites as educational tools.
- j. Continue limited commercial activities that provide income to support Arboretum activities and promote its continued use as a community facility.

- k. Remove alien and weedy species to aid in eco-system restoration, protect and add to existing plant inventories and maintain existing garden areas.
- l. Ex situ conservation of exotic tropical plants now endangered or extinct in their own habitats.
- m. Manage the substantial systematic collections built up over many years.

2.6.2 Economic Characteristics

The proposed action will have a small, but positive, impact on the economy of O'ahu. The Lyon Arboretum provides job opportunities. As the Lyon Arboretum continues to become established and recognized throughout the world, it is possible that tourists will be drawn to O'ahu, or may extend their stay on O'ahu in order to see the Lyon Arboretum. This action could slightly increase revenues for hotels, restaurants, rental cars and other tourist related services, and thus have a small positive impact on the economy of O'ahu and the State as a whole.

Other economic effects include payroll for staff, extramural funding for research programs, possible royalties related to research, and benefits of the Arboretum plant sales to the local plant nursery business.

2.6.3 Social Characteristics

The proposed action would have the following social characteristics:

- a. The on-site educational programs offered at the Lyon Arboretum will increase the public's awareness of the fragility of our natural and cultural resources, and stress the importance of preserving those resources for future generations. These programs could have far reaching impacts in increasing the public's awareness and attitude toward protecting our natural and cultural resources.
- b. The recreational opportunities available at the Lyon Arboretum have been planned to accommodate all kinds of visitors. Facilities and tours will be able to accommodate visitors with children as well as the handicapped, the elderly, and those unable to walk around the Arboretum.
- c. The Lyon Arboretum will and has provided the setting and impetus for the establishment of a volunteer organization that is drawn from the local community. It is hoped that this organization will continue to be a valuable asset to the Arboretum by continuing to provide help in the running of the Arboretum's operations and programs.

The ATF CDUA seeks to obtain the necessary approvals to allow these existing commercial activities and other similar activities to continue in the future.

2.6.4 Environmental Characteristics

Environmental characteristics include the following:

- a. 193.5 acres of land in the Mānoa Valley of Honolulu, O'ahu will be protected from adverse usage.

- b. This area will be managed for the benefit of the native Hawaiian organisms living there, as well as to preserve and perpetuate the natural beauty of this magnificent area.
- c. The aquatic environment of 'Aihualama Stream will be maintained, while its study will further enhance our limited knowledge about the fragile balance that exists therein.
- d. The archaeological sites located within this area will be protected, preserved, stabilized and studied. This will add to our limited knowledge about the colonization and utilization of this area by the ancient Hawaiian people.
- e. The "lower grounds" of the Lyon Arboretum will be managed as a botanical garden of tropical plants, and will be used for cultivation of native Hawaiian plant species, especially the rare and endangered species native to the mixed mesophytic forest and the lowland rainforest.
- f. Approximately 160 acres of land will be used as a research section.
- g. Approximately 10 acres of land will be managed as a native forest restoration area.
- h. The public will have controlled access to the Lyon Arboretum through the Arboretum's entry kiosk and visitor center. The visitor center will provide the public unique educational, recreational, and research opportunities while protecting this fragile area from being exploited and over utilized.
- i. Infrastructure to support the operations of the Arboretum will be constructed in a manner that will not impact the natural and cultural resources of Mānoa Valley.
- j. The Arboretum will preserve its immense resource of worldwide tropical flora, collected and planted over nearly 80 years. In the future this Arboretum of diversity is expected to grow.
- k. The proper maintenance of the Arboretum will enhance its function as a buffer and transitional critical habitat of the native and endangered 'Elepaio.

2.7 PRELIMINARY COST ESTIMATE

The necessary renovations for the Lyon Arboretum to be in compliance with health and safety standards have been categorized as Priority 1 and Priority 2. The Priority 1 category includes the replacement of the existing cesspool serving Cottages A & B with a septic tank; renovation of the Cottages A, G, and H; electrical upgrades; and ADA upgrades. The cost estimate for the septic tank is \$98,000. The cost estimate is \$950,000 for the renovation of Cottages A, G, and H. The cost estimate for the electrical upgrades for Cottage A, G, and H is \$162,000. The ADA Upgrades are estimated to cost \$90,000, totaling an estimate of \$1,300,000 for the Priority 1 category.

The Priority 2 category includes renovations of Cottages B, C, D, E, F, the Storage Shed and Work Shed; electrical upgrades; and parking and roadway upgrades. The cost estimate for the renovations of Cottage B, C, D, E, F, Storage Shed, and Work Shed is \$920,000. The cost estimate for the electrical upgrades to the cottages is \$112,000. The parking and roadway upgrades are estimated to cost \$225,000, totaling an estimate of \$1,257,000 for the Priority 2 category.

The total estimated cost for both Priority 1 and Priority 2 is \$2,557,000. See Appendix H for further information regarding the preliminary cost estimate for the Lyon Arboretum renovations.

SECTION 3.0

Affected Environment

3.0 AFFECTED ENVIRONMENT

3.1 LAND USE

The Lyon Arboretum is currently being used for botanical and horticultural research, recreational hiking activities, and instructional purposes as part of the University of Hawai'i. The subject site is situated within the State Land Use Conservation District, as displayed by Figure 3-1. According to the Land Study Bureau Detailed Land Classifications, the area has been classified for "Conservation" type uses and is located in the Resource "R" subzone.

The subject property is designated as "P-1: Restricted Preservation" by the City and County of Honolulu's Zoning Code, as displayed by Figure 3-2.

The City and County of Honolulu's Primary Urban Center Development Plan Land Use Map designates the subject property as Preservation. Adjacent land uses include residential and preservation. Urban areas in proximity to the site include the commercial and residential district of Mānoa and the University of Hawai'i Campus.

The site is located inland and is not included within the Special Management Area established by the City and County of Honolulu to administer the Coastal Zone Management (CZM) Program. Further relationship to land use policies and plans is described in Section 5.

3.2 CLIMATE

The Lyon Arboretum is located in the upper regions of the Mānoa Valley of Honolulu. Situated on the upper regions of the Ko'olau Mountains, Mānoa Valley is exposed to lower temperatures than the downtown area of Honolulu. According to the Soil Conservation Service (USDA, 1972), the average temperature at the site is 78° F (25.6° C) and can range between 52° and 90° F (11.1° and 32.2° C).

The upper regions of the Ko'olau Mountains receive a high amount of rain. The average annual rainfall is approximately 165 inches per year, with most rainfall occurring between December and April. Rainfall on these slopes is orographic in nature and result from the cooling of moisture-laden trade winds as they rise up the mountain slopes, as well as due to Kona (southerly) storms.

Northeasterly winds prevail much of the time throughout the state of Hawai'i. These trade winds vary in frequency. Often times they last for weeks on end. Other times they are virtually absent. This is the general result of the location of the North Pacific high pressure system. During the summer months, this system is larger, stronger and shifts farther to the north and produces stronger, more persistent trade winds. In the winter months, this high pressure system declines and shifts to the southeast at which time general wind patterns become weaker and more variable. Typical wind velocities range from 3 to 14 knots.

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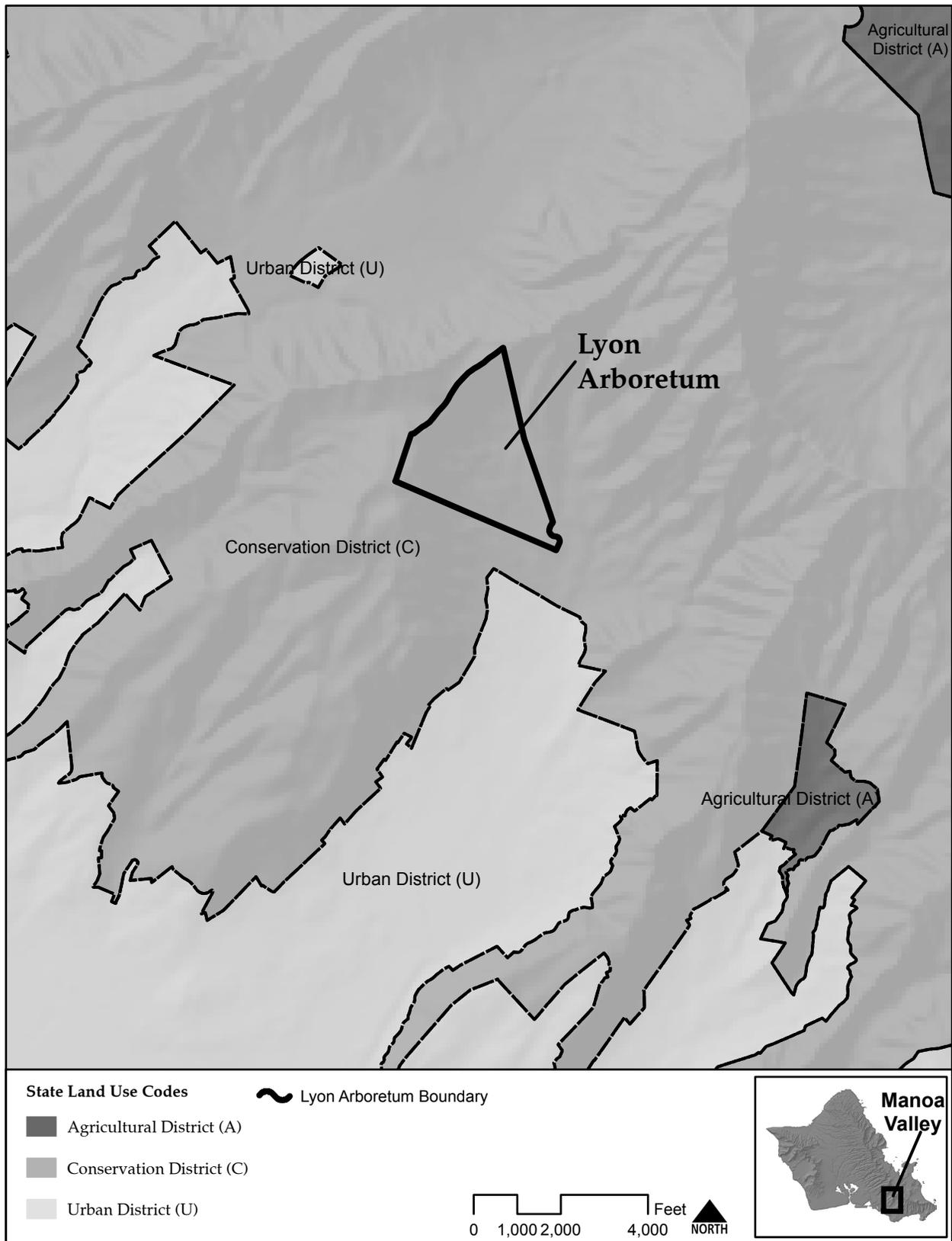


Figure 3-1: State Land Use Designations

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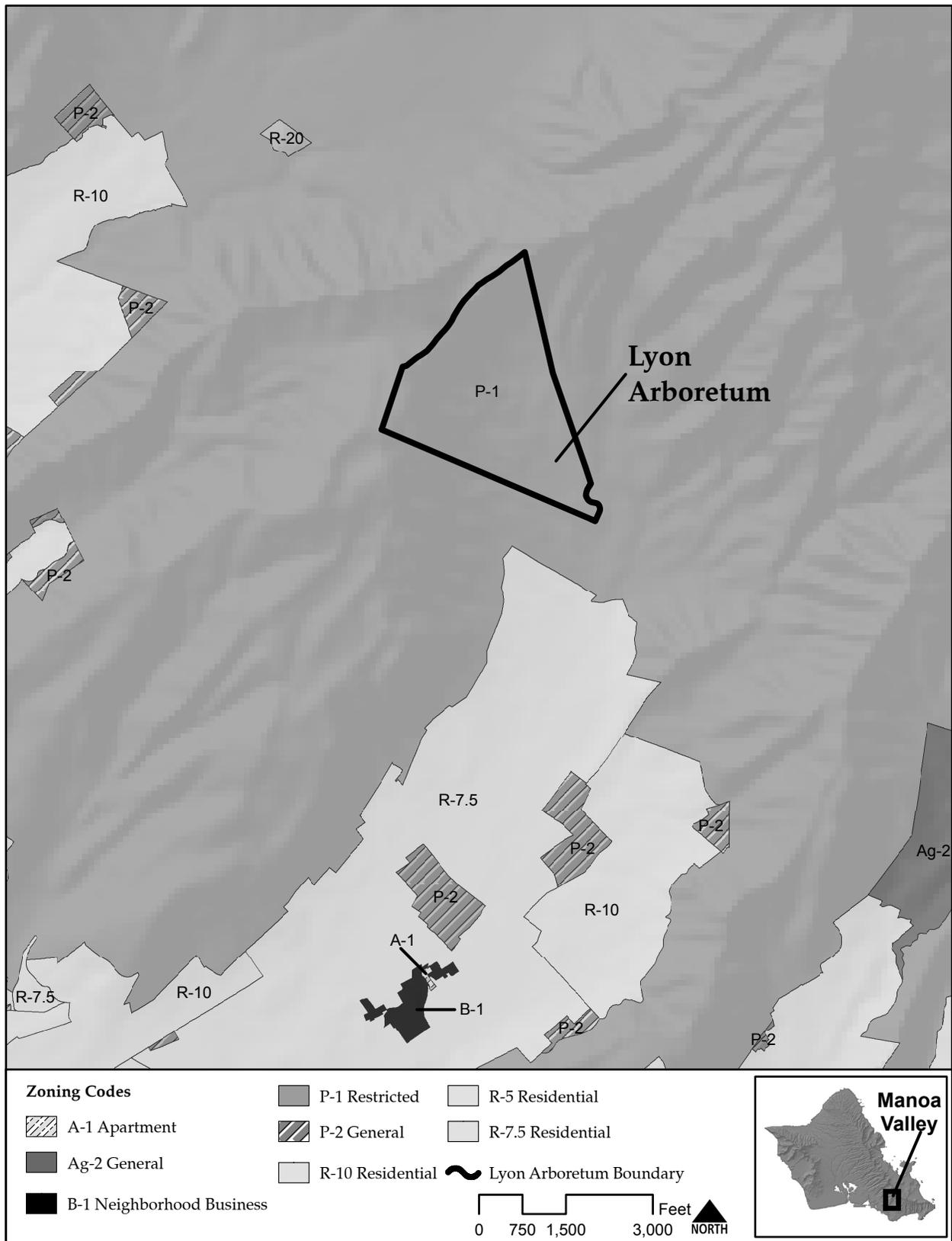


Figure 3-2: City and County of Honolulu Zoning

3.3 GEOLOGY AND TOPOGRAPHY

The Island of O'ahu is comprised of two major extinct volcanoes, Wai'anae and Ko'olau Volcano. The Lyon Arboretum is located in the mountainous area of Mānoa Valley situated on the southeastern slopes of the extinct Ko'olau Volcano of O'ahu. The valley was a result of a rejuvenated stage of eruptions, known as the Honolulu Volcanics, over 100,000 years ago. During the Honolulu Volcanics, many of the vents erupted through a coral reef that surrounded the island on the south side. The cinder cone of Mount Tantalus, Punchbowl (Puowaihu), and Rocky Hill (Punahou) were formed during this period. The other flows that erupted inland were funneled down valleys, such as Mānoa, thereby creating V-shaped valleys and steep ridges. The flows and ashes of the Honolulu Volcanics have high contents of sodium and potassium and low contents of silica.

The terrain of the site is relatively steep and the elevation rises rapidly from 450 to 1850 feet above sea level, as displayed by Figure 3-3. The area consists of very steep land broken by numerous intermittent drainage channels. The average slope ranges from 15 to 40 percent.

3.4 SOILS AND GRADING

According to Soil Survey of the Island of O'ahu (USDA, 1972), soils at the site belong primarily to the TAE (Tantalus silt loam, 15 to 40 percent slopes) and rRT (Rough Mountainous Land) classifications. As shown by Figure 3-4, the Tantalus series is found on the majority of the lower portion of the site, and the Rough Mountainous Land classification is located on the upper portion. The Tantalus series consists of well-drained soils that are moderately sloping to very steep, and were developed in volcanic ash and material weathered from cinders. On this soil, runoff is medium and the erosion hazard is moderate. The Rough Mountainous land (rRT) classification occurs in mountainous areas and is found on the upper portion of the site. The area consists of a very thin soil mantle which is relatively soft and permeable.

Other soils found at the perimeter of the site include the LoF (Loleka'a silty clay, 40 to 70 percent slopes) and HoB (Hanalei stony silty clay, 2 to 6 percent slopes) soil classifications. The Loleka'a silty clay is found on 40 to 70 percent slopes and occurs along drainage ways and on fans adjacent to the Ko'olau Range. Runoff is rapid, and the erosion hazard is severe. The Hanalei stony silty clay consists of poorly drained soils developed in alluvium derived from basic igneous rock. On this soil, runoff is slow and the erosion hazard is slight. Passive erosion control is conducted through planting ground cover, not removing trees in banks, and planting banyan trees (other than *Ficus microcarpa*) along actively eroding areas.

At the site, branches, leaves and other products of trimming/pruning are used as mulch under trees. Additional mulch is periodically donated by commercial landscape maintenance companies. Commercial potting soil is stored and used in the greenhouses. Mulching and some soil conservation are done. Weeds that are cut are stacked for soil development. When trails cross clearings, wind rows of brush are placed below the trails to prevent erosion and promote soil development.

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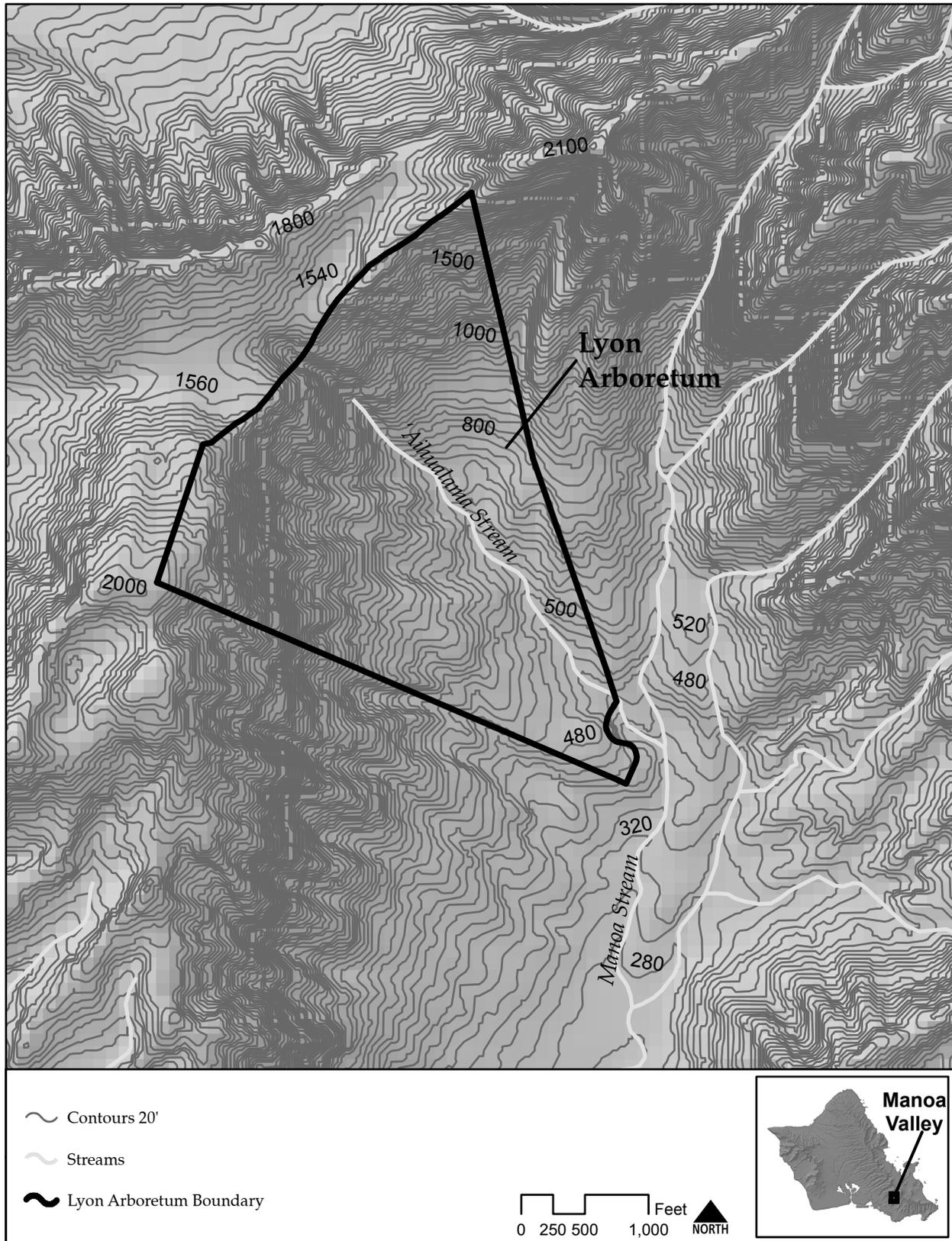


Figure 3-3: Topography and Streams

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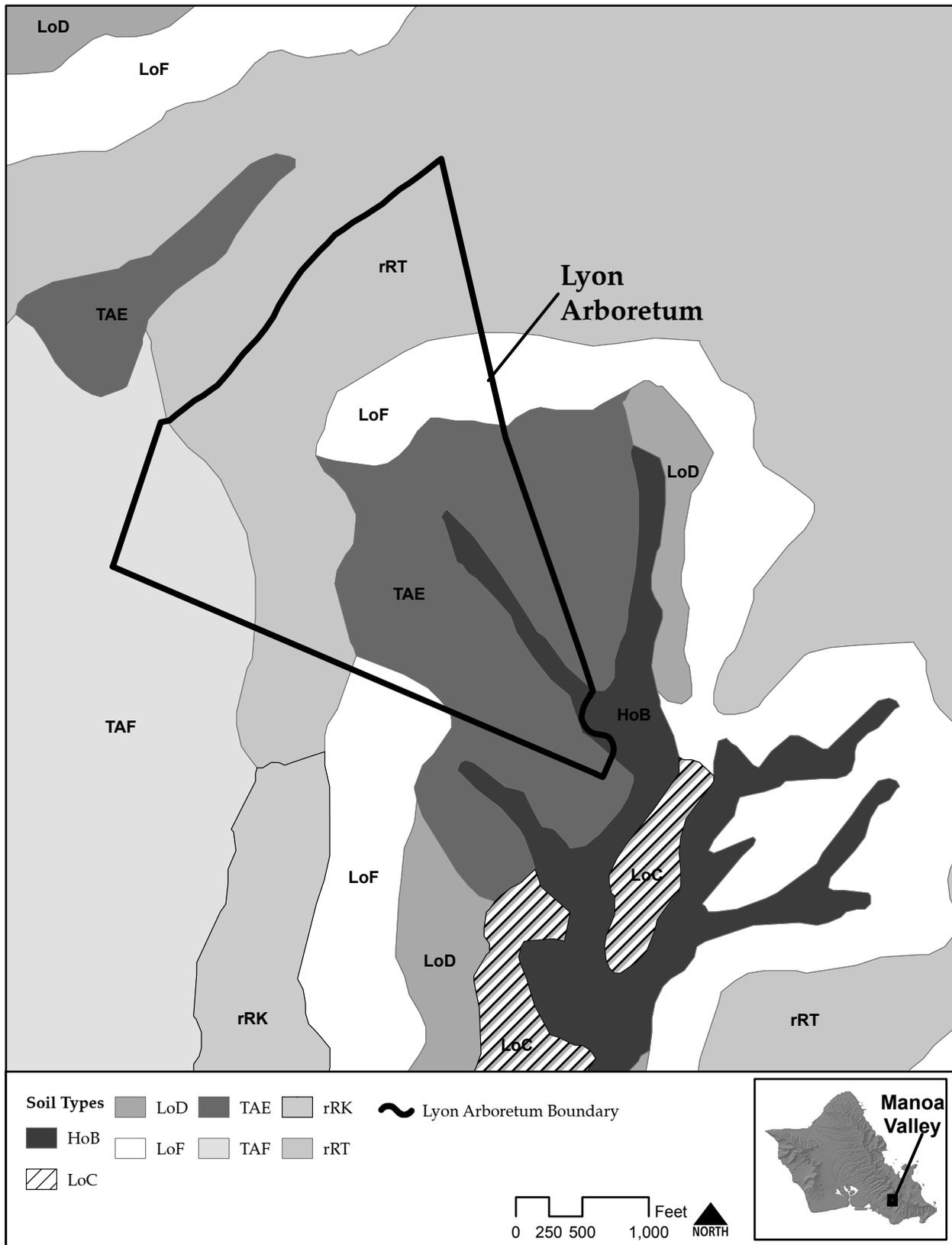


Figure 3-4: Soil Classifications

3.5 SURFACE WATER AND DRAINAGE

The 'Aihualama Stream is the major perennial stream located on the site, as displayed by Figure 3-3. The stream originates near the upper portion of the site and flows along the southeastern border of the site into Mānoa Stream. Eventually Mānoa Stream joins with Pālolo Stream and enters the Ala Wai Canal. The 'Aihualama Stream drainage basin is approximately 6 square miles and can generate a 100-year peak discharge of 2,500 cfs based on the Flood Insurance Rate Map (FIRM) for this area. Stream waters are vulnerable to point-source pollution (i.e., from a discrete or distinct source) and nonpoint source pollution (i.e., from a diffuse or widely spread, scattered, unconcentrated source) (COFP 2002).

Existing onsite storm drainage naturally drains southeast towards the 'Aihualama Stream. Various interceptor ditches, catch-basins and underground storm drain lines exist near the entrance of the site. Existing permeability on the site is good because of the vegetated landscape.

3.6 FLOOD HAZARD

The Federal Emergency Management Agency's Flood Insurance Rate Map (FIRM), Community Panel #15003 C 0360 F dated September 16, 1988, specifies flood hazards inundated by the 100-year flood with base flood elevations determined. The proposed project site is within the Zone X designation which is described as areas outside of the 500-year flood plain.

As previously noted the site of the Arboretum was selected by the HSPA partly for its condition as a landscape degraded by cattle grazing. Intentions included reforestation and erosion control. Due to the steep topography flooding is generally not a concern but erosion from heavy rainfall is another matter. This was demonstrated by the events of the recent October 2004 floods that ravaged the Mānoa Campus: The Arboretum suffered relatively minor damage though it is in a higher rainfall area: minor ponding and major rutting in sections of gravel access roads, and severe damage to the shoulder of those roads in two places. While it is of little consideration, the heavy landscaping probably mitigated some of downstream flooding that occurred in the Valley. Had this storm occurred when conditions in the back Valley were like they were in the 1920's, it is possible that the flood damage would have been even more severe.

3.7 FLORA

Surveys of plant diversity, fungal diversity, micro-organisms, birds, insects, invasive species, and other kinds of surveys are fundamental activities of the Arboretum. In conjunction with the functions of the Arboretum, thousands of trees have been planted in experimental and display plots in the lower grounds and research sections. In addition, understory plants accessioned into the Arboretum collections have been planted in ecologically appropriate locations in the lower grounds and research sections. Native trees and other plants have been planted in several sections of the lower grounds, research section, and native forest section.

Trees and shrubs are pruned as needed and as allowable by staffing and resources. Although Director Gillette planned to remove large albizia trees in the 1960's for safety reasons, they have yet to be removed. These are now so large that they will be quite expensive to eliminate. Albizia trees that are distributed over much of the lower portions of the research section and around the edges of the lower grounds have become quite large. Some of these trees are now becoming hazards as they break due to storms and due to loss of internal structure.

The natural vegetation at the site has been enhanced by the current operations of the Lyon Arboretum. Prior to the installation of the Arboretum, the vegetation on the site was devastated by free-ranging cattle and alien grasses. In 1918 the site was designated as a forest-restoration project site by the Hawaiian Sugar Planter's Association Experiment Station (HSPA) and used for sugar cane and vegetation experimentation projects. Then, in 1953 the site was obtained by the University. Since then, the University has used the site as a horticultural and botanical resource and has introduced over 2,000 ornamental and economically useful plants to the grounds. Today, the Arboretum serves as a center for the rescue and propagation of rare and endangered native Hawaiian plants.

The Arboretum's major emphases are tropical plants, native Hawaiian plants, conservation biology, and Hawaiian ethnobotany. The garden layout includes a fern valley, banyan trees, Hawaiian ethnobotany garden, Hawaiian ecosystem plants, spice garden, economic botany section, tropical palms and garden plants section, and a native forest restoration area. Some of the State of Hawai'i's designated "exceptional" trees are found at the Arboretum, including the Australian kauri pine, the sweet hoop pine, and sealing wax palm.

No new agriculture is practiced in the Arboretum. Lo'i on the west side of 'Aihualama Stream are modified from HSPA sugar terraces while those on the east side are from ancient Hawaiian terraces. Lo'i on the west side have been used for taro, ko, 'uala, mai'a, etc. in recent years while the lo'i on the east side have been minimally reopened but not yet replanted.

Throughout the Arboretum, some species of invasive trees are a chronic problem. These include *Falcataria* (Albizia), some banyans, *Cecropia*, *Heliocarpus*, *Macaranga*, *Schefflera*, *Cinnamomum*, *Ardisia*, *Citharexylum*, and *Trema*. Since these trees interfere with the research collections they are regularly trimmed or removed. These have been of particular concern when they are found invading native forest in the restoration section. Alien trees have been removed when a) hazardous, b) interfering with power lines, facilities, research plantings, c) preventing growth of native plants, d) when resources and staffing allow.

3.7.1 Hawaiian Plants

Threatened or Endangered plants: 130 species of plants native to the Hawaiian Islands are recognized as threatened or endangered by the U.S. Department of Interior. Arboretum programs in tissue culture and seed storage are helping to bring these species back from the edge of extinction. Samples of these rare plants grown in the greenhouses and nursery are planted out in the Arboretum grounds, offering unusual glimpses of past environments.

Hawaiian Ethnobotany: Ancient Polynesians settled the Hawaiian Islands almost 2000 years ago. Over 40 species of plants that were brought from the area of Polynesia were able to survive

in the climatically drier and cooler Hawaiian environments. Upon arrival, many plants were encountered that are found in other parts of the Pacific or have very similar looking relatives in other parts of the Pacific. Uses of these plants were thus transferred. Over the last 2000 years, Hawaiians have learned through careful observation, experimentation, intuition, and dreams about uses for many native species that had not been previously encountered elsewhere. The Arboretum has one of Hawai'i's largest collections of plants that helped to shape Hawaiian culture and were subsequently shaped by Hawaiians.

Hawaiian Crops: Bananas, Kava, Sweet Potatoes, Taro, Coconuts, Breadfruit, and Ti are among the crops that ancient Polynesians brought to the Hawaiian Islands. In each case, multiple varieties were probably introduced of each with genetic differences making some more suitable to one place or another and providing variety in the diet. The Arboretum has one of the most diverse network collections of Hawaiian crops. The Arboretum includes varieties that are better adapted to wet environments. The 'awa (kava) collections are the largest of their kind representing all of the known Hawaiian varieties.

3.7.2 Monocots

Araceae (Aroids): Over 1800 accessions (455 species in 53 genera with about 340 varieties) of edible and ornamental aroids growing as vines, ground cover, or erect plants are scattered throughout the Arboretum. Exceptional plants that can be seen in the Arboretum include *Epipremnum*, *monstera*, many kinds of taro, *Aglaonema*, and *Xanthosoma*

Palms (Arecaceae): The Arboretum has one of the world's largest living collections of palms and rattans with 1900 accessions (650+ species in 150 genera). Palms are among the most important plants to tropical cultures with most having numerous uses as foods, clothing, building materials, medicines, and craft materials.

3.7.3 Zingiberidae

Bromeliaceae (Pineapples and Air-plants): Over 400 accessions (120 species in 20 genera with about 200 varieties) of epiphytic and epilithic air-plants as well as agricultural varieties of pineapples are grown in the Arboretum. Some of these are on display in and near the gift shop while others are to be found scattered and in mass plantings throughout the grounds.

Musaceae (Bananas): Many wild banana species exist, but their numerous, hard seeds prevent us from eating them. Edible bananas and plantains (cooking bananas) are diploid, triploid and tetraploid hybrids without seeds. Ancient Polynesians introduced bananas to the Hawaiian Islands and subsequently developed three major lineages of traditional varieties.

Strelitziaceae (Bird of Paradise): This small group of banana-like plants consists of only 3 genera, each of which is found in the Arboretum. Among these are 1) Two species of bird of paradise (*Strelitzia*) from South Africa, pollinated by sunbirds; 2) the traveler's tree (*Ravenala*) of Madagascar, pollinated by lemurs; and 3) *Phenakospermum*, from northern South America, pollinated by bats. These beautiful plants are commonly focal features of local landscaping.

Heliconiaceae (Heliconias): The Arboretum is a very active conservation center for the

Heliconia Society International, which is interested in all eight families of the Zingiberales. The Arboretum's large collection of 430 accessions of Heliconia consists of 120 species, and 170 variations on those species. The collection was the starting nucleus for the Societies global conservation efforts and remains as a principle repository of biological diversity. Most heliconias are tropical American and are pollinated by hummingbirds (which are not found in Hawai'i), but some western Pacific and Southeast Asian species are pollinated by bats.

Lowiaceae: The Arboretum has four species of this small, little known family of only one genus (*Orchidantha*).

Zingiberaceae (Gingers): Polynesians introduced two gingers - `awapuhi kuahiwi or shampoo ginger (*Zingiber zerumbet*) and `olena or turmeric (*Curcuma longa*). The Arboretum now has 1200 accessions of ginger, with 349 species in 37 genera, some of them used for food or medicine. Arboretum researchers have developed improved hybrids of *Alpinia* and *Hedychium* and have also worked to combat problems with weedy species of gingers.

Costaceae (Spiral gingers): Our spiral ginger collection consists of 193 accessions, with 72 species in 4 genera. Although most are beautiful, some can be quite weedy. The true flowers of many are edible.

Cannaceae (Cannas): Only one genus and a few species comprise this family. Horticulturalists have been fond of this plant, breeding many showy hybrids. Some of these hybrids are on display in the Arboretum's collections.

Marantaceae (Prayer plants, West Indian Arrowroots): The Arboretum includes over 500 accessions of 205 species in 25 genera as one of the world's largest collections. Most of these prayer plants are grown for their patterned foliage, although some have colorful inflorescences. Several hybrids have been developed at the Arboretum which combine the patterned leaves with showy inflorescences.

3.7.4 Dicots

Ficus (Moraceae): The Arboretum has 308 accessions of figs including 118 species. Figs are among the most commonly recognized trees on the earth. All major religions include examples of figs as metaphors of various truths. The stories of figs and humans must be quite ancient and certainly are rich. Scattered throughout the Arboretum are fig trees, bushes, vines, and epiphytes (strangling figs) each with a story to tell about gods, spirits, ancient heroes, and the ways to live ones life.

Ornamental Hibiscus (Malvaceae): Among the best recognized symbols of Hawai'i is the Hibiscus. Native Hawaiian Hibiscus are bushes or small trees with red, orange, pink, white or yellow flowers, while many of the more famous introduced species and varieties are red or orange. The University of Hawai'i and the Arboretum have long been a center for production of unique hibiscus hybrids. In fact, many of the hibiscus flowers so commonly seen in Waikiki or in the yards of local families were first produced on the University of Hawai'i campus. The development of new varieties and DNA research using the Hibiscus collection at the Arboretum is ongoing.

3.8 FAUNA

The rough mountainous land supports wildlife habitats. As the Arboretum forest has grown and become more ecologically complex through the introduction of research species, the numbers and diversity of birds has increased. According to the U.S. Fish and Wildlife Services (USFWS) the Arboretum is located within a critical habitat boundary for the 'Elepaio, *Chasiempis sandwichensis*, a native Hawaiian bird of the Muscicapidae Family. The 'Elepaio is not commonly seen, but it is found in the forests on O'ahu and is a candidate for listing as Endangered. Figure 3-5 displays the designated critical habitat for the 'Elepaio. The most common birds found on the site are Cockatoos, Mynas, White-rumped Shama thrushes, Mejiro (Japanese white-eye), Common waxbills, Northern cardinals, Brazilian cardinals, bulbuls, doves, house finches and sparrows. The most-often seen endemic Hawaiian bird in the Arboretum is the 'amakihi.

Invasive pigs have become episodic problems with periods of time when the pigs destroy parts of the research collections. Hunters have been periodically brought into the Arboretum to deal with the pigs but because there is no fence, pigs are able to easily reenter the Arboretum from any of the adjacent properties.

Despite introductions of species of bromeliads and other plants known to serve as breeding sites for mosquitos, mosquito densities have not noticeably increased. However, changes in other insects have been noted with dramatic increases in kinds and numbers of ants and decreases in numbers of paper wasps.

3.9 AIR QUALITY

Ambient air quality is regulated under the Clean Air Act. The U.S. Environmental Protection Agency (USEPA) established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants as a measure of ambient air quality. These six criteria pollutants include carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, ozone, and particulate matter less than or equal to 10 micrometers. In addition, the State of Hawai'i established standards for carbon monoxide and nitrogen dioxide that are more stringent than federal standards as well as an additional ambient air standard for hydrogen sulfide (HIAAQS).

In the State of Hawai'i, both federal and state environmental health standards pertaining to outdoor air quality are generally met due to prevalent trade winds and the absence of major stationary sources of pollutant emissions. The air quality monitoring in closest proximity to the Arboretum is the State of Hawai'i Department of Health's University air quality monitoring station. The monitoring at the University, reported no incidences of exceeding state or federal ambient air quality standards during the year 2003. According to the State of Hawai'i Department of Health's 2003 Annual Summary of Hawai'i Air Quality Data, the State is in attainment for all federal ambient air quality standards (DOH, 2003). A residential character and the relative absence of stationary pollutant sources in the area presumably keep air quality around the site at levels considered good (i.e., well within the air quality standards).

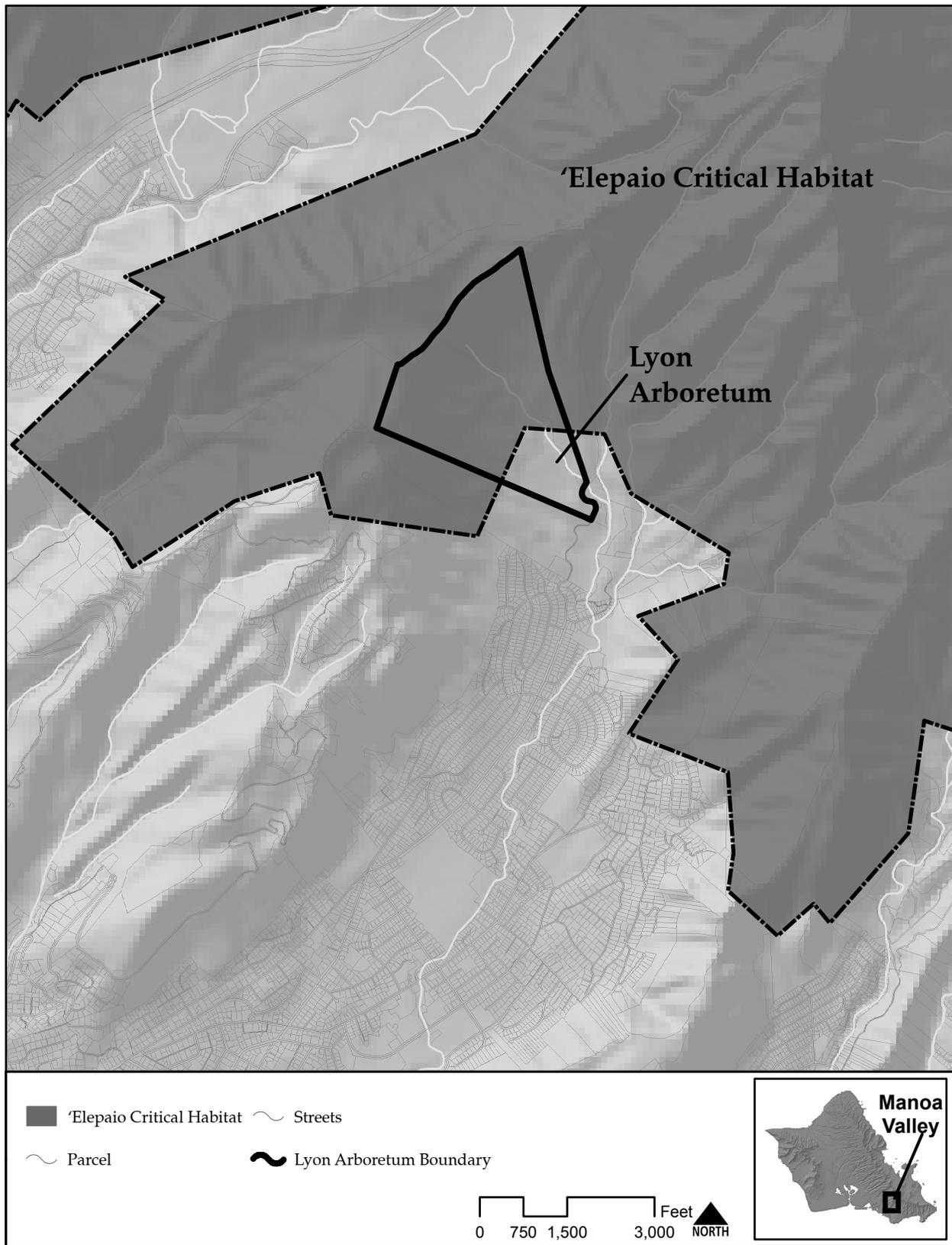


Figure 3-5: 'Elepaio Critical Habitat Designation

3.10 ARCHAEOLOGICAL RESOURCES

Only brief archaeological surveys have been conducted. Recorded archaeological sites that are present include at least 16 lo'i walls, one small heiau or large 'ahu, several smaller 'ahu which are possible burial sites. Brief surveys of several locations at the Arboretum were conducted in 1984, 1987, and 2002. A certified archaeological survey has not been identified in Arboretum records but is needed. Ancient lo'i terraces in the land section of `Aihualama Stream on the grounds of the Arboretum have been identified. A restoration of a portion of these lo'i, for the purposes of cultural perpetuation and education has begun under a partnership with Hālau Kū Mana New Century Public Charter School and be incorporated into the Hawaiian Ethnobotanical Garden. The lo'i are spring fed and should have little impact on stream flow. Work will concentrate in the first 3 or 4 lo'i below the spring. Restacking of walls will be necessary, but will not be done without an archaeological survey. Figure 3-6 displays the first 2 of the 16 walls in the lo'i restoration area below the stream. More walls exist mauka and makai of these. Figure 3-7 displays the location of the lo'i restoration area at the Arboretum.



Figure 3-6: Archaeological Site of Lo'i Restoration Area at the Lyon Arboretum, 2004.

Map of Lyon Arboretum

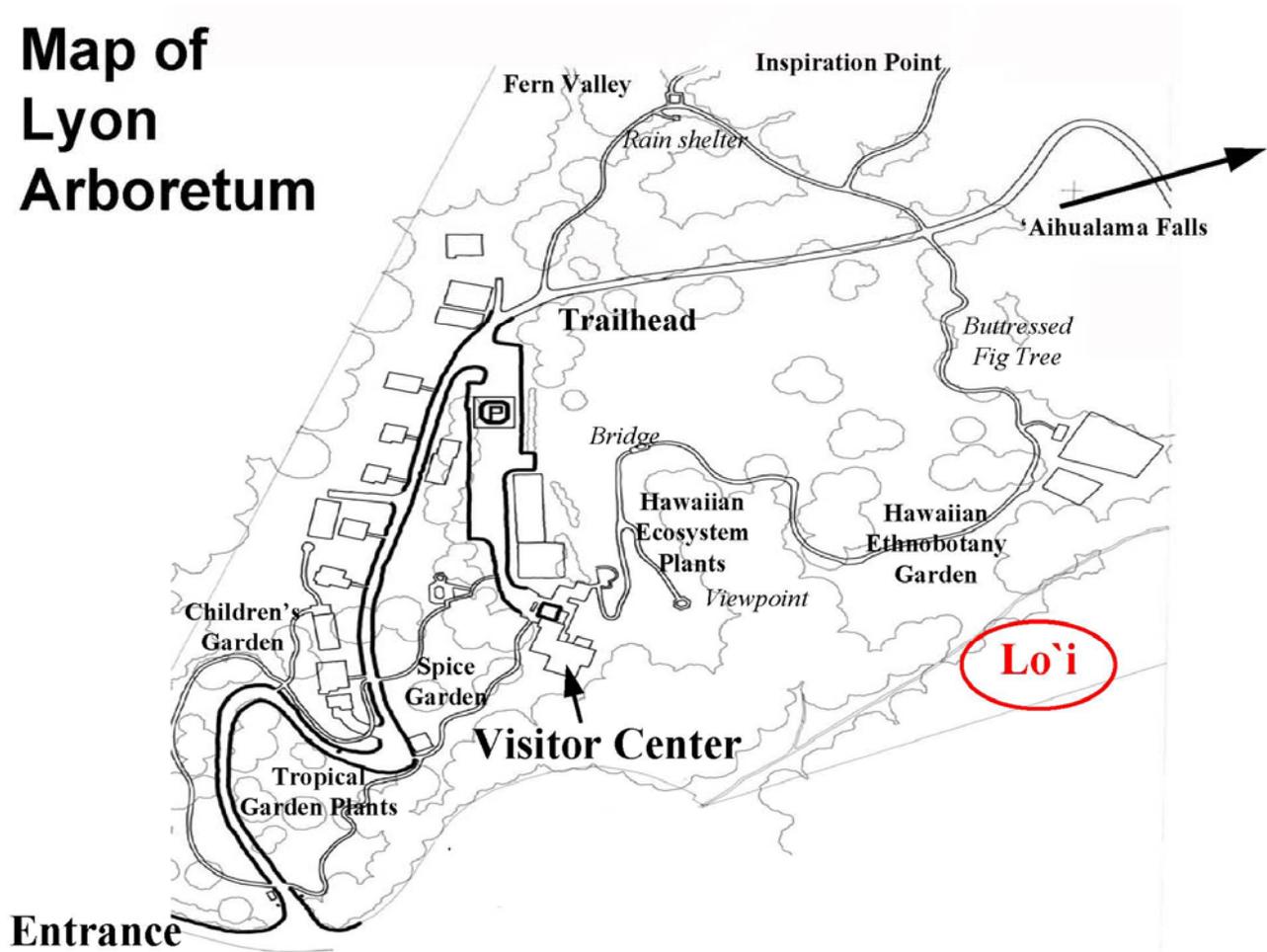


Figure 3-7: Map of Lo'i Restoration Area

The ancient lo'i located along the east side of 'Aihualama Stream have been only loosely maintained as adjacent large banyan trees have grown large enough to shade them. Periodic, limited efforts have been made to reopen these through removal of branches of adjacent trees and removal of smaller weedy trees to the south of the lo'i. Ditches that had been constructed to drain the lo'i have not been maintained, while small efforts have been made to restore old lo'i walls and 'auwai. Once functioning, this lo'i would also be used as a tool to demonstrate traditional resource management methods of the ancient Hawaiians. It will function as an integral part of the education program which is "place-based" and "culturally relevant," and fits well into the Arboretum goal of becoming a "Hawaiian place of learning." It is believed that such work is the responsibility of the Arboretum, as a stewardship of upper Mānoa Valley. The restoration will proceed with guidance from trained practitioners and approval from the State Historic Preservation Office and the Corps of Engineers.

3.11 CULTURAL AND HISTORICAL RESOURCES

Lyon Arboretum was established in 1918 by the Hawaiian Sugar Planters Association to demonstrate the value of watershed restoration, test tree species for reforestation and collect plants of economic value. The story of The Harold L. Lyon Arboretum is one of reconstruction. What is now Lyon Arboretum started in 1918 as a forest-restoration project by the Hawaiian Sugar Planter's Association Experiment Station (HSPA) on land that was denuded by cattle. The HSPA acquired 124 acres of land and put Dr. Harold L. Lyon, a young botanist from Minnesota, in charge. Dr. Lyon brought in and planted some 2,000 or so tree species on the grounds. The facility came to be known as the Mānoa Arboretum.

In 1926, the Lyon Arboretum Annual Report discussed a restoration strategy for the land: "A series of drainage ditches has been cut through the ancient taro patches lying on the eastern side of 'Aihualama Stream. In digging these ditches, numerous, well-preserved stumps of large coconut palms were found buried in the muck, showing that coconuts once grew in this valley. It is proposed to drain this land to a point where it will no longer supply breeding places for mosquitoes, which have always been very plentiful in its vicinity. We shall eventually plant it up with trees and shrubs or use it for nursery purposes as our work in the Arboretum progresses." (Lyon Arboretum Annual Report, 1926). See Figure 3-8.

Dr. Lyon persuaded the HSPA to convey the Mānoa Arboretum to the University of Hawaii in 1953, with the provision that the facility must be used as an Arboretum and botanical garden in perpetuity. When Dr. Lyon passed away in 1957, the Board of regents renamed the facility the Harold L. Lyon Arboretum in honor of the man who founded it and nurtured its growth for nearly four decades. Today, a bronze plaque in the upper part of the Arboretum commemorates Dr. Lyon.

After the University took over, the emphasis shifted from forestry to horticulture. During the last thirty years nearly 2,000 ornamental and economically useful plants have been introduced to the grounds. More recently the Arboretum has dedicated itself to becoming a center for the rescue and propagation of rare and endangered native Hawaiian plants.

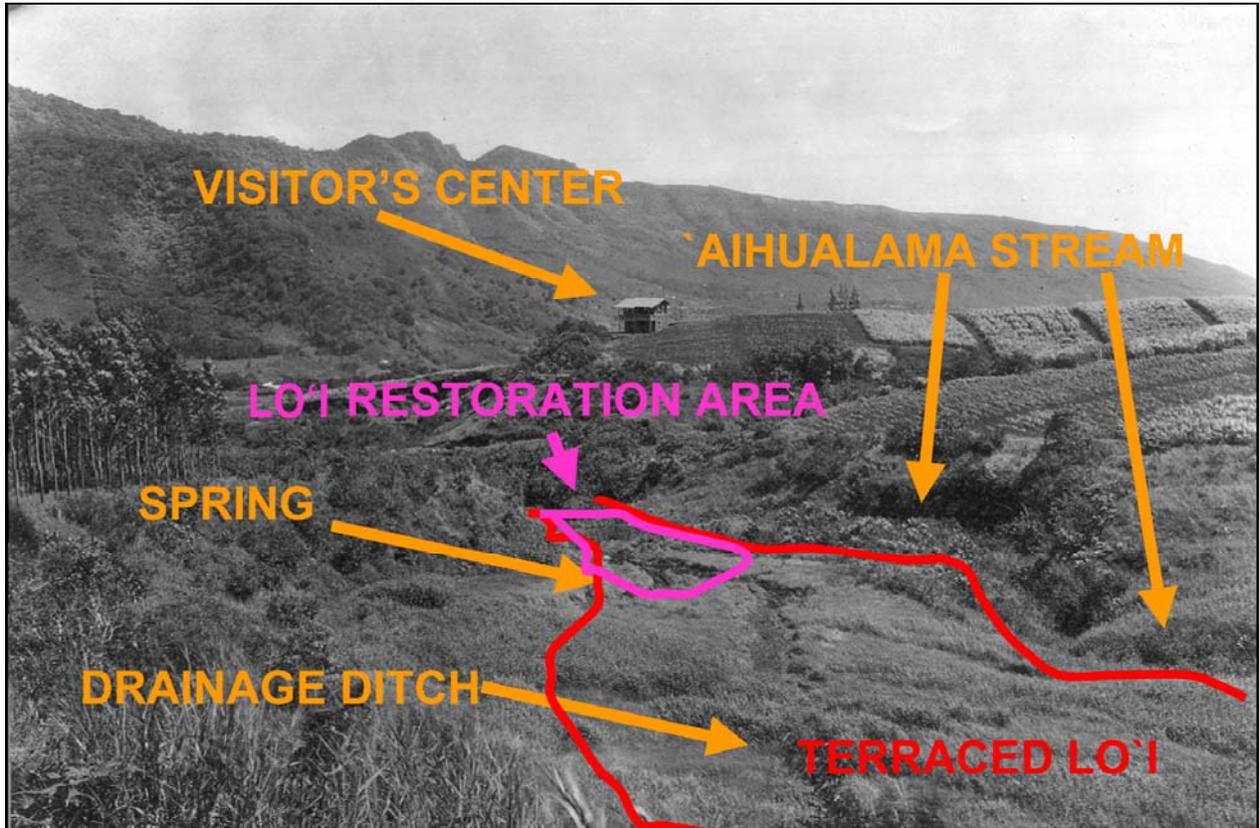


Figure 3-8: Historical Perspective from the Lyon Arboretum Annual Report, 1926.

3.12 SOCIO-ECONOMIC CHARACTERISTICS

Mānoa is a suburban area of Honolulu located 5 miles mauka outside of Waikiki. According to the 2000 U.S. Census Data, approximately 7,398 residents live in the Mānoa and Upper Mānoa Census Tracts. The Census data reports 2,731 households and 2,043 families in the area. Mānoa also consists of the University of Hawai'i campus, which has an additional resident population of 4,553. Approximately, 34,000 visitors each year participate in classes, research projects, other community activities, or simply wander the grounds enjoying the beautiful plant displays. As a branch of the University of Hawai'i, the Arboretum also serves as a center for educational activities on plants, arts, culture, geography, and a range of other sciences. In addition, several community organizations use the Arboretum as their base of operations including Hui Hana, Garden Club of Honolulu, and the Lyon Arboretum Association. Through these organizations and others that periodically use the facilities, the University is able to regularly interact with a broad cross-section of the local community.

A mix of activities employs Mānoa residents ranging from the University of Hawai'i educational industry, service industries, wholesale and retail trade, government, diversified agriculture, manufacturing and construction. The University of Hawai'i has grown tremendously academically and demographically. The Arboretum serves as an educational, community, and tourist industry asset. With continued growth projected for the University of Hawai'i and in tourism industries, demands for unique and multi-functional facilities, such as the Arboretum, will continue to grow in Hawai'i.

Major public facilities located within proximity of the proposed site include the University of Hawai'i at Mānoa campus, University of Hawai'i Lab School, Hanahau'oli School, Mānoa Elementary School, Noelani Elementary School, Washington Intermediate, Roosevelt High School, Mānoa Public Library, Mānoa Police and Fire Station, and Kapiolani Women and Children's Hospital. Other private educational facilities located in Mānoa include Pūnahou School, Mid-Pacific Institute School of the Arts, and Saint Francis Academy. In addition to schools many churches are located in Mānoa, including the St. Theresa, Hongwanji, and others.

Mānoa Valley primarily consists of residential neighborhoods. Public housing facilities in Mānoa consists of an elderly public housing facility, located next to Mānoa Field, and University of Hawai'i faculty housing, located along Woodlawn. Commercial areas in the valley include the Mānoa Marketplace, the commercial zone of shops and restaurants along Mānoa Road, and the Mānoa Innovation Center. The Salvation Army, Wai'oli Tea Room and Mānoa Theatre are additional venues in Mānoa. Paradise Park, a commercial visitor attraction adjacent to the Arboretum has been closed for many years.

3.13 VISUAL RESOURCES

The project site is located on the edge of a developed urban residential neighborhood on conservation land. The existing residential views consist of the surrounding conservation open space and of the Mānoa residential community, as displayed by Figures 3-9 and 3-10. The view of the entrance to the Arboretum is displayed by Figure 3-11. The existing Cottages and facilities blend in with the natural environment of the Arboretum, see Figures 3-12 and 3-13.



Figure 3-9: Aerial Photo of Lyon Arboretum.



Figure 3-10: Aerial Photo of Lyon Arboretum and Mānoa Residential Community.



Figure 3-11: View of Lyon Arboretum Grounds.



Figure 3-12: View of Entrance to Lyon Arboretum.



Figure 3-13: View of Cottage A.



Figure 3-14: View of Cottage F.

3.14 UTILITIES

3.14.1 Water System

The Mānoa area is served by the Honolulu Board of Water Supply. Water service is currently available on the property. 95% of Honolulu's water comes from underground aquifers. Water pipes connecting the 'Aihualama Stream collection tank to parts of the research area and lower grounds near the jeep trail have been replaced with new polyethylene pipe. City water has been plumbed from the cottages to several locations in the lower grounds for watering of plant collections. Indoor plumbing systems have been maintained with hook-ups to the City water supply.

3.14.2 Wastewater System

The majority of residences in Upper Mānoa rely on individual cesspools and septic tanks. Honolulu has 6 plants for secondary treatment of waste water using national method of treating. As parts of the sewer system have become faulty they have generally been replaced but not removed. There are several abandoned injection wells and sewer pipes that have been functionally replaced by placement of new pipes and injection wells nearby.

The municipal wastewater system currently does not serve the subject property. Septic Tank File #3662, a treatment individual wastewater system (IWS) is listed for TMK: (1) 2-9-055:006 by the State of Hawai'i Department of Health. Formerly sewage was deposited in injection wells with one for every one or two cottages. Fewer injection wells are now available with several being abandoned and no longer maintained. The new Cottage H septic tank drains into the old cesspool, which is functioning as a leach field. Since, there is no municipal system, all generated domestic wastewater is treated and disposed of via IWSs. The University is currently reviewing waste water system improvement needs and will be making improvements to the septic after the evaluation. The use of treated water for irrigation and other nonpotable water purposes will be strongly considered. The State Department of Health should be contacted for wastewater disposal regulations and approvals.

3.14.3 Electrical and Telephone

On the property, there are existing Hawaiian Electric Company (HECO) power lines. Electrical systems have been maintained although most buildings still include some wiring that is out of date.

The telephone system in the Arboretum has been maintained and upgraded to provide service to each cottage and the main greenhouse. Internet fiber optic cables have been installed and maintained for outside internet access and communication for Cottages E, F, G, and H. Antennas for wireless internet have been placed on the main greenhouse.

3.14.4 Drainage

The City and County of Honolulu storm drainage system serving the Mānoa area consists of a network of storm drainage pipes and culverts. Storm runoff collected by these pipes and culverts is either disposed of in sumps, drywells, injection wells, or the ocean. In general, the Arboretum landscaping facilitates percolation of rainwater into the ground. There is not an underground storm drain system, however there are some diversion trenches and pipes that move surface water past buildings or roads. These have been periodically cleaned of debris.

3.15 ROADWAYS AND TRAFFIC

The driveway entrance to the Arboretum is located at the end of Mānoa Road. Mānoa Road is one of the main connector roads in Mānoa Valley and is utilized by residents and visitors alike. The majority of the users are Mānoa residents traveling to and from work in Honolulu during normal business hours. Mānoa Road connects to Punahou Street coming from King Street and O'ahu Avenue coming from University Avenue.

Prior to 1964 all of the roads on the property and the current main entrance road and parking area were unpaved, composed of crushed coral and gravel. Underlying the crushed coral and gravel, at least in parts of the road, is a foundation of large stones. Original access to the Arboretum property followed a road that is now impassable in sections of the adjacent property. Access to the Arboretum has been almost exclusively via the main entrance road. The access road has been widened, paved, and drainage was placed where needed. The parking lot on the first Arboretum ridge was widened and paved. Other roads have not been significantly improved although drainage trenches and pipes have been installed along the jeep trail. The Arboretum does not have any bike paths or vehicular ramps.

Several pathways in the lower grounds area have been hardened with gravel that is considered to be safer than using grass covered paths or bare soil. Some of these gravel paths have been damaged by heavy rains.

Wooden pedestrian ramps are located on several of the cottages. The ramps are kept clean and some have skid-proof material applied to prevent falls. Cottage D does not have skid-proof material, and is slippery when wet. Each of the cottages has 1-3 sets of stairs that are maintained with handrails.

3.16 PUBLIC ACCESSIBILITY

Public access to the Arboretum grounds is controlled and the entrance to the Arboretum is gated. Presently, visitor hours are from 9 a.m. to 4 p.m. Monday thru Friday and closed on weekends and holidays. The Arboretum restricted weekend hours are temporary with the current after-the-fact permit violations situation. A kiosk, as shown by Figure 3-12, is located at the entrance of the Arboretum. The kiosk's intent is to provide information, control traffic flow, increase visitor safety, and collect donations. The kiosk also serves as a security measure to control the flow of visitors into the grounds, provide security for staff and plants, and prevent theft and/or vandalism at the Arboretum. The Arboretum grants accessibility to the lo'i restoration area for native Hawaiians and Hālau Ku Mana New Century Public Charter School.

The Arboretum has many miles of trails that vary in quality from easily accessible gravel pathways, to steep, narrow "pig trails". Trails are based on: former agricultural activity trails; access roads to houses; paths cut to older plant projects; and access to current collections of plants and are displayed by Figure 2-4. The trails in the lower grounds area have been managed for easy access by educational groups and general visitors, with educational signs next to plants along the pathways. Trails in the research section have been managed for access

to the plant collections and for hiking by visitors, specifically those wanting to visit some of the waterfalls, other land features, view points, and unusual collections of plants. Trails in the restoration section have limited access and are poorly maintained. (Exceptions to this are the Mānoa Cliffs trail that passes through part of the Arboretum native forests and the upper 'Aihualama trail. These sections are maintained by Na Ala Hele.) All of the present day hiking trails are displayed by Figure 2-5.

No formal trail management plan has been approved by the University or other state agencies, but staff, students, and volunteers have steadily worked to improve overall trail quality and to maintain accessibility for researchers and visitors. Trail improvements in the lower grounds include surfacing with gravel and lining trails with trex. Steep trails in the research section include dug-out steps lined with trex and reinforced to prevent erosion. DLNR staff of the Na Ala Hele Trails and Access Program (NAH) has been consulted about material and design considerations prior to trail construction. Trail improvements in the lower grounds include surfacing with gravel and lining trails with trex. Steep trails in the research section include dug-out steps lined with trex and reinforced to prevent erosion.

The NAH has committed to continue to consult the Arboretum on trail management activities, including trail maintenance, risk assessments, and bridge or sign design. The NAH will also collaborate with the Arboretum on special projects such as the Volunteer Service Network. The NAH is in support of the attended kiosk on the lower road to aid in mitigating traffic and security problems. The NAH has also committed to help the Arboretum establish a formal Memorandum of Agreement for the management of those segments of state forestry trail that traverse through the Arboretum property.

A landscape architect with a specialty in ADA accessibility issues was consulted about trails in the children's garden area. Accessible routes for ADA compliance need to be established for access to the facilities, including Cottage H and the Children's Learning Center. Refer to Section 3.20 for further discussion.

3.17 NOISE

The Arboretum is located near suburban residences and open spaces that do not generate significant noise emissions. Ambient noise levels are derived primarily from Arboretum activities, occasional traffic at the end of Mānoa Road, or other natural sources.

3.18 HAZARDOUS MATERIALS

Approved pesticides and herbicides have been conservatively used in the lower grounds and parts of the research section. The Arboretum does not have a certified applicator for application of pesticides and herbicides. It is unclear the extent to which these have been used in the past 40 years, but these are used minimally now in the greenhouses and around research collections in order to control pests and weeds. Most herbicide usage is in the upper areas (research and restoration), with relatively minimal use in the lower area.

3.19 HEALTH AND SAFETY

Hawai'i Occupational Health and Safety Division and the University of Hawai'i Safety Offices make periodic inspections of the Arboretum, which have resulted in actions on the part of Arboretum staff and director.

3.20 ADA FACILITIES

Presently, at the Arboretum there are no ADA compliant facilities and/or accessible pathways to the Children's Learning Center or Visitor Center (Cottage H). The ADA accessible pathways and routes have deteriorated and have been discontinued from use because of unsafe conditions. The Arboretum would like to pursue ADA compliant ramps and replacement pathways to be constructed. In order to function as a public facility, the Arboretum would like to provide ADA accessibility and facilities as much as feasible for visitors and employees.

SECTION 4.0

Impacts and Mitigation

4.0 IMPACTS AND MITIGATION MEASURES

As a part of the resolution for the violations, the Board of Land and Natural Resources (BLNR) recommended that the University of Hawai'i College of Natural Sciences, Lyon Arboretum submit and expedite an After-the-Fact (ATF) CDUA and Environmental Assessment for: 1) the structures constructed after 1964; 2) for the renovated cottages and wood workshop/garage; 3) for some of the landscape features and 4) commercial activities. This section will discuss the short-term, long-term, secondary and cumulative impacts associated with each of these actions in relation to the affected environment. In addition, where needed associated mitigation measures will be addressed.

According to the BLNR, the structures constructed and/or renovated after 1964 without the proper authorizations include:

1. the Children's Learning Center (1999-2002);
2. the Hong Yip Young Memorial Garden (1990);
3. the prefabricated storage shed (1997);
4. the large greenhouse/head house (1967);
5. the visitor kiosk;
6. the Fern Valley rain shelter, and the Spice Garden Pavilion; and

According to the BLNR, the unauthorized renovations to the cottages and wood workshop/garage include:

1. Cottages B, C and D constructed decking;
2. Cottages B, C, D, and F were excavated to add a bottom floor;
3. Cottage H increased the maximum developable area (MDA) for a covered lanai and classrooms; and
4. the garage across from Cottage B was renovated into a wood workshop.

The unauthorized landscape features cited by BLNR include the memorial gardens, water features, signs, statues, benches, trails and pathways, and drainage.

In addition, unauthorized commercial use of the property identified by BLNR included some of the following activities: the establishment of a visitor gift shop; plant sales; education classes; Awa Festival and other festivals; cottage rentals; weddings; memorial services; commercial ventures; commercial tours by eco tour companies; and the sale of small items.

4.1 LAND USE

The State Land Use law was enacted in the early 1960s and designated all lands into 4 categories: 1) Conservation, 2) Agriculture, 3) Rural, and 4) Urban. The enactment of the law created the requirement for conservation district use permits for activities in the conservation district. Therefore, new structures and significant renovations to existing structures since 1964 require permits. In addition, landscape features and commercial activities also require permits.

4.1.1 Structures Constructed After 1964

Structures constructed after 1964 in the Resource Subzone require a Conservation District Use Permit (CDUP) from the DLNR.

4.1.2 Renovated Cottages and Wood Workshop/Garage

Significant renovations to cottages and the wood workshop/garage in the Resource Subzone require a CDUP permit from the DLNR.

4.1.3 Landscape Features

Landscape features including signs, benches, memorials, artwork, and fountains require a CDUP permit and site plan approval by the department.

4.1.4 Commercial Use

Commercial use of the Resource Subzone requires a CDUP permit from the DLNR.

4.1.5 Mitigation

In the resolution of the issue of violations the BLNR recognized the value of the work of the Arboretum. The BLNR decision on the issue basically notes the procedural issue of engaging in a regulated activity without a permit. The resolution of the issue is the processing and approval of an ATF CDUA. The BLNR did not state that the activities were detrimental; only that permits were needed to continue them. Therefore, mitigation measures include an Environmental Assessment and the After-The-Fact CDUA.

4.2 CLIMATE

The construction of the structures after 1964, renovations of the cottages and wood workshop/garage, landscape features, and commercial activities had no substantial impact on climate. The retroactive approval of activities will have no short-term or long-term adverse impacts on climate. Therefore, no mitigation measures are required.

4.3 GEOLOGY AND TOPOGRAPHY

4.3.1 Structures Constructed After 1964

There was no substantial alteration to the overall existing topography of the site. No substantial fill or excavations was involved. The geology and topography of the area was not significantly impacted. The retroactive approval will have no short-term or long-term adverse impacts to the geology and topography.

4.3.2 Renovated Cottages and Wood Workshop/Garage

There was no substantial alteration to the overall existing topography of the site. No substantial fill or excavations was involved. The geology and topography of the area will not be significantly impacted. The retroactive approval will have no short-term or long-term adverse impacts to the geology and topography.

4.3.3 Landscape Features

There was no substantial alteration to the overall existing topography of the site for the items sited. No substantial fill or excavations was involved. The areas were relatively small and the geology and topography of the area were not significantly impacted. The retroactive approval will have no short-term or long-term adverse impacts to the geology and topography.

4.3.4 Commercial Use

The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to the topography.

4.3.5 Mitigation

Mitigation measures are not anticipated as these activities have not altered the topography significantly over the years.

4.4 SOILS AND GRADING

4.4.1 Structures Constructed After 1964

Where construction occurred, soils were covered by paving and other infrastructure at the site. Paving over the area reduced permeability and increased runoff velocity. However, the areas of coverage are relatively small and over time landscaping has mitigated the impacts of construction. The retroactive approval of cited constructed structures will have no short-term or long-term adverse impacts to the soils.

4.4.2 Renovated Cottages and Wood Workshop/Garage

Soils were not significantly impacted by the renovation of the cottages and wood workshop/garage, as no significant amounts of new area were exposed during the renovation. The retroactive approval of cited renovated structures will have no short-term or long-term adverse impacts to the soils.

4.4.3 Landscape Features

Soils at the site were used for cultivation and horticultural activities and no significant impacts were generated. The retroactive approval of cited landscape features will have no short-term or long-term adverse impacts to the soils.

4.4.4 Commercial Use

The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to the soils.

4.4.5 Mitigation

The activities cited in the violations were for completed actions or ongoing activities. There are no new activities proposed for this CDUA. The request is to authorize activities cited and to continue existing routine maintenance activities to preserve the inventory and maintain health and safety for the Arboretum. The activities cited generally do not have significant negative impacts to soils and no mitigation measures are needed. The long-term landscape management plan will include proper management of fertilizers and pesticides. Site design should minimize runoff and collection through on-site dispersal and filtering methods. Increased surface runoff

from newly paved areas should be minimized through these methods. A more detailed comprehensive planting plan is also being developed that should improve soil quality and reduce overall erosion.

4.5 SURFACE WATER AND DRAINAGE

4.5.1 Structures Constructed After 1964

No significant impact to surface water and drainage was anticipated during the construction of the structures after 1964. No significant impact to groundwater underlying the project site was anticipated during the construction and operations at the site. Construction on the site was unlikely to introduce or release any substance into the soil that could adversely affect groundwater quality. The retroactive approval of cited constructed structures will have no short-term or long-term adverse impacts to surface water and drainage.

4.5.2 Renovated Cottages and Wood Workshop/Garage

Renovations were small and mostly internal to the building. No significant impact to surface water and drainage was noted during the renovation of the cottages and wood workshop/garage. No significant impact to groundwater underlying the project site was anticipated during the renovations at the site. Construction on the site was unlikely to introduce or release any substance into the soil that could adversely affect groundwater quality. The retroactive approval of cited renovated structures will have no short-term or long-term adverse impacts to the surface water and drainage.

4.5.3 Landscape Features

No significant impact to water and drainage occurred in relation to the development of the landscape features. The retroactive approval of cited landscape features will have no short-term or long-term adverse impacts to the surface water and drainage.

4.5.4 Commercial Use

The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to the surface water and drainage.

4.5.5 Mitigation

The long-term landscape management plan includes proper management of fertilizers and pesticides. Onsite storm drainage for the site consists of various onsite inlets and underground drainage lines which connect to the existing roadway storm drainage system. The existing overall drainage pattern with discharge into 'Aihualama Stream remains the same.

4.6 FLOOD HAZARD

4.6.1 Structures Constructed After 1964

The Arboretum is not located in a flood zone. The structures constructed after 1964 should be in compliance with Federal Building Ordinance Regulations and meet County Building Code. No short-term or long-term impacts are anticipated with the retroactive approval of cited constructed structures.

4.6.2 Renovated Cottages and Wood Workshop/Garage

The Arboretum is not located in a flood zone. The renovations of the buildings should be in compliance with Federal Building Ordinance Regulations and meet County Building Code. No short-term or long-term impacts are anticipated with the retroactive approval of cited renovated structures.

4.6.3 Landscape Features

No significant short-term or long-term impacts are anticipated with the retroactive approval of cited landscape features.

4.6.4 Commercial Use

No short-term or long-term impacts to flooding are anticipated with the retroactive approval of cited commercial activities.

4.6.5 Mitigation

No mitigation measures are required in response to potential flooding. During the severe flooding that occurred in October 2004, the Arboretum only experienced minor flooding and washout of small sections of the interior roads. The steep terrain, dense vegetation, and low density of the facility mitigated potential danger. Maintenance activities have maintained open channels on most of the valley's channels near the developed portion of the Arboretum and this has also reduced the risk of flooding. Although if the drainage malfunctions, heavy rains can enter the lower floors of various cottages, which has occurred at least in Cottages D and G.

4.7 FLORA

4.7.1 Structures Constructed After 1964

The Arboretum is a major resource center for tropical plants and is responsible for enhancing the site's living plant collection. The Arboretum has developed a research and training program in restoration of Hawaiian ecosystems and serves as a University field station for terrestrial biology and stream biology. No negative short-term or long-term impacts on the flora are anticipated with the retroactive approval of cited constructed structures.

4.7.2 Renovated Cottages and Wood Workshop/Garage

Renovations had little or no impact on ground cover and flora. Work related to this group of activities is primarily internal to existing buildings or on developed areas. No short-term or long-term impacts are anticipated with the retroactive approval of cited renovated structures on the flora.

4.7.3 Landscape Features

The cited landscape features minimally disturbed vegetated areas. No long-term negative impacts occurred and the disturbed areas were re-landscaped to mitigate the short-term effect. No short-term or long-term impacts are anticipated with the retroactive approval of cited landscape features on the flora.

4.7.4 Commercial Use

Commercial activities at the Arboretum are generally related to supporting the Arboretum and its mission. Some plants grown in the Arboretum have been sold in plant sales on and off the Arboretum property. The maintenance of these activities is generally viewed as beneficial to the Arboretum and without significant negative impact to the general flora of the site. No short-term or long-term impacts are anticipated with the retroactive approval of cited commercial uses on the flora.

4.7.5 Mitigation

No adverse impacts are anticipated, and therefore no mitigation measures beyond construction period water quality protection should be considered necessary.

4.8 FAUNA

4.8.1 Structures Constructed After 1964

The Arboretum is partially located within a designated critical habitat area for the 'Elepaio. Structures constructed after 1964 were localized and construction activity was of short duration. The cited construction activities were located within the existing paved roadway area. The activities did not impact the 'Elepaio's habitat. No short-term or long-term impacts are anticipated with the retroactive approval of cited constructed structures on the fauna.

4.8.2 Renovated Cottages and Wood Workshop/Garage

The renovations are located within the critical habitat designated area. No short-term or long-term impacts are anticipated with the retroactive approval of cited renovated structures on the fauna.

4.8.3 Landscape Features

No significant short-term or long-term impacts are anticipated with the retroactive approval of cited landscape features on the fauna.

4.8.4 Commercial Use

Continuance of commercial activities will increase the number of visitors to the Arboretum. This may have some minor and temporary nuisance impact on the 'Elepaio, as groups and individuals walk through habitat areas. However, given the scale of the forest, the nature of these visitors and relatively small numbers, the impacts are seen as negligible. Conservation biology, native species rescuers, and ecosystem restoration and similar programs supported by the activities more than compensate for the minimal disturbance that might occur. No short-term or long-term impacts are anticipated with the retroactive approval of cited commercial uses on the fauna.

4.8.5 Mitigation

The Arboretum is in the transition zone from suburban to conservation. The 'Elepaio habitat is in the deep nature forest and the mixed transition forest with introduced and alien species. It provides a diverse ecosystem and a permanent buffer against urban encroachments. The activities cited help to maintain the Arboretum and therefore help to protect the critical habitat. No mitigation measures are needed for the activities cited in this report.

4.9 AIR QUALITY

4.9.1 Structures Constructed After 1964

Short-term effects of the structures constructed after 1964 were fugitive dust emissions resulting from operation of construction equipment and vehicles. These effects ceased upon completion of the projects. No long-term effects on air quality due to the operation of construction equipment or vehicles occurred. The retroactive approval of cited constructed structures will have no additional short-term or long-term adverse impacts to air quality.

4.9.2 Renovated Cottages and Wood Workshop/Garage

The renovation activities had minimal short-term effects on air quality, including fugitive dust emissions resulting from operation of construction equipment and vehicles. These effects were short-term and ceased upon completion of the projects. No long-term effects on air quality due to the operation of construction equipment or vehicles occurred. The retroactive approval of cited renovated structures will have no short-term or long-term adverse impacts to air quality.

4.9.3 Landscape Features

No long-term or short-term adverse impacts to air quality due to the landscape features occurred. The retroactive approval of cited landscape features will have no short-term or long-term adverse impacts to air quality.

4.9.4 Commercial Use

Short-term effects of commercial activities to air quality were increased emissions from automobiles. These effects were short-term and had minimal effects on air quality. The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to air quality.

4.9.5 Mitigation

Construction activities in the future after the resolution of the violations will incorporate dust control measures and Best Management Practices (BMPs) such as a regular dust-watering program and covering of trucks during the transport of soils and storage of soils. Renovation activities in the future after the resolution of violations will incorporate preventative measures to avoid encounters with lead paint or asbestos.

4.10 ARCHAEOLOGICAL RESOURCES

In 1926, the Lyon Arboretum Annual Report noted ancient taro patches lying on the eastern side of 'Aihualama Stream (Lyon Arboretum Annual Report, 1926). Today, this site has been preserved and functions as an integral part of the Arboretum's educational program. Other potential archaeological sites were identified by surveys conducted in 1984, 1987, and 2002 at the Arboretum.

4.10.1 Structures Constructed After 1964

The cited structures constructed after 1964 are located within the "lower grounds" area, in areas previously developed before 1964. The archaeological resources at the Arboretum have been identified as the lo'i area located on the eastern side of the 'Aihualama Stream. The structures

constructed after 1964 were not constructed in proximity to the identified lo'i archaeological site and had no short-term or long-term impacts to the resource. The retroactive approval of cited constructed structures will have no short-term or long-term adverse impacts to archaeological resources.

4.10.2 Renovated Cottages and Wood Workshop/Garage

The cited renovated cottages and wood workshop/garage are located within the "lower grounds" area, in areas previously developed before 1964. The archaeological resources at the Arboretum have been identified as the lo'i area located on the eastern side of the 'Aihualama Stream. The renovated cottages and wood workshop/garage are not located in proximity to the identified lo'i archaeological site and had no short-term or long-term impacts to the resource. The retroactive approval of cited renovations will have no short-term or long-term adverse impacts to archaeological resources.

4.10.3 Landscape Features

The cited landscape features are not located in proximity to the identified lo'i archaeological site and had no short-term or long-term impacts to the resource. The retroactive approval of cited landscape features will have no short-term or long-term adverse impacts to archaeological resources.

4.10.4 Commercial Use

The cited commercial activities were not located in proximity to the identified lo'i archaeological site and had no short-term or long-term impacts to the resource. The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to archaeological resources.

4.10.5 Mitigation

No mitigation measures are needed for the activities cited in this report.

4.11 CULTURAL AND HISTORICAL RESOURCES

Established in 1918, the Arboretum serves as a cultural and historical resource. The cited activities are all striving to maintain and preserve the functions and mission of the Arboretum. Historical and cultural resources also include the lo'i archaeological site.

The uses and history of the Arboretum site before the development of the site by the Hawaiian Sugar Planters is not well documented. That the site was damaged by wild and domestic animals, is well established and indicated a combination of sugar cane and pasture usage. The existence of coconut trees and taro lo'i confirm the use of the site by native Hawaiians for residential and agricultural uses. Being in the upper valley and below the steep summit region, it is likely that the site was used for traditional hunting and gathering purposes.

4.11.1 Structures Constructed After 1964

The cited structures constructed after 1964 were not located in proximity to the cultural and historic lo'i site and had no short-term or long-term impacts to any cultural and/or historical resources. The retroactive approval of cited structures will have no short-term or long-term adverse impacts to cultural or historical resources.

4.11.2 Renovated Cottages and Wood Workshop/Garage

The cited renovated cottages and wood workshop/garage were not located in proximity to the cultural and historic lo'i site and had no short-term or long-term impacts to any cultural and/or historical resources. The renovation activities were striving to maintain the historical features of the Arboretum. The retroactive approval of cited structures will have no short-term or long-term adverse impacts to cultural or historical resources.

4.11.3 Landscape Features

The cited landscape features are not located in proximity to the cultural and historical lo'i site and had no short-term or long-term impacts to any cultural and/or historical resources. The retroactive approval of cited landscape features will have no short-term or long-term adverse impacts to cultural or historical resources.

4.11.4 Commercial Use

The cited commercial activities were not located in proximity to the cultural and historical lo'i site and had no short-term or long-term impacts to any cultural and/or historical resources. The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to cultural or historical resources.

4.11.5 Mitigation

Many of the structures at the Arboretum qualify for consideration under the National and State Historic Preservation Act. They meet the age and many of the significance criteria. Future renovations should consider the historic character of these structures in the evaluation of its uses and any additional renovations that might be considered. An application for listing on the Hawai'i and/or National Register of Historic places will likely be considered. No mitigation measures are required.

4.12 SOCIO-ECONOMIC CHARACTERISTICS

4.12.1 Structures Constructed After 1964

The structures constructed after 1964 created short-term benefits as a result of design and construction employment. The activities also created jobs for local construction personnel. Local material suppliers and retail businesses also benefited through a multiplier effect from the increased construction activities, even though the activities were minimal. The principal socio-economic impact of the construction activities was the creation of a community and tourist learning and tourist center, which provides educational services such as research and training facilities. Long-term benefits of the construction activities also created jobs for education instruction and scientific advances in horticultural research, and a rescue and recovery center for endangered species. The socio-economic impacts were positive for the local community, as well as the City and State. The retroactive approval of cited structures will have no short-term or long-term adverse impacts to socio-economic resources.

4.12.2 Renovated Cottages and Wood Workshop/Garage

The renovations of the cottages and wood workshop/garage created short-term benefits as a result of design and construction employment. The activities created jobs for local construction personnel. Local material suppliers and retail businesses also benefited through a multiplier

effect from the increased construction activities, even though the activities were minimal. The principal socio-economic impact of the construction activities was the maintenance of community and tourist facilities, which provide educational services such as research and training facilities. The socio-economic impacts were positive for the local community, as well as the City and State. The retroactive approval of cited renovated structures will have no short-term or long-term adverse impacts to socio-economic resources.

4.12.3 Landscape Features

The principal socio-economic impact of the landscape features was the benefit of enhancing the community and tourist facilities. The socio-economic impacts were positive for the local community, as well as the City and State. The retroactive approval of cited landscape features will have no short-term or long-term adverse impacts to socio-economic resources.

4.12.4 Commercial Use

The cited commercial uses at the Arboretum created short-term benefits for the community and the Arboretum. The activities created jobs for local artists and community members. Local farmers and botanical suppliers also benefited from the plant sales and community venues. The socio-economic benefit of the commercial uses was the maintenance of community and tourist facilities, which were funded by the commercial uses at the Arboretum and provide educational services such as research and training facilities. The socio-economic impacts were positive for the local community, as well as the City and State. The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to socio-economic resources.

4.12.5 Mitigation

No specific socio-economic mitigation actions are recommended other than the ATF CDUA.

4.13 VISUAL RESOURCES

4.13.1 Structures Constructed After 1964

The structures constructed after 1964 do not impact the view of the open conservation land. The goals of the Arboretum strive to enhance the natural landscape of the site. Landscaping was used to improve the visual character of the structures constructed after 1964. The retroactive approval of cited constructed structures will have no short-term or long-term adverse impacts to visual resources.

4.13.2 Renovated Cottages and Wood Workshop/Garage

Renovations were generally internal and on developed spaces. They are consistent to their surroundings. The retroactive approval of cited renovated structures will have no short-term or long-term adverse impacts to visual resources.

4.13.3 Landscape Features

The landscaped features are situated very low to the ground and do not impact the view of the open conservation land. The goals of the Arboretum strive to enhance the natural landscape of the site. The retroactive approval of cited landscape features will have no short-term or long-term adverse impacts to visual resources.

4.13.4 Commercial Use

The commercial uses do not impact any visual resources. Commercial venues, such as the awa ceremony and commercial tours strived to connect the community with the goals of the Arboretum, which include enhancing the natural landscape of the site. The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to visual resources.

4.13.5 Mitigation

No mitigation measures are required.

4.14 UTILITIES

4.14.1 Structures Constructed After 1964

The structures constructed after 1964 did not have any significant impacts or demand on existing utilities. Because of their age and longevity, the quality is part of baseline conditions. The retroactive approval of cited constructed structures will have no short-term or long-term adverse impacts to existing utilities.

4.14.2 Renovated Cottages and Wood Workshop/Garage

The renovations to cottages and wood workshop/garage did not have any significant impacts or demand on existing utilities. The retroactive approval of cited renovated structures will have no short-term or long-term adverse impacts to existing utilities.

4.14.3 Landscape Features

The landscape features did not have any significant impacts or demand on existing utilities. The retroactive approval of cited landscape features will have no short-term or long-term adverse impacts to existing utilities.

4.14.4 Commercial Use

The commercial uses did not have any significant impacts or demand on existing utilities. The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to existing utilities.

4.14.5 Mitigation

The activities identified in the citation and in this report have been around for a long term and qualify as baseline conditions for utilities. Retroactive approval of these activities should have no impact on these conditions. The uses are low density and small and do not have a significant impact on infrastructure. Also, with regard to wastewater and drainage the systems are self contained and have no impact on public utilities. All wastewater plans will conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems." No mitigation measures are required.

4.15 ROADWAYS AND TRAFFIC

The construction of the structures after 1964, renovations of the cottages and wood workshop/garage, landscape features, and commercial activities had no substantial impact to roadways or traffic. If anything, the paving of the Arboretum's private driveway benefited the use for visitors and employees. The retroactive approval of activities cited as violations by the BLNR will have no short-term or long-term adverse impacts to the roadways and/or traffic. Therefore, no mitigation measures are required.

4.16 PUBLIC ACCESSIBILITY

The construction of the structures after 1964, renovations of the cottages and wood workshop/garage, landscape features, and commercial activities had no substantial impact to public access. If anything, the paving of the Arboretum's private driveway and management of the trails and pathways benefited the use for visitors and employees. Controlled public access is in the Arboretum's interest to maintain public safety and management of the facilities and grounds. The Arboretum is committed to allowing access to native Hawaiians and is partnered with the Hālau Ku Mana New Century Public Charter School to encourage restoration of the lo'i area. The retroactive approval of activities cited as violations by the BLNR will have no short-term or long-term adverse impacts to public accessibility. Therefore, no mitigation measures are required.

4.17 NOISE

4.17.1 Structures Constructed After 1964

The construction of the cited structures did not increase noise levels to significant levels. The only increase in noise was the temporary noise from construction of the structures as well as some paving of the area. The retroactive approval of cited constructed structures will have no short-term or long-term adverse impacts to noise levels.

4.17.2 Renovated Cottages and Wood Workshop/Garage

The renovation of the cited structures did not increase noise levels to significant levels. The only increase in noise was the temporary noise from the renovation activities on the structures. The retroactive approval of cited renovated structures will have no short-term or long-term adverse impacts to noise levels.

4.17.3 Landscape Features

Landscape features did not increase noise levels to significant levels. The retroactive approval of cited landscape features will have no short-term or long-term adverse impacts to noise levels.

4.17.4 Commercial Use

The cited commercial uses did not increase noise levels to significant levels. The only increase in noise was the temporary noise from the commercial venues and tours, which was not at significant levels. The retroactive approval of cited commercial uses will have no short-term or long-term adverse impacts to noise levels.

4.17.5 Mitigation

No mitigation measures are required.

4.18 HAZARDOUS MATERIALS

It is anticipated that the construction of the structures after 1964, renovations of the cottages and wood workshop/garage, landscape features, and commercial activities did not use significant amounts of hazardous materials. Use of hazardous materials at University of Hawaii facilities is guided by policies and procedure developed by the University of Hawaii Safety Office. Use of fertilization, pesticides, and herbicides are carefully managed and monitored to avoid over use and migration of chemicals. The retroactive approval of activities cited as violations by the BLNR will have no hazardous materials short-term or long-term adverse impacts. Therefore, no mitigation measures are required.

4.19 HEALTH AND SAFETY

The construction of the structures after 1964, renovations of the cottages and wood workshop/garage, landscape features, and commercial activities had no substantial impact to health or safety. If anything, the maintenance and construction of the Arboretum's facilities benefited the use for visitors and employees. The retroactive approval of activities cited as violations by the BLNR will have no short-term or long-term adverse impacts to health and/or safety. Therefore, no mitigation measures are required.

SECTION 5.0

Alternatives to the Proposed Project

5.0 ALTERNATIVES

This Draft Environmental Assessment evaluates alternatives actions to the proposed CDUA process. The alternatives include:

5.1 NO-ACTION ALTERNATIVE

The “no-action” alternative would result in the continued limited use of the land for Arboretum purposes. The Arboretum will remain out of compliance due to lack of necessary permits and non-compliance with the BLNR decision. Additional fines will probably be imposed by the BLNR.

The no-action alternative would result in the continued shortage of botanical educational facilities and services. The no-action alternative does not meet the needs or address the problems of the current situation and would force the organization to pursue perhaps more costly site alternatives or solutions. While the no-action alternative would have no adverse environmental impacts, it cannot be considered a reasonable solution to the existing and future shortfalls facing the Lyon Arboretum.

In this alternative, activities at the Lyon Arboretum would remain limited. Resources would go under-utilized and maintenance would suffer. Although this alternative would have limited adverse environmental impacts, the positive community benefits associated with the Arboretum improvements would not be available.

5.2 REMOVAL OF VIOLATIONS

The removal of violations alternative would require all post-1964 constructed structures to be demolished. All unauthorized renovations of the cottages and wood/workshop garage would be removed. All unauthorized landscape features would be removed. All commercial activities would also cease.

Removal of all violations would severely impact the operations of the Arboretum. Some cottages would become unusable or uninhabitable. The buildings and facilities would be even more out of compliance with current codes and standards. Most of the buildings would be shut down, in addition to those already shut down including Cottages A, B, C, E, G, because of OSHA and ADA requirements.

The limitation and restrictions on commercial activities would reduce the dollars available to the Arboretum by a considerable amount. The inability to raise this entire funding will impact the maintenance and educational programs and limit public use and enjoyment of the facility. The limitation of commercial uses will reduce the number of visitors to the site, thereby lessening the direct import of people in the conservation district. This will probably have a net negative impact in that the beneficial work of the Arboretum would also be curtailed. This includes native species propagation and restoration of the hillside with endemic and endangered plants. While this alternative would address the violations it would not meet the mission of the Arboretum as activities and programs would suffer.

5.3 ADDRESS VIOLATIONS WITH CDUA PROCESS AND RE-COMMENCE USES AND ACTIVITIES

This alternative is the current strategy favored. Things would remain at status quo until the environmental assessment is completed and the ATF CDUA is approved. After that the University would complete a master plan for the Arboretum and prepare another CDUA for future growth and activity of the Arboretum.

This alternative would address the current violations and be consistent with the mission of the Arboretum. This alternative is also consonant with the recommendations of the State Auditors report. The violations with the CDUA process and re-commence uses and activities alternative would approve the violations and allow for continued use of the Arboretum.

5.4 EVALUATION OF ALTERNATIVES

To evaluate the alternatives it is necessary to consider the impacts each alternative would have on the physical environment (visual, traffic, noise, and air quality, etc). In addition, it is important to weigh these effects against the benefits each alternative would bring to the surrounding community.

The “no-action” alternative would have a low impact on the environment, noise level, and view planes. However, while open space conservation land can be an important neighborhood amenity for view planes, the activities cited do not greatly impact visual resources, in this case, because the conservation land surrounds the site, thus leaving the surrounding area mainly undeveloped and preserving view planes.

The removal of violations alternative would greatly curtail further horticultural, educational, research, and economic benefits the Arboretum provides to the community and tourism. The removal alternative would negatively impact efforts of community members and the University to maintain the functions of the Arboretum’s mission. In addition, the removal alternative would greatly reduce the Arboretum’s many functions that support the work of DLNR and other similar conservation agencies within and beyond the State of Hawai’i.

Alternative three addresses the violations with the ATF CDUA process, and recommends resuming uses and activities and completes a resolution of this issue between the University and DLNR. The University would be granted the opportunity to resolve the pertinent issues of the Arboretum. The values of the Arboretum would be maintained and the economic benefits of the Arboretum would continue.

SECTION 6.0

Plans and Policies

6.0 PLANS AND POLICIES

6.1 HAWAII STATE PLAN

The Hawai'i State Plan establishes a statewide planning system that provides goals, objectives, and policies which detail property directions and concerns of the State of Hawai'i. Priority guidelines relating to the economy, housing, population growth, facility systems, and the physical environment will be discussed as they relate to the Lyon Arboretum activities.

It is the goal of the State, under the Hawai'i State Planning Act (Chapter 226, HRS), to achieve the following:

- A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawai'i present and future generations.
- A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.
- Physical, social, and economic well-being, for individuals and families in Hawai'i, that nourishes a sense of community responsibility, of caring, and of participation in community life (Chapter 226-4, HRS).

The objectives and policies of the State Plan that are relevant to the Arboretum activities are discussed below:

Economy:

The objectives for planning the State's economy include increasing and diversifying employment opportunities to provide a better economic quality of life for Hawai'i's people. It is also the objective of the State to create a diversified economic base that is not overly dependent on a few industries, and includes the development and expansion of industries on the neighbor islands. It is the policy of the State to:

- Expand existing markets and penetrate new markets for Hawai'i's products and services (Chapter 226-6, HRS).

Discussion: The Arboretum's mission supports the State's economic goals by providing another attractive tourist venue and penetrates new markets for Hawai'i's products and services. Research at the Arboretum brings in outside dollars that add to the economy and diversifies own services. Research may also provide new plants and cultivations that could expand our exports.

Education:

Planning for the State's socio- cultural advancement with regard to education shall be directed towards achievement of the objective of the provision of a variety of educational opportunities to enable individuals to fulfill their needs, responsibilities, and aspirations. It is the policy of the State to:

- Support educational programs and activities that enhance personal development, physical fitness, recreation, and cultural pursuits of all groups.

- Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.
- Promote educational programs which enhance understanding of Hawai'i's cultural heritage.
- Provide higher educational opportunities that enable Hawai'i's people to adapt to changing employment demands.
- Assist individuals, especially those experiencing critical employment problems or barriers, or undergoing employment transitions, by providing appropriate employment training programs and other related educational opportunities.
- Promote programs and activities that facilitate the acquisition of basic skills, such as reading, writing, computing, listening, speaking, and reasoning.

Discussion: The Arboretum's mission strives to promote educational opportunities and programs for the State of Hawai'i. The Arboretum promotes the goals of the State of Hawai'i by providing educational programs, research and training, and cultural education opportunities. The Arboretum educational and visitor activities include classes of pre-K-12 children, teachers, University courses, tourists, and small ecotourism groups learning about botany and conservation biology, plant environments, and ecosystem restoration issues. Typically over 4,000 children and teachers visit the Arboretum each year. Since August 2004, the Arboretum has had to deny access to more than 1,500 students who were scheduled for field trips. In addition, scholars from Anthropology, Biology, Botany, Culinary Arts, Engineering, Geography, Hawaiian Studies, Horticulture, Zoology, Education, Dance, Art, and Travel Industry Management use the Arboretum in parts of their research or teaching. For instance, the Honolulu Community College Fire Science class uses the Arboretum for training in chain saw use for fighting wild land fires, which is a direct benefit to DLNR and the public.

To fulfill its mission of outreach, since the 1970's the Arboretum has sponsored classes to the general public; usually horticulture, crafts, plant conservation, nature studies, photography, cooking etc. In a typical year 150 adult classes were offered. In 2003 roughly \$25,000 was paid in tuition fees for Arboretum classes. This revenue is essential to the operation of the Arboretum and there is great potential for growth.

Culture:

Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawai'i's people. It is the policy of the State to:

- Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawai'i's people and which are sensitive and responsive to family and community needs.

Discussion: The Arboretum promotes the goals of Hawai'i's State Plan by providing cultural educational opportunities and activities, which promote cultural values, customs, and arts that enrich the lifestyles of Hawai'i's people. The Arboretum is involved in the promotion of culture through its ethnobotanical gardens, conservation biology programs that preserve native species and its restoration ecology program for the hillsides it controls. In addition, it has engaged in restoration of ancient and historic lo'i and auwai for educational purposes. This has been done

with the Hawaiian Charter School Hālau Kū Mānā. The Arboretum also teaches crafts that include native crafts and conducts classes on science and culture. Finally, the 'Awa Festival and similar events promotes culture and community.

6.2 HAWAII STATE FUNCTIONAL PLANS

The State Functional Plans implement the Goals, Objectives, Policies and Priority Guidelines of the Hawai'i State Plan. The Functional Plans provide the connection between State programs and State policy. Twelve functional plans have been adopted by the State Legislative, which includes the areas of Agriculture, Conservation Lands, Education, Energy, Health, Higher Education, Historic Preservation, Housing, Recreation, Tourism, Transportation and Water Resources. The Functional Plans are designed to address issues pertaining to physical resource needs and development. The functions and activities of the Lyon Arboretum are required to be in conformance with these functional plans.

6.3 HAWAII STATE LAND USE DISTRICT BOUNDARIES

The State of Hawai'i Land Use Law regulates the classification and uses of lands in the State to accommodate growth and development, and to retain the natural resources in the area. All State lands are classified by the State Land Use Commission, with consideration given to the General Plan of the County, as either Urban, Rural, Agricultural, or Conservation.

As discussed in Section 3.0, implementation of the project involves permitted uses of the Conservation District with appropriate permits. The Arboretum includes lands within the designated Conservation District. The surrounding area is located within the Urban and Conservation District. Refer to the Land Use Map as described by Figure 3-1.

The approval of the cited activities and improvements to the Arboretum advocates the following goals and policies:

"The purpose of the Conservation District is to conserve, protect and preserve the important natural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety and welfare."

Discussion: The retroactive approval of the cited activities will enhance the conservation, protection and preservation of lands in the vicinity of the Lyon Arboretum. The Arboretum coordinates, facilitates, and executes research, instruction, and service activities that utilize its collections and resources. The major emphases at the Arboretum are tropical plants, native Hawaiian plants, conservation biology, and Hawaiian ethnobotany. In addition, the Arboretum is in accordance with the objectives by:

- Developing a major resource center for tropical plants with Hawai'i/Pacific Basin/Asian focus, by enhancing its living plant collection, and establishing an appropriate reference library and herbarium. Making its collections and information

available to a broad clientele including students, researchers, industry, and the general public, by performing and disseminating the results of research, by appropriate outreach and educational activities, and through plant and seed exchange programs.

- Serving as an outdoor laboratory for school and university students and classes.
- Importing, identifying, improving through breeding, and introduction to the public, plants useful for horticulture, research, education, or industry.
- Preserving and propagating germplasm of endangered plant species, especially those native to Hawai'i. Special attention is given to the use of micropropagation and tissue culture technology in conservation of Hawaiian plants.
- Developing a research and training program in restoration of Hawaiian ecosystems. Serving as a University field station for terrestrial biology and stream biology.

"The objective of the Resource subzone is to develop, with proper management, areas to ensure sustained use of the natural resources of those areas."

Discussion: The mission of the Lyon Arboretum is synonymous with the objectives of this subzone. The mission of the Arboretum was created to be consistent with the University's LRDP research, education, sustainability, and stewardship goals. The mission of the Arboretum not only seeks to protect botanical and biological resources, but to further understand them, and educate others so that we can further preserve and enhance natural environments. The resource subzone covers the entire site of the Arboretum.

6.4 CITY AND COUNTY OF HONOLULU GENERAL PLAN

Adopted by resolution in 1977, the General Plan for the City and County of Honolulu sets forth the long-range objectives for the general welfare and prosperity of the people of O'ahu and broad policies to attain those objectives. The General Plan provides objectives and policies intended to guide and coordinate City land use planning and regulation, and budgeting for operations and capital improvements. One element of this coordination is the Land Use Ordinance which is the legal instrument that regulates land use within the County.

The approval of the cited activities and improvements to the Arboretum advocates the following goals and policies of the City and County of Honolulu General Plan:

Economic:

Objective A: To promote employment opportunities that will enable all the people of Oahu to attain a decent standard of living.

Policy 1: Encourage the growth and diversification of Oahu's economic base.

Policy 2: Encourage the development of small businesses and larger industries which will contribute to the economic and social well-being of Oahu residents.

Policy 3: Encourage the development in appropriate locations on Oahu of trade, communications, and other industries of a nonpolluting nature.

Objective B: To maintain the viability of Oahu's visitor industry.

Policy 8: Preserve the well-known and widely publicized beauty of Oahu for visitors as well as residents

Natural Environment:

Objective A: To protect and preserve the natural environment.

Policy 2: Seek the restoration of environmentally damaged areas and natural resources.

Policy 3: Retain the Island's streams as scenic, aquatic, and recreation resources.

Policy 10: Increase public awareness and appreciation of Oahu's land, air, and water resources.

Health and Education:

Objective B: To provide a wide range of educational opportunities for the people of Oahu.

Policy 1: Support education programs that encourage the development of employable skills.

Policy 2: Encourage the provision of informal educational programs for people of all age groups.

Objective C: To make Honolulu the center of higher education in the Pacific.

Policy 1: Encourage continuing improvement in the quality of higher education in Hawai'i.

Policy 2: Encourage the development of diverse opportunities in higher education.

Policy 3: Encourage research institutions to establish branches on Oahu.

Culture and Recreation:

Objective A: To foster the multiethnic culture of Hawai'i.

Policy 1: Encourage the preservation and enhancement of Hawai'i's diverse cultures.

Policy 2: Encourage greater public awareness, understanding, and appreciation of cultural heritage and contributions to Hawai'i made by the City's various ethnic groups.

Objective B: To protect Oahu's cultural, historic, architectural, and archaeological resources.

Policy 1: Encourage the restoration and preservation of early Hawaiian structures, artifacts, and landmarks.

Policy 4: Promote the interpretive and educational use of cultural, historic, architectural, and archaeological sites, buildings, and artifacts.

Objective D: To provide a wide range of recreational facilities and services that are readily available to all residents of Oahu.

Policy 4: Encourage public and private botanic and zoological parks on Oahu to foster an awareness and appreciation of the natural environment.

Discussion: The Arboretum promotes the objectives of the City and County General Plan by serving as a center for educational activities, community events, cultural practices, and recreational activities. Educational activities include classes on plants, arts, culture, geography, and a range of other sciences. Approximately 34,000 visitors each year participate in classes, research projects, other community activities, or simply wandered the grounds enjoying the beautiful plant displays. Several community organizations use the Arboretum as their base of operations, including Hui Hana, Garden Club of Honolulu, and the Arboretum Association. The Harold L. Lyon Arboretum coordinates, facilitates, and executes research, instruction, and service activities that utilize its collections and resources. The major emphases at the

Arboretum are tropical plants, native Hawaiian plants, conservation biology, and Hawaiian ethnobotany. In addition, the Arboretum is in accordance with the objectives by:

- Developing a major resource center for tropical plants with Hawai'i/Pacific Basin/Asian focus, by enhancing its living plant collection, and establishing an appropriate reference library and herbarium. Making its collections and information available to a broad clientele including students, researchers, industry, and the general public, by performing and disseminating the results of research, by appropriate outreach and educational activities, and through plant and seed exchange programs.
- Serving as an outdoor laboratory for school and university students and classes.
- Importing, identifying, improving through breeding, and introduction to the public, plants useful for horticulture, research, education, or industry.
- Preserving and propagating germplasm of endangered plant species, especially those native to Hawai'i. Special attention is given to the use of micropropagation and tissue culture technology in conservation of Hawaiian plants.
- Developing a research and training program in restoration of Hawaiian ecosystems. Serving as a University field station for terrestrial biology and stream biology.

6.5 PRIMARY URBAN CENTER DEVELOPMENT PLAN

The Primary Urban Center Development Plan (PUC DP) has been prepared in accordance with the Charter-prescribed requirements for development plans and is to be accorded force and effect as such for all Charter- and ordinance-prescribed purposes (adopted on June 21, 2004 as Ordinance 04-14). PUC DP is one of a set of eight community-oriented plans and consists of conceptual schemes for implementing and accomplishing the development objectives and policies of the general plan that present a vision for the Primary Urban Center's future development. The PUC DP includes the coastal plain that extends along O'ahu's south shore from Waialae-Kahala in the east to Pearl City in the west, and from the shoreline to the westerly slopes of the Ko'olau mountain range.

The approval of the cited activities and improvements to the Arboretum advocates the following vision, policies, and guidelines of the PUC DP:

2.1 Honolulu's Natural, Cultural and Scenic Resources Are Protected and Enhanced

The mountain lands and shorelines that frame the city are protected and preserved, as are the natural, cultural and scenic areas and resources that lie within the urban area. Beaches and coastal waters, as well as historic sites and mountain lands, are actively managed and improved. Physical access to the mountains, the shoreline, streams and other resources is assured and continually enhanced.

Within the city, the open space network links mauka lands and shorelines to parks and open spaces within the urban area. Regional, beach and nature parks, the larger district parks, major campuses and golf courses provided green open space and recreational opportunities. The Civic Center, campuses and cemeteries also provide valuable open space. The public enjoys the Honolulu and Pearl Harbor

waterfronts, with their promenades, bikeways and opportunities for entertainment.

Stream greenbelts, numerous bikeways and pedestrian-friendly streets connect major parks and open spaces.

Culturally- and historically –important sites, landforms and structures continue to be preserved and enhanced. Historic and cultural districts are improved and interpreted for visitors.

People enjoy the panoramic view of Honolulu’s mountain ridges, craters and coastlines from key vantage points. Within the city, view corridors are preserved through careful planning and design.

Discussion: The Arboretum promotes the vision of the PUC DP by preserving a natural, cultural and scenic area within the PUC. The major emphases at the Arboretum are tropical plants, native Hawaiian plants, conservation biology, and Hawaiian ethnobotany. As part of the mission, the Arboretum provides cultural educational opportunities and activities, which promote cultural values, customs, and arts that enrich the lifestyles of Hawai‘i’s people. The Arboretum is involved in the promotion of culture through its ethnobotanical gardens, conservation biology programs that preserve native species and its restoration ecology program for the hillsides it controls. In addition, it has engaged in restoration of ancient and historic lo‘i and auwai for educational purposes. This has been done with the Hawaiian Charter School Hālau Kū Mānā. The Arboretum also teaches crafts that include native crafts and conducts classes on science and culture. Finally, the ‘Awa Festival and similar events promotes culture and community.

3.1.2 Policies

Establish and maintain an integrated open space network throughout the Primary Urban Center comprised of the following elements:

- **Preserve historic and cultural sites.** *Preserve and protect sites that have high preservation value because of their good condition or unique features. Protection includes planning and design of adjacent uses to avoid conflicts or abrupt contrasts that detract from or destroy the physical integrity and historic or cultural value of the site. Retain, whenever possible, significant vistas associated with historic, natural and man-made features. Allow adaptive reuse of historic buildings to serve a new function and/or enhance interpretive value without destroying the historic value of a site.*
- **Preserve and protect natural resource and constraint areas.** *Establish an Urban Community Boundary to define the area for urban development. Place large contiguous areas of natural resource and constraint areas designated for Preservation, including all lands within the State Conservation District, outside of the Urban Community Boundary.*
- **Preserve panoramic views of natural landmarks and the urban skyline.** *Preserve views of the Ko‘olau Wai‘anae Mountain Ranges, Punchbowl, Diamond Head, Pearl Harbor and other natural landmarks. Maintain important view corridors within and across urban Honolulu and keep Downtown as the most prominent feature of the urban skyline. Views along the Pearl Harbor shoreline and the Pearl Harbor Historic Trail toward the mountains, shoreline, significant landmarks, and adjacent communities should be created and maximized wherever possible and appropriate.*
- **Improve access to shoreline and mountain areas.** *Provide continuous lateral access along the Honolulu waterfront and around the East Loch of Pearl Harbor, where urban activity is most intense. Maintain access to mountain hiking trails and increase opportunities for nature education and camping.*

- **Develop stream greenbelts.** *Develop and maintain greenbelts and pathways along streams, especially those running from the mountains to the sea through central Honolulu, as visual and physical linkages between mauka and makai open spaces.*
- **Provide parks and active recreation areas.** *Develop and maintain parks and other outdoor public spaces in a manner that expands opportunities for both active and passive recreation. Increase and enhance recreational open space in the most densely settled parts of the PUC.*

3.1.3 Guidelines

3.1.3.1 Historic and Cultural Sites

- *Preserve and enhance the significant historic and aesthetic features of institutional campuses and campus clusters through zoning permit reviews for campus expansions or modifications.*

3.1.3.2 Mauka Conservation Areas

- *Prevent development on properties with average slopes of 40 percent or more, and on lands with slopes of 20 percent or more where development of the site would have a significant adverse visual impact when viewed from parks, major public streets, and other public places.*
- *Maintain public access points and hiking trails on the slopes of the Ko'olau Range in the areas beyond the Urban Community Boundary, and improve amenities for hiking, camping and nature study.*
- *In Preservation areas, avoid disturbance to native species and prevent the visual intrusion of structures, including utility and telecommunications installations, when seen from below and from hiking trails.*
- *Ensure access for traditional and customary practices and gathering rights, consistent with the provisions of the Constitution of the State of Hawai'i.*

Discussion: The mission of the Lyon Arboretum promotes the policies and guidelines of the PUC DP. The mission of the Arboretum strives to provide a natural site for educational, recreational, and community activities. The mission of the Arboretum not only seeks to protect botanical and biological resources, but to further understand them, and educate others so that we can further preserve and enhance natural environments. The Arboretum promotes preservation of natural resource by developing a major resource center for tropical plants with Hawai'i/Pacific Basin/Asian focus, and by enhancing its living plant collection. In addition, the Arboretum is consistent with the PUC DP policies and guidelines by being involved in the promotion of culture through its ethnobotanical gardens, conservation biology programs that preserve native species and its restoration ecology program for the hillsides it controls. For instance, it has engaged in restoration of ancient and historic lo'i and auwai for educational purposes. By preserving the Arboretum panoramic views of natural landmarks, such as the Ko'olau Mountains, would be maintained and preserved in the PUC. Finally, the Arboretum provides and promotes public access to mountain hiking trails and increased opportunity for nature education by serving as an outdoor laboratory for school and university students and classes and the public.

6.6 CITY AND COUNTY OF HONOLULU LAND USE ORDINANCE

Adopted in 1967, the purpose of the Comprehensive Land Use Ordinance (LUO) for the City and County of Honolulu is required by Charter to be consistent with the General Plan and eight Development Plans. The project site is located in the State Conservation Land Use District, and zoned P-1 Restricted Preservation. The adjacent parcels are also zoned P-1 Restricted Preservation. The nearest urban parcels which are some distance *makai* of the site are zoned R-7.5 Residential. The development standards in the P-1 District are governed by the appropriate state agency which is the State Department of Land and Natural Resources.

6.7 THE UNIVERSITY OF HAWAII AT MANOA STRATEGIC PLAN 2002-2010

The University of Hawaii at Manoa Strategic Plan, 2002-2010 is responsive to focusing on achieving key strategic goals for the University. The approval of the cited activities and improvements to the Arboretum advocates the following goals and objectives of the *University of Hawaii at Manoa's Strategic Plan*:

Goal 2: A Learning, Research, and Service Network

Objective 1: To excel in basic and applied research for the discovery and dissemination of new knowledge.

Goal 3: A Model local, regional, and global University.

Objective 2: To strengthen the crucial role that the University of Hawaii system performs for the Indigenous people and general population of Hawaii by actively preserving and perpetuating Hawaiian culture, language, and values.

Goal 4: Investment in faculty, staff, students, and their environment.

Objective 2: To create positive, healthful, resource efficient, and sustainable physical environments on the campuses of the University that enhance the psychological well-being of the students, employees, and community members.

Discussion: The Arboretum promotes the goals of the *University of Hawaii at Manoa Strategic Plan* by providing educational programs, research and training, and cultural education opportunities. Educational activities include classes on plants, arts, culture, geography, and a range of other sciences. In addition, scholars from Anthropology, Biology, Botany, Culinary Arts, Engineering, Geography, Hawaiian Studies, Horticulture, and Zoology use the Arboretum in parts of their research or teaching. More recently the Arboretum has dedicated itself to becoming a center for the rescue and propagation of rare and endangered native Hawaiian plants. The Lyon Arboretum conducts research, reaches out to the public through its educational program, and serves the public in numerous ways.

6.8 ADA POLICY

According to the Americans with Disabilities Act of 1990, for purposes of section 202 of this Act and section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794), public facilities should be readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs. In addition, where the public entity is undertaking construction of a facility and/or an alteration that affects or could affect usability of or access to an area of the facility containing a primary function, the entity shall also make the facilities and /or alterations in such a manner that, to the maximum extent feasible facilities should be readily accessible to and usable by individuals with disabilities, including individuals who use wheelchairs.

Discussion: The intent of the Arboretum is to serve as a public facility, and provide ADA accessibility and facilities as much as feasible for visitors and employees. Presently, at the Arboretum there are no ADA compliant facilities and/or accessible pathways to the Children's Learning Center or Visitor Center (Cottage H). The ADA accessible pathways and routes have deteriorated and have been discontinued from use because of unsafe conditions. The Arboretum would like to pursue ADA compliant ramps and pathways to be constructed.

SECTION 7.0

Findings Supporting Anticipated Determination

7.0 FINDINGS SUPPORTING ANTICIPATED DETERMINATION

7.1 ANTICIPATED DETERMINATION

After reviewing the significance criteria outlined in Chapter 343, Hawai'i Revised Statutes (HRS), and Section 11-200-12, State Administrative Rules, Contents of Environmental Assessment, it is anticipated that the approval of the activities cited as violations by the Board of Natural Resources (BLNR) will not result in significant adverse effects on the natural or human environment. A Finding of No Significant Impact (FONSI) is anticipated for this project.

7.2 REASONS SUPPORTING THE ANTICIPATED DETERMINATION

The potential impacts of the retroactive approval of activities cited as violations by the BLNR have been fully examined and discussed in this Environmental Assessment. As stated earlier, there are no significant environmental impacts expected as a result of the proposed activities. This determination is based on the following assessments:

(1) Involve an irrevocable loss or destruction of any natural or cultural resources.

The proposed activities do not involve any known destruction of existing natural or cultural resources. As previously noted, the significant archaeological and historical sites known to exist at the Arboretum are being preserved and restored for educational, cultural and historical purposes. All activities will be in cooperation with the Historic Preservation Division of the State Department of Land and Natural Resources. The activities and uses cited are generally located in the developed portions of the Arboretum and their continuation does not represent significant loss or destruction of natural resources in the conservation district.

(2) Curtail the range of beneficial uses of the environment.

The proposed activities will not curtail the range of beneficial uses of the environment. The approval will allow the area to be used to benefit the community. The activities identified support the beneficial uses of the environment through research and educational programs that strive to protect the natural and cultural resources.

(3) Conflict with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.

The proposed activities do not conflict with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and

amendments thereto, court decisions, or executive orders. The goals of the Arboretum are consistent with the goals in the Conservation District and promote all goals of Chapter 344. The issues for the ATF CDUA are procedural rather than substantive in nature. The mission of the Arboretum supported by these activities is consistent with the general goals of the Conservation District: to preserve and protect natural and cultural resources.

(4) Substantially affects the economic or social welfare of the community or State.

The Arboretum provides community amenities and services such as educational facilities and community resources. The approval will help maintain a sense of community ownership of the Arboretum. The Action helps the University bring in external research dollars and diversify the tourism industry. It provides both a venue and program that enhances appreciation of our natural and cultural resources and consequently improves social welfare.

(5) Substantially affects public health.

The approval will not substantially affect public health in a negative manner. Some tentatively positive benefits are increased recreational opportunities and outdoor venues and education. The Arboretum has received two grants from the State of Hawai'i Department of Health, using tobacco fund money, to encourage people to hike within the Arboretum. One grant was used to put a "virtual walk" on the Lyon Arboretum's website to encourage people to come and see the Arboretum, and the other grant was used to develop a map and integrated system of sign posts located throughout the Arboretum to prevent people from getting lost.

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities.

The approval will not have substantial secondary impacts, such as population changes or effects on public facilities. The approval will enhance much needed community services and maintain programs beneficial to the public. Impacts to public facilities are relatively minor and insignificant as these activities have occurred for decades and are seen as part of existing conditions.

(7) Involves a substantial degradation of environmental quality.

The approval of the ATF CDUA does not involve a substantial degradation of environmental quality. The approval would improve environmental quality by allowing landscaping and maintenance activities to occur at the Arboretum. Nearly all activities cited occur on developed portions of the Arboretum and does not degrade environmental quality. Air, noise, and water quality are largely unaffected.

- (8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.**

The approval will have no cumulative effects or involve a commitment for larger actions. The application is part of a compliance action with a BLNR decision in December. At the same time, it is clear that in the long term after the University completes a master planning effort for the Arboretum there is a possibility of other facilities and activities being added to this Arboretum's programs and plans. However, that action is a separate and potentially future activity that is not a part of the ATF CDUA.

- (9) Substantially affects a rare, threatened or endangered species, or its habitat.**

The approval will not substantially affect a rare, threatened or endangered species, or its habitat. If anything, the approval will improve the U.S. Fish and Wildlife designated critical habitat area of the endangered 'Elepaio bird by improving its habitat through the support of the ecosystem restoration program, which is attempting to retrieve the native habitat of the 'Ohia and Koa forest ecosystem.

- (10) Detrimentially affects air or water quality or ambient noise levels.**

The approval will not detrimentally affect air or water quality or ambient noise levels. Since most activities cited occurred in developed areas there is no increase in runoff. Landscape areas identified represents a small, minor portion of the overall landscape and management practices avoid chemical migrations that could affect ground or surface waters. The items listed do not represent activities that contribute to air borne pollutants and approval does not degrade air quality. The activities represent increased noise levels but the thresholds are well below community standards.

- (11) Affects or is likely to suffer damage by being located in an environmentally sensitive area such as flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.**

The Arboretum is not located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters. The Arboretum is located on steep lands and in a high rainfall area, but the approval will not affect these environmental conditions, since the facilities and activities under question are in the developed portions of the Arboretum, and will not suffer damage by being located there.

(12) Substantially affects scenic vistas and view-planes identified in county or state plans or studies.

The approval will not substantially affect any scenic vistas and view-planes. The site is currently developed as the Lyon Arboretum. The listed activities help to maintain the appearance of the grounds and the facilities. It does not represent any significant new construction that might impact viewplanes.

(13) Require substantial energy consumption.

Since this is an ATF CDUA the energy imbedded in construction has already occurred. Also, the scale of activities is relatively small and operational costs are relatively minor. The approval will not require substantial energy consumption relative to existing conditions.

7.3 SUMMARY

Based on the above findings, further consideration of the potential impacts of the retroactive approval of activities cited as violations by the BLNR through the preparation of an Environmental Impact Statement is not warranted. A Finding of No Significant Impact (FONSI) is anticipated for this proposal. The Lyon Arboretum will continue to provide great public benefits while resulting in minimal impacts on the surrounding environment.

SECTION 8.0

List of References and Personal Communications

8.0 LIST OF REFERENCES AND PERSONAL COMMUNICATIONS

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APPENDIX A

Management and Fiscal Audit of the Harold L. Lyon Arboretum

The Auditor State of Hawai'i

Management and Fiscal Audit of the Harold L. Lyon Arboretum

A Report to the
Governor
and the
Legislature of
the State of
Hawaii

Report No. 04-14
December 2004



THE AUDITOR
STATE OF HAWAII

The Office of the Auditor

The missions of the Office of the Auditor are assigned by the Hawaii State Constitution (Article VII, Section 10). The primary mission is to conduct post audits of the transactions, accounts, programs, and performance of public agencies. A supplemental mission is to conduct such other investigations and prepare such additional reports as may be directed by the Legislature.

Under its assigned missions, the office conducts the following types of examinations:

1. *Financial audits* attest to the fairness of the financial statements of agencies. They examine the adequacy of the financial records and accounting and internal controls, and they determine the legality and propriety of expenditures.
2. *Management audits*, which are also referred to as *performance audits*, examine the effectiveness of programs or the efficiency of agencies or both. These audits are also called *program audits*, when they focus on whether programs are attaining the objectives and results expected of them, and *operations audits*, when they examine how well agencies are organized and managed and how efficiently they acquire and utilize resources.
3. *Sunset evaluations* evaluate new professional and occupational licensing programs to determine whether the programs should be terminated, continued, or modified. These evaluations are conducted in accordance with criteria established by statute.
4. *Sunrise analyses* are similar to sunset evaluations, but they apply to proposed rather than existing regulatory programs. Before a new professional and occupational licensing program can be enacted, the statutes require that the measure be analyzed by the Office of the Auditor as to its probable effects.
5. *Health insurance analyses* examine bills that propose to mandate certain health insurance benefits. Such bills cannot be enacted unless they are referred to the Office of the Auditor for an assessment of the social and financial impact of the proposed measure.
6. *Analyses of proposed special funds* and existing *trust and revolving funds* determine if proposals to establish these funds are existing funds meet legislative criteria.
7. *Procurement compliance audits* and other *procurement-related monitoring* assist the Legislature in overseeing government procurement practices.
8. *Fiscal accountability reports* analyze expenditures by the state Department of Education in various areas.
9. *Special studies* respond to requests from both houses of the Legislature. The studies usually address specific problems for which the Legislature is seeking solutions.

Hawaii's laws provide the Auditor with broad powers to examine all books, records, files, papers, and documents and all financial affairs of every agency. The Auditor also has the authority to summon persons to produce records and to question persons under oath. However, the Office of the Auditor exercises no control function, and its authority is limited to reviewing, evaluating, and reporting on its findings and recommendations to the Legislature and the Governor.



THE AUDITOR

STATE OF HAWAII

Kekuanao'a Building
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OVERVIEW

Management and Fiscal Audit of the Harold L. Lyon Arboretum

Report No. 04-14, December 2004

Summary

As requested by the Legislature in Senate Concurrent Resolution 115 of the 2004 Regular Session, we conducted a management and fiscal audit of the Harold L. Lyon Arboretum (Lyon Arboretum). In its resolution, the Legislature noted concerns regarding operational and fiscal accountability at the arboretum. The Lyon Arboretum is an organized research unit administratively attached to the College of Natural Sciences of the University of Hawaii at Manoa. Located at the head of Oahu's Manoa Valley, the arboretum covers approximately 194 acres harboring a collection of native and exotic plants.

We found that, for over half a century, the University of Hawaii has neglected its stewardship of the arboretum. The university was entrusted with "full powers of management and control . . . to use, maintain, and preserve the granted premises as an arboretum and botanical garden only" when the Hawaii Sugar Planters' Association gifted the facility to the institution in 1953. However, the university administration has not provided the strategic direction needed to fully explore and develop the arboretum's potential contribution to the institution's mission. Instead, the arboretum's course has been left to its caretakers—the facility's staff—without affirmative integration into the university's strategic mission.

The university's neglect has been reflected in its spare funding support of the arboretum and its tolerance of the facility's physical deterioration. The funds provided to the arboretum by the university have barely sustained the status quo. No regularly scheduled repair and maintenance have been performed, and the arboretum's upkeep relies heavily on the help of volunteers. At our urging, the university assessed the arboretum's condition and temporarily closed the premises for health and safety reasons.

The arboretum also suffers from organization disarray. Effective management controls are missing, exposing the arboretum to disorder. Without a strategic plan, the arboretum's resources cannot be effectively deployed. The arboretum lacks a systematic budgeting process, an updated organizational structure, and accurate position descriptions. Under this state of affairs, no meaningful staff performance evaluations can be accomplished.

We also found that a disinterested university administration has overlooked irregular and improper operations at the arboretum. The university was recently fined \$10,250 for several land use violations and cannot undertake construction or other land use projects on its premises, other than routine maintenance for health and safety reasons, without first resolving these violations. Arboretum employees have also planned for and built structures without proper permits. Furthermore, the arboretum must resolve federal wastewater disposal issues by April 2005 or face substantial fines.



We also found the arboretum's financial and inventory accounting to be substandard. The arboretum has tolerated the Lyon Arboretum Association's encroachment on fiscal and operational affairs, leading to a blurring of areas of responsibilities between the two entities. Uncertainty surrounds the arboretum's inventory of equipment and other resources. The arboretum and the association cannot confirm ownership of certain equipment purchased by the association; for operational expediency, certain arboretum contracts and grants have been administered by the association to circumvent university policies and procedures; and certain association fundraising activities have involved use of university employees and resources. In addition, the association and other organizations have occupied arboretum premises and expended associated utilities rent-free, with no lease agreements.

Recommendations and Response

We recommended that the University of Hawaii's Board of Regents, its administration, and the chancellor of the Manoa campus determine whether the university's continued stewardship of the arboretum is in concert with the institution's overall mission. If the stewardship is to continue, we recommended that the university begin a strategic planning process with definite deadlines and inclusion of appropriate stakeholders and that it ensure the management tools flowing from a strategic plan be developed. In addition, we recommended that the arboretum be brought into conformance with conservation district and other applicable requirements. We also recommended that roles and responsibilities between the arboretum, the association, and other organizations occupying arboretum facilities be defined and appropriate documents be prepared to memorialize the relationships. Finally, we recommended that the arboretum's financial and inventory accounting systems be brought into conformance with university requirements.

In its response to our draft report, the university appears to be in general agreement with our findings and recommendations. It reports that the university has already addressed some of the recommendations and will address each of them within the next year. The university, however, is disappointed that our report did not sufficiently recognize the efforts made since June to correct "the shortcomings in past practices." It points to certain remedial measures taken to reopen the arboretum in January 2005, its \$3 million request for capital improvements at the arboretum, and formation of a task force. However, strategic questions concerning the arboretum's mission, its role in the university's overall mission, and the arboretum's continued association with the university still remain unanswered.

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APPENDIX B

Land Management of the Lyon Arboretum

William McClatchey and Charles Hayes

The following appendix is a work-in-progress, and is not to be considered a final draft. As such, this has not yet been approved by the interim director of Lyon Arboretum, the Office of the Vice-Chancellor, or the Board of Regents. A final draft is anticipated by August 2005.



LYON ARBORETUM
The University of Hawai'i at Manoa

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September 22, 2004

Peter Young, Chairman
Department of Land and Natural Resources, State of Hawaii
1151 Punchbowl Street, Rm 220
P.O. Box 621
Honolulu, HI 96809

Aloha Peter Young,

Please find enclosed a discussion of the Lyon Arboretum's management history. When the University of Hawai'i received the Lyon Arboretum from the Hawai'i Sugar Planters Association, the focus of its management expanded from that of a large experiment in watershed restoration to include general horticultural and botanical research. Since then, the Arboretum has expanded from research alone to include educational and community service activities. In recent years this expansion has included being open to the public and development of a diverse range of training and educational opportunities for students of all ages and the general public. A number of different small scale commercial activities have been conducted, including the popular "plant sales". All commercial activities have been used to generate funding to support on-going Arboretum programs.

It has recently been brought to the attention of the Arboretum directors, staff and University upper administration that the Arboretum is deficient in its adherence to the regulations of the Department of Land and Natural Resources. The enclosed document is intended to describe the activities of the Arboretum, particularly as they relate to decisions about facilities that have been made over the last 40 years. Following the submission of this document, it is the intention of the University to produce a CDUA and land management plan as soon as possible.

This discussion of the Lyon Arboretum is divided into three sections. First is an overview of the way in which the Arboretum resources have been managed. Second is a review of the components of the Arboretum before 1964. Third is a review of activities that have occurred since 1964.

Sincerely,

Charles Hayes, Interim Arboretum Director and Dean, College of Natural Sciences

Land Management of the Lyon Arboretum

I. Land Usage.

The Arboretum lands consist of over 190 acres made up three management areas (see **Appendix 1**): 1. About 20 acres of landscaped lower grounds with parking, paved roads, and buildings for grounds maintenance, research, education, and visitor information and activities that to a large extent have functioned as a botanical garden (hereafter called “**lower grounds**”), 2. About 160 acres of artificial forest composed of collections of alien trees, shrubs, vines, and herbs arranged in research plots, (hereafter called “**research section**”) and 3. About 10 acres of native forest in the steep, higher elevation parts of the Arboretum (hereafter called “**restoration section**”).

These lands have been managed loosely in the above three categories with greatest effort focused in the lower grounds and research sections and only minor effort in the restoration section. Throughout the Arboretum, some species of invasive trees are a chronic problem. These include *Albizia*, some banyans, *Cecropia*, *Heliocarpus*, *Macaranga*, *Schefflera*, *Cinnamomum*, and *Trema*. Since these trees interfere with the research collections they are regularly trimmed or removed. These have been of particular concern when they are found invading native forest in the restoration section. Alien trees have been removed when a) hazardous, b) interfering with power lines, facilities, research plantings, c) preventing growth of native plants, d) when resources and staffing allow.

Although there has been no formal management plan, efforts by the staff have generally centered on:

1. Maintenance and development of the diversity of research collections growing in the grounds
2. Maintenance of landscaping in the lower grounds
3. Reduction of the density and distributions of invasive species
4. Improvement of elements of Hawaiian cultural landscape such as the lo‘i, and improvement of research and production capacity to work with native plant species for restoration and other conservation activities.

II. Facilities.

The Arboretum facilities include buildings originally designed to house sugar cane plantation workers, as well as equipment sheds and barns. In addition, greenhouses, rain shelters, environmental monitoring stations, and open air educational buildings have been constructed since the University took over management of the grounds. Although the buildings vary in their quality and level of maintenance, all (except the seismographic station) have been in recent use. Although the total footprint of Arboretum buildings has increased since the University acquired responsibility for the site, if older, less useful buildings were removed, there would probably be a net decrease in foot print.

Although there have been several plans for facilities that have been developed over the years, none of these have been advanced for approval by the University and appropriate state agencies. Instead, management of the facilities has shifted over the years from most of the facility space (cottages) being used as rentals to support the Arboretum budget, to research and education activities focused primarily in three areas: 1. Horticultural development, 2.

Native plant conservation, and 3. Adult, university, and children’s (K-8) environmental education. (Adult education emphasized in the 1980's and 1990's with children’s education expanding after 2001.)

III. Trail System.

The Arboretum has many miles of trails that vary in quality from easily accessible gravel pathways, to steep, narrow “pig trails”. The trails in the lower grounds area have been managed for easy access by educational groups and general visitors, with educational signs next to plants along the pathways. Trails in the research section have been managed for access to the plant collections and for hiking by visitors, specifically those wanting to visit some of the waterfalls, other land features, view points, and unusual collections of plants. Trails in the restoration section have limited access and are poorly maintained. (Exceptions to this are the Manoa Cliffs trail that passes through part of the Arboretum native forests and the upper Aihualama trail. These sections are maintained by Na Ala Hele.)

No formal trail management plan has been approved by the University and other state agencies, but long-time staff member Ray Baker has steadily worked to improve overall trail quality and to maintain accessibility for researchers and visitors. Some recent improvements to trails in the lower grounds have been well received by visitors but have also involved a need for greater maintenance by the staff in areas where erosion is a problem.

IV. Research Plant Collections.

The Arboretum research plant collections include roughly 1,500 native accessions and 15,000 accessions of alien species, including palms, bromeliads, aroids, figs, ancient Hawaiian cultivars, and others listed below. These have been managed with special care taken to eradicate any parts of the alien plant collections with tendencies to become invasive. Research collections also include species of native plants growing in native forest, in experimental restoration areas, in educational displays, in greenhouses, and in tissue culture. The research collections are spread across all three areas of the grounds.

Although no formal plan for management of research collections has been approved by the University, there has been consistent emphasis by the staff on expansion of species diversity and development of greater opportunities for horticultural, taxonomic, biochemical, ecological, and conservation researchers. The result of decades of steady work by the staff is a collection of plants that is not equaled anywhere else in the United States.

V. Educational and Visitor (General Public & Tourists) Activities.

The Arboretum educational and visitor activities include classes of pre-K-12 children, teachers, University courses, tourists, and small ecotourism groups learning about plants, plant environments, and conservation issues. Visitors not associated with the University have been asked to provide a donation each time they visit or to become annual members of the Lyon Arboretum Association. The Arboretum offers a range of K-12 teacher training courses, courses for children, and adult education courses dealing with topics tightly or loosely associated with plants. Most students in most courses have been asked to pay a tuition fee. Tuition and donations have been used to pay for grounds and education staff and for improvements in the lower grounds. Educational and visitor programs of all types are limited in scale by the small size of the Arboretum parking lot, limited classroom facilities, and number of available staff members.

Children’s education programs usually have involved a nominal fee of ~\$3 per child for school field trips that are activity-based (the vast majority). This covers the costs of materials and equipment replacement. The Arboretum does not charge anything for self-guided school tours or for groups that

provide their own instructional materials and equipment (probably about 2% of the school field trips are self-guided). Chaperones and teachers are not asked to pay an activity fee.

No formal education development plan has been approved by the University. However, consistent efforts by the staff have developed the Arboretum curriculum as a major resource for environmental science education of local school children.

VI. Commercial Activities.

Although the Arboretum is not established for commercial purposes, some activities have been conducted that are commonly done at botanical gardens and arboreta elsewhere in order to support the costs of maintaining plant collections. These include:

- Establishment of a visitor gift shop for distribution of books and other items of botanical interest, as well as gifts and curios the sale of which supports the activities of the Arboretum.
- Growing plants for sale to the public including new cultivars, ornamental varieties, and native species. The primary purpose of this activity is to make new plant materials available to the public and to promote conservation activities.
- Sale of plants with commercial vendors providing the bulk of the plants for sale.
- Adult education courses, most of which involve some kind of plant, nature, or environmental education component. Adult classes partially support the educational mission of the Arboretum, and fees charged for these classes cover the cost of class materials, an honorarium for the instructor, and the remainder is used to fund and support Arboretum educational programs and events.

Lyon Arboretum Before 1964

Appendix 2 is a map of the Arboretum prior to 1964 with indications of the locations of facilities and major trails. The following is a discussion of the land usage, facilities, trail system, research plant collections, and visitor activities management that was in place before 1964.

I. Land Usage.

Original access to the Arboretum property followed a road that is now unpassable in sections of the adjacent property. This road passes through the northwest part of Paradise Park and emerges behind Cottage G. This road was not functional in 1964. Another road that accessed the Carter house on the east side of the Arboretum may have crossed the Arboretum. However, this road was probably not in use in 1964. A vehicle bridge crossed the Aihualama stream at the point where the current DLNR pedestrian bridge to Manoa falls crosses the stream. All of these roads and the current main entrance road and parking area were unpaved, composed of crushed coral and gravel.

The following are some points about land usage in the Arboretum:

- Since trees had not grown to their present height, the view from the Arboretum was not blocked by Albizia trees as it is today. Likewise, the Manoa community would have been able to see much more of the Arboretum without the Albizia trees.
- Invasive pigs were apparently a problem before 1964 with annual reports mentioning damage. There is a photograph on record of a cage used for pigs.
- Horace Clay and an overseeing committee had established a landscaping plan for the lower grounds area. This includes addition of collections of ornamental and agricultural plants such as Camellias.
- No hardened pathways existed in the lower grounds. Instead, grass pathways were maintained for access to collections. Grass areas were not lined by borders nor divided into sections.
- Maintenance in the research section was limited to the trails and areas adjacent to the trails. Maintenance was most intensive near the lower grounds section.
- The upper parts of the Arboretum research section and restoration section were accessible by trails but not visited often.
- Ancient lo'i located along the east side of Aihualama stream were drained prior to 1964 by construction of a ditch through them. Although it is unclear when the lo'i were last used for growing kalo, presence of walls and auwai indicate that the land was managed for agriculture in the past.
- The U.S. Army used Pauoa flats for training and sometimes these activities flowed over into the Arboretum. There may have been other government activities that periodically took place in the Arboretum because of its position and forest.

II. Facilities.

Cottages A-H existed and were renovated just after Harold Lyon died Renovations facilitated renting cottages A-H to support the Arboretum budget.

- One greenhouse had been constructed next to cottage G.
- Garages were located across from cottages A and B with the one across from A being a

- more solid structure than that across from B (only a covered parking space). Additionally a covered parking garage was located across from cottage D.
- A shower building (~8'x8') was located behind cottage D.
 - A glass greenhouse (~8'x10') was located behind cottage F.
 - The Harrison house was located uphill from cottage G, approximately in the location of the current rain shelter. This house was approximately the same size as cottage B. The sewage system for the Harrison house has not been identified.
 - 2 mule sheds (~8'x12' each) (possibly one being a workshop) were located below cottage G. Another mule shed of unknown size was located next to the Harrison house on the flat area that is now next to the rain shelter.
 - A shed (~10'X10') was located behind cottage H near the trail head for the Hawaiian ecosystem garden.
 - A seismographic station (~10'x15') was placed in the area below Aihualama falls at the end of the jeep trail.
 - A water tank building (~8'x10') stood at the end of the jeep trail near the seismographic station.
 - A diversion pipe led from a holding tank near Aihualama stream along the jeep trail to the current Hawaiian section then across Inspiration point to the Harrison house. A second pipe connected the tank down the jeep trail to the upper cottage area and the lo'i.
 - A Quonset hut had been installed in the entrance of a cave. This included a concrete pad (~6'x8') in front of the cave.

III. Trail System.

Trails in the Arboretum are based first upon trails left from former agricultural activities and access roads for houses. Secondly, trails are based upon paths cut for access to Lyon's tree research plots. Third, trails are based upon access to other collections of plants. The major trail network was established prior to 1964 with trails traveling along ridges and along section boundaries and contours.

IV. Research Plant Collections.

The foundations of the current plant collections were established before 1964. Of particular importance is the overall distribution of tree collections that were originally laid out in a large research plot by Harold Lyon. This plot also includes plantings on adjacent properties where the trees are also still found.

- Prior to 1964 there were three workers who mowed lawns and worked on keeping trails open.
- Taro research collections were well developed and being grown in the area that is now the "great lawn". Adjacent lo'i were not in use at that time. Samples of other Hawaiian cultivated plants were also around the lawn area.
- Research plantings included gingers, heliconias, aroids and palms, however, most of these were not formally accessioned until after 1964.
- Areas of the research section had been planted with a diverse range of palm trees building on some of Lyon's earlier collections.
- A research project testing Arsenic-based toxins had been conducted but no records

- have been identified to indicate where this took place nor what was specifically involved.
- Cottage B (or C?) was used for experiments on mosquitos.
- A weather station was present in the Arboretum before 1964.
- The Arboretum herbarium was established before 1964 and is recognized as an international plant voucher specimen repository.
- A reference library was established before 1964.

V. Educational and Visitor (General Public & Tourists) Activities.

The Arboretum was formerly, for the most part, closed to the public. However, most Arboreta are managed as botanical gardens that are open to the public. As such it would seem that the only reason the Arboretum was not open to the public before 1964 would be a lack of landscaping, facilities, trails, developed collections, and most important, staff to interact with visitors.

VI. Commercial Activities.

Although the Arboretum was donated to the University of Hawaii with an endowment, this has been insufficient to meet the budget. Commercial activities have been conducted to provide a steady revenue stream for the Arboretum that could supplement funds provided by the University and through grants.

- Cottages A-H were rented prior to 1964 as a primary source of revenue.
- Since the Arboretum was not open to the public, there were few opportunities to establish other commercial activities.

Lyon Arboretum Since 1964

Appendix 3 is a map of the Arboretum as it currently (since 1964) with indications of the locations of facilities and major trails. The following is a discussion of the land usage, facilities, trail system, research plant collections, and visitor activities management since 1964. General scenes of the Arboretum grounds are provided in figures 1-3.

Since 1964, the Arboretum has been increasingly used by the public and the University. This has demanded a range of improvements, many of which have been beyond the budget provided by the University. Improvements that have been made have been through special grants or donations and with major efforts from volunteer community groups. Many improvements are still lacking. These will be addressed in a later report.

I. Land Usage (also partly addressed under III below).

Access to the Arboretum has been almost exclusively via the main entrance road (figure 4). The access road has been widened, paved, and drainage placed where needed. The parking lot on the first Arboretum ridge was widened and paved. Other roads have not been significantly improved although drainage trenches and pipes have been installed along the jeep trail.

Albizia trees that are distributed over much of the lower portions of the research section and around the edges of the lower grounds have become quite large. Some of these trees are now becoming hazards as they break due to storms and due to loss of internal structure (figure 5).

Invasive pigs have become episodic problems with periods of time when the pigs destroy parts of the research collections. Hunters have been periodically brought into the Arboretum to deal with the pigs but because there is no fence, pigs are able to easily reenter the Arboretum from any of the adjacent properties.

Despite introductions of species of bromeliads and other plants known to serve as breeding sites for mosquitos, mosquito densities have not noticeably increased. However, changes in other insects have been noted with dramatic increases in kinds and numbers of ants and decreases in numbers of paper wasps.

As the Arboretum forest has grown and become more ecologically complex through the introduction of research species, the numbers and diversity of birds has also increased.

Several pathways in the lower grounds area have been hardened with gravel that is considered to be safer than using grass covered paths or bare soil.

Maintenance in the research section has been extended to include all of the valleys below the restoration section. The research section is largely managed as a set of 10 valleys described below under IV. Maintenance includes control of invasive species such as palm grass that has been heavily reduced with herbicides.

Restoration areas in the upper parts of the Arboretum have been partially surveyed and promoted as sites for restoration research projects.

Ancient lo'i located along the east side of Aihualama stream have been only loosely maintained as adjacent large banyan trees have grown large enough to shade them. Periodic, limited efforts have been made to reopen these through removal of branches of adjacent trees and removal of smaller weedy trees to the south of the lo'i. Ditches that had been constructed to drain the lo'i have not been maintained, while small efforts have been made to restore old

lo'i walls and 'auwai. Lo'i on the west side of the stream have been maintained growing kalo and other Hawaiian cultivars (figure 6). These were used in the 1970's by kupuna Silver Piliwale and have been in varying levels of usage since then.

The Arboretum has been increasingly used as a community facility for meetings and activities of groups not directly connected with the University. University use has also greatly increased in recent years with many courses being taught in part in the Arboretum with field trips, research activities, meetings, etc. University activity has involved faculty and students from several campuses, Leeward, Windward, Honolulu, and Manoa.

II. Facilities.

The following is a list of Arboretum facility activities since 1964. This is organized roughly following the format of HAR Section 11-200-8.

The primary facilities of the Arboretum are:

1. Eight cottages (former homes of sugar plantation workers)(figures 7-13).
2. Greenhouses (figure 14)
3. Children's Learning Center (figure 15)
4. Roads and Parking lot (figure 4)
5. Rain shelters (figure 16)
6. Garages and work sheds (figure 17)

Class #1: Operation, repair or maintenance of existing structures, facilities, equipment or topographical features, involving negligible or no expansion or change of use beyond that previously existing.

1. Operation, repair or maintenance of:

- a. Existing buildings used for offices, classrooms, laboratories, laboratory animals, aquaria, libraries, theaters, student and faculty housing, food service, stores or storage on lands owned, leased or rented by the University.** Repair and maintenance have been irregularly conducted on each of the Arboretum buildings used as offices, classrooms, laboratories, greenhouses, storage sheds, and as a library/herbarium.
- b. Workshops and warehouses.** Workshops (figure 17) are maintained for small tool and cart repair, storage, and construction of fixtures. The Arboretum has not maintained any warehouses.
- c. Swimming pools, gymnasiums, arenas, playfields and playcourts. Playfields to include football, baseball, softball, soccer fields, track and field, and golf short course and putting green. Playcourts to include tennis, basketball, volleyball, badminton and handball.** Although the Arboretum includes lawns that are large enough to be playing fields, they are sloped and unsuitable for sports.
- d. Auto repair shops and fuel storage and pumps not requiring Department of Health permit.** Only small amounts of fuel are stored on site in flammables cabinets. The fuel is for lawn mowers, chain saws, and related landscaping equipment.

e. Automotive equipment. Small gas/electric landscaping carts and a light pickup truck are repaired periodically and stored at the Arboretum for work in the Arboretum (figure 18).

f. Air conditioning and ventilating systems. Air conditioning (figure 19) is only minimally used for preservation of library and herbarium collections in cottage A and for preservation of records in the director's office of cottage H (The cottage H unit has not been used in quite a few years). The systems are periodically maintained. Because the buildings are small, windows are used for ventilation rather than mechanical systems.

g. Refrigerators and freezers. Refrigerators and freezers are used for storage of food and non-hazardous research supplies and samples. These are periodically maintained and/or replaced. Non-repairable refrigerators and freezers are not stored on site.

h. Heaters, boilers, and stoves. No heaters or boilers are used in the Arboretum. Plant driers are used in the greenhouse for processing of plant voucher specimens. These driers are rarely in operation and when in operation function at very low temperatures. These are periodically cleaned before usage. Several cottages have stoves that are used for food preparation including one commercial stove in cottage H.

i. Antennas, towers, and poles. No separate transmission towers have been established in the arboretum, however antennas for wireless internet have been placed on the main greenhouse (figure 20). These have been maintained. No flag poles have been planted. Power line poles cross the Arboretum and have been periodically maintained or improved. Maintenance of the power lines includes trimming adjacent trees.

j. Communication systems. The telephone system in the Arboretum has been maintained and upgraded to provide service to each cottage and the main greenhouse. Internet fiber optic cables have been installed and maintained for outside internet access and communication between the cottages.

k. Electrical, plumbing, and storm drainage systems. Electrical systems have been maintained although most buildings still include some wiring that is out of date. Indoor plumbing systems have been maintained with hook-ups to the city water supply. Problems have been addressed as they are identified. There is not an underground storm drain system, however there are some diversion trenches and pipes that move surface water past buildings or roads. These have been periodically cleaned of debris.

l. Sewer pipelines, aeration ponds and tanks, and cesspools. There is no pipe connection to the city sewer system. Formerly sewage was deposited in injection wells with one for every one or two cottages. Fewer injection wells are now maintained with several being abandoned and no longer maintained. The injection well system for Cottage H failed and has been replaced by a septic tank and leach field (figure 19). No aeration ponds have been used.

m. Roads, walkways, parking lots, bike paths, and vehicular ramps. A single entrance road (figure 4) has been maintained and periodically improved. This road was originally crushed coral and now is paved. A primary access road into the Arboretum through the adjacent property to the south has not been maintained. The primary access road through the middle of the Arboretum (the "jeep trail") is regularly maintained by removing fallen branches and other debris and cleaning of water

diversion trenches. Most walkways in the Arboretum are minimally maintained with fallen branches and leaf litter being periodically removed when grounds crews are working in the area on projects. Walkways near in the lower grounds area are maintained regularly, being kept clean of debris. One parking lot has been improved from gravel/coral to a paved lot with marked parking spaces (figure 4). The Arboretum does not have any bike paths. The Arboretum does not have any vehicular ramps.

n. Furnaces and kilns. The Arboretum has no furnaces. One kiln was constructed on the site but has since been removed. No furnaces or kilns are being maintained by the University.

o. Compactors and incinerators. No compactors or incinerators are maintained at the Arboretum.

p. Pens, cages, ponds/pools, tanks, and greenhouses. Although the Arboretum formerly had pens for horses/mules, these no longer exist. No cages are maintained, although pig traps have been used occasionally. One artificial pond is maintained in the spice garden. Another small pond is maintained near the parking lot. It is kept clean of debris with aquatic plants growing in it. One water holding tank is maintained below Aihualama falls at the end of the jeep road. Screens are kept around the tank to prevent access for mosquitos. Several small natural ponds exist along Aihualama stream. These are not maintained other than sometimes removing trees that have fallen into them. The greenhouses in the Arboretum (figure 14) are minimally maintained because of budget constraints. Maintenance has focused on keeping them operational for growing plants as part of conservation/restoration activities and for sale to support Arboretum activities.

q. Piers, catwalks, floating docks and boat landings. The Arboretum has none of these and will not need them unless global warming becomes extreme.

r. Walls, seawalls, and fences. The Arboretum has numerous low rock walls, some from ancient times, some from the colonial period before 1964, and others that have been constructed since 1964. The walls have rarely been maintained. The Arboretum has no seawalls, yet (global warming may change this in the future). A fence is maintained that encloses the shade house area off of the parking lot. The fence has gates that are usually locked to prevent visitor access to the plant growing areas. Barbed wire is placed across the old entrance road (now covered in weedy trees and bushes) that comes from the bridge at the head of Manoa Falls trail into the Arboretum.

s. Elevators, pedestrian ramps and stairways. There are no elevators in the Arboretum. Wooden pedestrian ramps are located on several of the cottages. The ramps are kept clean and have skid-proof material applied to prevent falls. Each of the cottages has 1-3 sets of stairs that are maintained with handrails.

t. Seats, bleachers, and booths. The Arboretum has numerous benches (figure 24) provided for visitors and staff to use when in the gardens. Benches are of wood, concrete, and/or stone. Many of the benches are memorial markers. The benches are kept clean and periodically refinished/painted or if they become damaged, removed. Some of this work is done by volunteers so is done as they are available and have time. The only booth is an entrance kiosk that has not been in place for long.

u. Campus signs and scoreboards. Larger information signs are placed at the Arboretum entrance, at each end of the parking lot, at the beginning of major trails, and in some of the garden display areas. Thousands of smaller plant identification signs are located next to, or attached to, species for identification by visitors. Very small id tags are found on many plants throughout the Arboretum. These tags are for identification of research collections. The Arboretum has no scoreboards. Examples of signs are shown in figure 22.

v. Artwork and historic structures. Permanent artwork in the Arboretum includes one statue (walking Buddha near the rain shelter), one fountain with a bronze lotus bowl (in the spice garden/Young Memorial Garden area), an orchid stand (near cottage H), and memorial markers. Memorial markers are scattered throughout the lower grounds area and are only minimally maintained. Figure 23 includes examples of sculptures and memorial markers. There are no “historic” structures in the Arboretum, however numerous low rock walls, auwai, and the ahu are all important Hawaiian pre-historic structures that are important to the history and future of the Arboretum. It is unclear if cottage H is considered to be historic. According to Dr. Spencer Lineweber (UH, College of Architecture), it is unlikely that cottage H is an historic building because of the extensive modifications that have been made and its not being already listed on the historic register.

w. Scientific equipment used for research, instructional, and experimental functions, including but not limited to lasers, x-rays, spectrometers, oscilloscopes, analyzers, distillers, computers, electron microscopes and diathermic apparatus. All research equipment that is being actively used is periodically serviced and maintained by individual researchers. Major equipment that is currently maintained is used for rare and endangered species research.

2. Painting and re-roofing of existing buildings. Most of the cottages and greenhouses have been entirely or partly re-roofed and/or painted since 1964. The few exceptions are in desperate need of re-roofing. Most buildings have been repainted during the last 40 years, but these buildings also could stand to be painted again.

3. Campus landscaping and maintenance. Approximately the lower 20 acres of the Arboretum is maintained in a landscaping plan that includes lawns, displays of native and introduced species, and thematic gardens (such as a spice garden) intended to provide visitors with the opportunity to learn about plants and plant environments. Much of the Arboretum staff is dedicated to development and maintenance of the landscaping.

4. Use of EPA and State Department of Agriculture approved pesticides and herbicides under the supervision of certified applicators for spot treatments within specified areas on land owned, leased, or rented by the University, except on Mauna Kea, Haleakalaa, or other sensitive areas. The Arboretum staff includes a certified applicator for application of pesticides and herbicides. It is unclear the extent to which these have been used in the past 40 years, but these are used minimally now in the greenhouses and around research collections in order to control pests and weeds. Usage of these products is primarily in the

lower 20 acres with only minimal application around collections and along trails in the research and restoration sections.

Class #2: Replacement or reconstruction of existing structures and facilities where the new structure will be located generally on the same site and will have substantially the same purpose, capacity, density, height and dimensions as the structure replaced.

1. Replacement or reconstruction of:

- a. Existing buildings used for offices, classrooms, laboratories, or storage on lands owned, leased, or rented by the University, except those that may be aesthetically, historically, or culturally significant.** The Arboretum does not include buildings that have been identified as aesthetically, historically, or culturally significant. One house that was located uphill from Cottage G (The Harrison House) was replaced by a smaller open-sided rain shelter. The garage (covered parking) across from Cottage B was replaced with a workshop.
- b. Hazardous waste material storage areas.** No structures have been reconstructed or built to replace a waste storage area.
- c. Flammable fluid storage facilities or structures.** No structures have been reconstructed or built to replace a flammable storage facility.
- d. Cold storage.** No structures have been reconstructed or built to replace a cold storage area.
- e. Pumps and storage for fuel oils, not requiring Department of Health permit.** No fuel pumps or storage dumps have been established or replaced in the Arboretum.
- f. Workshops and tool sheds.** No replacement workshops or tool sheds have been constructed in the Arboretum.
- g. Tents and temporary sheds.** Although tents have been periodically set up and used for short periods of time, none are currently set up. A metal storage shed behind cottage D replaced the bath house. The Arboretum does not have any temporary sheds set up but does own small metal sheds that could be set up if needed.
- h. Pens, cages, ponds/pools, tanks, and greenhouses.** No pens, cages, ponds, tanks, nor greenhouses have been reconstructed.
- i. Piers, catwalks, floating docks and boat landings.** No piers, catwalks, floating docks, nor boat landings have been reconstructed.
- j. Walls and fences.** Low rock walls have been repaired or replaced as damage has occurred from growth of trees or erosion.
- k. Sewer pipelines, aeration ponds/tanks, and cesspools.** As parts of the sewer system have become faulty they have generally been replaced but not removed. There are several abandoned injection wells and sewer pipes that have been functionally replaced by placement of new pipes and injection wells nearby.
- l. Electrical, plumbing, communications and drainage systems.** Older electrical and plumbing systems have mostly been replaced with modern systems as the older systems have failed.
- m. Air conditioning and ventilating systems.** Air conditioners that have failed have been replaced. These are small non-commercial, window positioned air conditioners. No other ventilating systems are used.

- n. Antennas, towers, and poles.** No antennas, towers, or poles have been replaced except for damaged or aging power line poles that are replaced by the power company.
- o. Elevators, pedestrian ramps, and stairs.** No elevators or ramps have been replaced. Stairs have been replaced or repaired as needed.
- p. Athletic courts and fields.** No athletic courts or fields have been replaced.
- q. Parking lots, walkways, roads, and bike paths.** The main parking lot was formerly made of crushed coral and gravel. It was replaced with a paved parking lot. Several grass walkways in the lower grounds area have been replaced with gravel pathways. The entrance road has been widened and re-paved. There are not official bike paths in the Arboretum.
- r. Compactors and incinerators.** No compactors or incinerators have been replaced in the Arboretum.
- s. Campus signage.** Signs have been periodically replaced as they have become damaged or worn with age.

Class #3: Construction and location of single, new, small facilities or structures and the alteration and modification of same and installation of new, small, equipment and facilities and the alteration and modification of same including but not limited to: (a) single family residences less than 3,500 square feet not in conjunction with the building of two (2) or more such units; (b) multi-unit structures designed for not more than four (4) dwelling units if not in conjunction with the building of two (2) or more such structures; (c) stores, offices and restaurants designed for total occupant load of twenty (20) persons or less per structure, if not in conjunction with the building of two (2) or more such structures; (d) water, sewage, electrical, gas, telephone, and other essential public utility services extensions to serve such structures or facilities; and (e) accessory or appurtenant structures including garages, carports, patios, swimming pools, and fences; and acquisition of utility easements.

One new building has been constructed, the Children's Learning Center (figure 15), that is not addressed in the following categories. The building is located between cottages A and B and does not include toilet or most other facilities. The building is intended to serve as a site for teaching children in conjunction with the adjacent Children's Garden. The building is an open-air rain shelter facility used for children's and adult education, community meetings, and is the only ADA compliant facility in the Arboretum. The Hong Yip Young Memorial Garden was constructed in the 1990's and includes a stone wall, walkways, pond, and pavilion (gazebo).

1. Construction or alteration of:

- a. Storage sheds** (figure 17). The shower building that was located behind cottage D was removed and replaced by a pre-fabricated storage shed (~8'x8') on the former foundation.
- b. Workshops** (figure 17). A workshop (~25'x20') was constructed across the road from cottage B. The Pacific Potter's Guild constructed a shed (~20'x20') next to Cottage A. This shed included a kiln. (The shed has since been removed and replaced with the snail greenhouses discussed below.)

c. Greenhouses (10,000 square feet or less) and shadehouses (20,000 square feet or less) (figure 14). A greenhouse (~25'x40') for growing rare and endangered species associated with the tissue culture lab was constructed behind cottage C. Two small greenhouses (~10'X15') for experiments on native plants and terrestrial snails were placed next to cottage A. One greenhouse with small head house for certified plants was constructed between cottage F and G next to an older greenhouse. A large greenhouse (~25'x50') and head house (~25'x50') on the main parking lot was finished in 1967. A shade house and acclimation yard was subsequently constructed off the east end of this greenhouse. A teaching greenhouse (~20'X30') was added in the late 1980's behind cottage H.

d. Booths and tents. A 4'x6' open sided kiosk (figure 22) was placed just inside the entrance gate in order to provide information, control traffic flow, increase visitor safety, and collect donations.

2. Air conditioning and ventilating systems: Window units not to exceed recommended size for the room or 32,000 BTU, whichever is smaller. All normal maintenance and operations to be permitted.

3. Incinerators to be used only for the disposal of pathological materials, some of which may be contaminated by radionuclides. Capacity of incinerators to be not more than 175 lbs./hr. of animal or contaminated wastes. Incineration of radionuclides to comply with license issued by U. S. Nuclear Regulatory Commission. License specifies limits of emissions and ash content of radionuclides. Complete record is kept by UH Environmental Health and Safety Office on all receipts, transfers, uses and disposal of radioactive materials.

The Arboretum has no incinerators.

4. Antenna Systems: Receiving-only type antennas, 6 feet diameter or less dish antennas or 20 feet high or less vertical antennas.

The Arboretum has no large antennas.

Class #6: Construction or placement of minor structures accessory to existing facilities.

1. Construction or placement of:

a. Ticket booths, tents, platforms, and toilets. A 4'x6' open sided kiosk (figure 22) was placed just inside the entrance gate in order to provide information, control traffic flow, increase visitor safety, and collect donations. Tents (figure 19) have been periodically erected for a day or two during events that take place on the lawns and in the parking lots. No permanent platforms have been constructed but temporary stages have been placed on the lawns and park lots for events. New toilets facilities have been installed in some of the cottages without modification of the building footprint. Portable toilets (figure 19) have been brought in for short periods of a few days to months in order to meet additional needs of events, courses, and tourists.

- b. Pens, sheds, cages, tanks, and ponds.** No new pens have been constructed. Small work and storage sheds have been constructed in the lower grounds area adjacent to roads and existing cottages.
- c. Scoreboard, signs and flag poles.** Three larger signs have been placed in the new Hawaiian ecosystems garden using a grant from the DLNR Kaulunani program.
- d. Sculptures and statues.** Art (figure 23) has been placed in a variety of locations in the lower grounds section.
- e. Standby generators, panel boards, and switchboards.** No standby generators, panel boards, or switchboards are in the Arboretum
- f. Utilities and trash enclosures.** No enclosures have been built.
- g. Water pumps and pipes.** No water pumps are installed. Water pipes connecting the Aihualama collection tank to parts of the research area and lower grounds near the jeep trail have been replaced. City water has been plumbed from the cottages to several locations in the lower grounds for watering of plant collections.
- h. Lights to all walkways, roads, and exits.** The Arboretum has not installed lights along most walkways, roads and exits. One exception is lighting that leads along the path from the front of cottage H to the teaching greenhouse.
- i. Furnishings.**

2. Structures not to exceed 500 square feet floor area, one story and including all normal and usual types of electrical and plumbing systems. Two new structures have been built that exceed 500 square feet: the Children's Learning Center (figure 15) between cottages A and B, and the Rare/Endangered plant greenhouse (figure 14) behind cottage C. Each of these was built with the knowledge of DLNR staff.

3. Air conditioners and ventilating equipment: maximum capacity not to exceed 32,000 BTU.

4. Within the building footprint and envelope (building perimeter and height) construction of additional building floor area limited to no more than 10% of the existing building floor area. Small porches and extensions of rooms have been made that are less than 10% increases. However, decking around cottage C (figure 9) has been built that exceeds a 10% increase and decking built around cottage D (figure 10) may be close to exceeding 10%. Excavations below cottages B, C, D, and F were conducted in order to add a floor beneath each. Concrete foundations were also poured below each of these buildings. The footprint of the buildings was not changed with the addition of these floors, although the floor space in each building was dramatically increased.

Cottage H (figure 13) has had several minor renovations that have resulted in increased working areas within the building. These include conversion of the north facing lanai into an enclosed classroom above and a director's office below, building of a covered lanai off the northwest side of the enclosed classroom, enclosing and pouring a foundation for the lower classroom/work area/kitchen, construction of a teaching greenhouse at the back, and extension of the entrance roof on the west end of the building in front of the gift shop. Altogether these improvements exceed a 10% expansion of foot print.

Class #7: Interior alterations involving such things as partitions, plumbing, and electrical conveyances.

1. Construction, repair, or removal of interior partitions. Walls have been removed, repaired, and constructed in several of the cottages in order to accommodate changing research, office, and education programs.

2. Modifications to interior plumbing, electrical, communication, and ventilating systems. The plumbing, electrical, and communications in most of the buildings has been either improved, added, or replaced as needed for safety and convenience.

3. Repairs or modifications to transformers, transmitters, panel boards and switchboards. A transformer on a power pole blew up in flames when a tree fell on the lines many years ago. This was replaced. The transformer that serviced the defunct Seismic Cave, was removed.

4. Modifications to floors, ceilings, and roofs. Numerous modifications to the cottages have included changes in flooring, ceilings, and roof materials.

5. Painting. Buildings are periodically painted.

6. Masonry and concrete work. Cottages A, B, C, D, F, and H have had parts or complete foundations poured under them. In addition, retaining walls have been built under some of the cottages in order to prevent water incursions.

Class #8: Demolition of structures not functional or economical to remodel and maintain, except those located on any historic site as designated in the National Register or Hawai'i Register as provided for in the National Historic Preservation Act of 1966, Public Law 89-665, 16 U.S.C. Section 470, as amended, or Chapter 6E, Hawai'i Revised Statutes. The Harrison house was removed since 1964 with its foundation cleared to make way for the rain shelter. Two small sheds have collapsed from lack of maintenance/use and were removed for safety reasons. Several of the cottages may be in need of extreme repairs or demolition.

The small glass greenhouse that was behind cottage F collapsed in a wind storm, and was not replaced because of lack of funds. It has been largely removed.

Class #9: Zoning variances for storage of flammable and combustible materials except: use, density, height, parking requirements and shoreline set-back variances. No variances have been requested for the Arboretum.

Class #10: Continuing administrative activities including, but not limited to purchase of supplies and personnel-related actions.

1. Purchase of supplies, services, and equipment for instruction, research, public service, and support functions of existing operations. The Arboretum staff and director continue to purchase materials needed for continuance of the Arboretum.

2. Performance of research, instruction, public service, and support functions in existing facilities. All existing indoor and outdoor facilities are used, although not continuously.

3. Procurement and use of utility services, motor vehicles and maintenance equipment. The Arboretum has purchased vehicles, utility services, and grounds and building maintenance equipment.

4. Receipt and storage of supplies and equipment. Supplies and equipment are received and stored at the Arboretum.

5. Actions necessary to comply with Occupational Safety and Health Act and Title IX requirements. HIOSH and the University of Hawaii Safety Offices make periodic inspections of the Arboretum with have resulted in actions on the part of Arboretum staff and director.

III. Trail System and Landscape Management.

Trails in the Arboretum are based first upon trails left from former agricultural activities and access roads for houses. Secondly, trails are based upon paths cut for access to Lyon's tree research plots. Third, trails are based upon access to other collections of plants. The major trail network was established prior to 1964 with trails traveling along ridges and along section boundaries and contours. Since then, trails have been improved in a number of ways intended to reduce erosion and improve researcher access to collections and experimental restoration plots.

Trail improvements in the lower grounds include surfacing with gravel and lining trails with trex. Steep trails in the research section include dug-out steps lined with trex and reinforced to prevent erosion. DLNR staff has been consulted about material and design considerations prior to trail construction. A landscape architect with a specialty in ADA accessibility issues was consulted about trails in the children's garden area.

As trails have been maintained, new trails have been added where new collections are being out-planted. New trails have also been developed into restoration areas in order to facilitate researcher and volunteer worker access. Trails in the restoration section also facilitate monitoring for *Miconia* and other possible invaders, and allow pig hunters to cross these areas without damaging the forest.

The following is a list of Arboretum trail activities since 1964. This is organized roughly following the format of HAR Section 11-200-8.

Class #4: Minor alterations in the condition of land, water, or vegetation.

The staff of the Arboretum use a small truck, utility carts, lawn mowers, chain saws, and other small tools to maintain the grounds and trails.

Three training groups have used the Arboretum to develop their skills in forest management. These include local arborists who train in the Arboretum, providing free services in the process, fire fighters conducting controlled burns as part of their training for dealing with forest fires, and the volunteer stewardship network. Controlled burns and chain saws have been used to clear downed, damaged, and invasive trees shading the lo'i and adjacent Hawaiian cultivated plant collections. Controlled burns have been conducted with City and County permits and inspections. The volunteer stewardship network worked on clearing,

planting native species, building trails. Presumably the training has been useful for conservation efforts and fire control activities elsewhere in the state.

1. Grubbing and mowing of landscaped and lawn areas. The Arboretum lower grounds has large areas of lawn that are regularly mowed. The lawns are intermixed with plant displays and other landscaping features. These are all maintained and periodically altered with replacement of dead or damaged plants with new plants and with out-planting of interesting new accessions.

2. Planting of trees, other plants, and sod. The Arboretum is AN ARBORETUM. Thousands of trees have been planted in experimental and display plots in the lower grounds and research sections. In addition, understory plants accessioned into the Arboretum collections have been planted in ecologically appropriate locations in the lower grounds and research sections. Native trees and other plants have been planted in several sections of the lower grounds, research section, and native forest section.

3. Pruning of trees and shrubs. Trees and shrubs are pruned as needed and as allowable by staffing and resources. Although Director Gillette planned to remove large albizzia trees in the 1960's for safety reasons, they have yet to be removed. These are now so large that they will be quite expensive to eliminate.

4. Cultivation, tillage, ridging, and land leveling preparations for agricultural purposes. No new agriculture is practiced in the Arboretum. Lo'i on the west side of 'Aihualama stream are modified from HSPA sugar terraces while those on the east side are from ancient Hawaiian terraces. Lo'i on the west side have been used for taro, ko, 'uala, mai'a, etc. in recent years while the lo'i on the east side have been minimally reopened but not yet replanted. Passive erosion control is conducted through planting ground cover, not removing trees in banks, and planting banyan trees (other than *Ficus microcarpa*) along actively eroding areas.

5. Use of EPA and State Department of Agriculture approved pesticides and herbicides under the supervision of certified applicators for spot or test plot applications within specified areas on land owned, leased, or rented by the University, except on Mauna Kea, Haleakala, or other sensitive areas. Approved pesticides and herbicides have been conservatively used in the lower grounds and parts of the research section.

6. Stockpiling of up to 500 cubic yards of soil material. Soil is not stockpiled although branches, leaves and other products of trimming/pruning are used as mulch under trees. Additional mulch is periodically donated by commercial landscape maintenance companies. Commercial potting soil is stored and used in the greenhouses but not in large quantities. Mulching and some soil conservation are done. Weeds that are cut are stacked for soil development. When trails cross clearings, wind rows of brush are placed below the trails to prevent erosion and promote soil development.

IV. Research Plant Collections.

A large amount of research has been conducted in the Arboretum since 1964. However, most of this has not involved changes in the structure or management of the Arboretum. The primary research collections in the research section are organized as follows by valley (see **appendix 4**)

- Valley 1: Fern and cycad collections/displays
- Valley 2: Aroids but mostly undeveloped
- Valley 3: Native Hawaiian Plants, miscellaneous, Economic plant displays, upper area includes an experimental restoration site.
- Valley 4: African and Madagascar palms
- Valley 5: Asian and American palms
- Valley 6: Pacific palm section and 'Aihualama falls
- Valley 7-10: Miscellaneous tree collections

Other plant collections are mixed in with the above based upon appropriateness of ecosystem and availability of space. The lower grounds also has thematic collections some of which are accessioned and others that are not. Thematic sections in the lower grounds and research section include:

- Spice and Herb collection
- Childrens garden
- Hawaiian ethnobotany garden
- Caum's gulch South Pacific plant collection
- Ornamental ti collection
- Native Hawaiian plant collection
- Hawaiian Ecosystem demonstration garden
- Ginger collection
- Heliconia collection
- Economic plant display
- Marantaceae collection
- Bromeliad collection
- Palm collection
- Cycad collection

The following is a brief overview of Arboretum research activities since 1964. A listing of specific research activities would be much longer. This is organized roughly following the format of HAR Section 11-200-8.

Class #5: Basic data collection, research, experimental management, and resources evaluation activities which do not result in a serious or major disturbance to an environmental resource. The Arboretum was originally a large research experiment on growth of trees and other introduced plants for watershed restoration. Research is still the primary focus of the Arboretum.

Arboretum living plant collections, in tissue culture laboratory, seed refrigerators, greenhouses, and throughout the grounds are major assets for the State of Hawaii and the University of Hawaii. The herbarium and library are important resources associated with these

collections. Although the herbarium has been temporarily located onto the main campus, as soon as appropriate facilities are available, it will be returned to the Arboretum where it will be accessible to researchers. Other major research assets include large collections of images, databases, and a germ plasm bank. The Arboretum functionally has one of the largest bioinformatics collections in the state of Hawai'i.

In addition to conducting research and maintaining plant collections, the staff of the Arboretum also serve as unofficial extension agents for the community. Questions are addressed often enough that it would be appropriate for the University to have an Arboretum-based extension agent with the task of providing Arboretum research, plants, and associated information to the public.

One of the important research activities is the conservation and restoration of native Hawaiian plants. This work has involved experimental out-planting of hibiscus, sedges, 'ohi'a, koaia, hapu'u, maile, 'uki'uki, and other species as well as preliminary studies of native forest diversity. As a rule, when native plants are encountered in the Arboretum they are left alone and encouraged through local weeding/hand release. Conservation efforts through propagation of native plants and development of a native seed bank are key aspects of this effort.

1. Gathering of soil, air, water, plant, animal, fish, mineral and other specimens for research, experimental, or instructional purposes. This item does not apply to: the gathering of threatened or endangered plant, animal or fish species; the importation of plant, animal or fish species; actions that detrimentally affect air or water quality and ambient noise level. Samples of plants, animals, and soil have been collected and examined as part of research activities.

2. Historic, geographic, or demographic surveys. Informal archaeological, geological, and geographical surveys have been conducted in the Arboretum mostly by University faculty and students.

3. Topographic, land use, soils, and drainage surveys. Studies of topography, soils, and hydrology have been conducted in the Arboretum.

4. Flora and fauna surveys. Surveys of plant diversity, fungal diversity, micro-organisms, birds, insects, invasive species, and other kinds of surveys are fundamental activities of the Arboretum.

5. Environmental impact research. Environmental impact studies of restoration of forests and native forests have been underway since before 1964.

6. Horticultural, silvicultural and floracultural experiments within confined sites. For many years a major focus of the Arboretum was on horticultural development of new ornamental plant varieties. Horticulture is traditionally an important part of the kinds of research conducted in an Arboretum. Silviculture has been conducted only on a very small scale but needs to be increased, particularly in the area of native tree production. Floracultural

experiments have been conducted in the lower grounds as these are consistent with publicly accessible displays of interesting flowering plants.

7. Experimental and research projects with native flora and fauna, including within the Conservation District with the consent of DLNR and the respective county agencies, where applicable. Experimental research on native plants and ecosystems has been conducted in the Arboretum, some using DLNR funding.

8. Archaeological surveys supervised by a qualified archaeologist. Only brief archaeological surveys have been conducted. Sites that are present include at least 16 lo'i walls, one small heiau or large 'ahu, several smaller 'ahu which are possible burial sites. A certified archaeological survey has not been identified in Arboretum records but would be helpful.

9. Storage of flammable and combustible liquid to comply with OSHA regulations and not to exceed 5,500 gallons in approved storage facilities; floor area not to exceed 700 square feet. Storeroom to be equipped with automatic fire protection and 2-hour firewall. All flammable materials are stored in approved quantities in approved locations. The laboratories, greenhouses and work shops are periodically inspected by HIOSH and University of Hawaii safety inspectors with problems addressed as they are encountered and plans developed for prevention of problems.

10. Storage of radioactive materials. Storage to comply with U. S. Nuclear Regulatory Commission license issued to the University of Hawai'i. A complete record is kept of all radioactive material received. No radioactive materials are stored or used in the Arboretum.

V. Educational and Visitor (General Public & Tourists) Activities.

The Arboretum was first opened to the public in 1972. By the end of the 1970's it was open most week days. In the last two years the Arboretum has periodically been open seven days a week. Visitors to the Arboretum receive brochures and maps about the collections. Many collections are labeled with informative signs. Improved interpretation signs have been developed in recent years (figure 22).

Periodically the public has used the Arboretum for large gatherings. The largest of these was the 'Awa Festival held in October 2003. This event involved as estimated 2500 people visiting the Arboretum in one day (figures 25&26).

VI. Commercial Activities.

Commercial activities have been important for the support of staff and programs. Some of the activities include:

- Cottages A-H were rented (off and on) over the years with the last (Cottage F) tenant in 2000.
- Sale of plants (native and new hybrids) grown in the Arboretum and brought to the Arboretum for sale by commercial vendors.

- Weddings.
- Memorial services.
- Commercial films and photography. Non-commercial films have also been produced in the Arboretum for HVCB ads, DOH water quality ads, and many educational productions done by students and NGO's.
- Community courses for children and adults.
- Commercial tours by eco-tour companies and/or Arboretum docents.
- Open house day sales of crafts and plants.
- Sale of cut flowers/foilage
- Sale of wood benches and curios, oshibana, seed jewelry, pottery, kadomatsu, and lei
- Lyon Arboretum Gift Shop
- Sale of jams & jellies made by a volunteer group for the benefit of the Arboretum.
- 'Awa Festival sales of plants, shirts, food, etc by commercial vendors.

Figure 1. Views of the Arboretum



Figure 2. Views of the Arboretum. **A** Arboretum native forest restoration section in foreground and upper part of left side of slope. **B** Arboretum native forest restoration section in foreground and Arboretum facilities in middle.

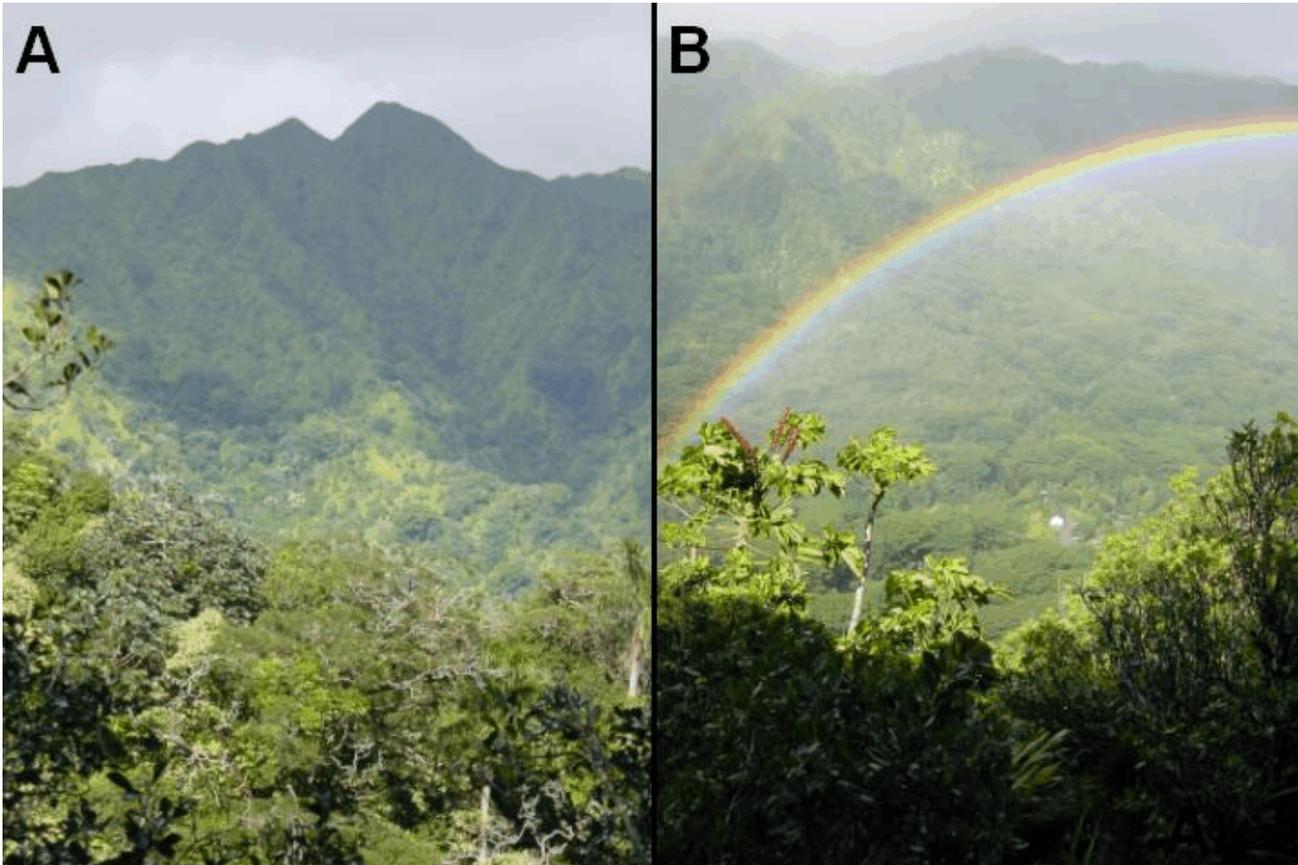


Figure 3. Views of the Arboretum. **A** Left half of photo is Arboretum. **B** Arboretum facilities as seen from the upper heights of the Arboretum. **C** Entrance road near cottage A, B, and Children's Learning Center. **D** Facilities as seen from the air.

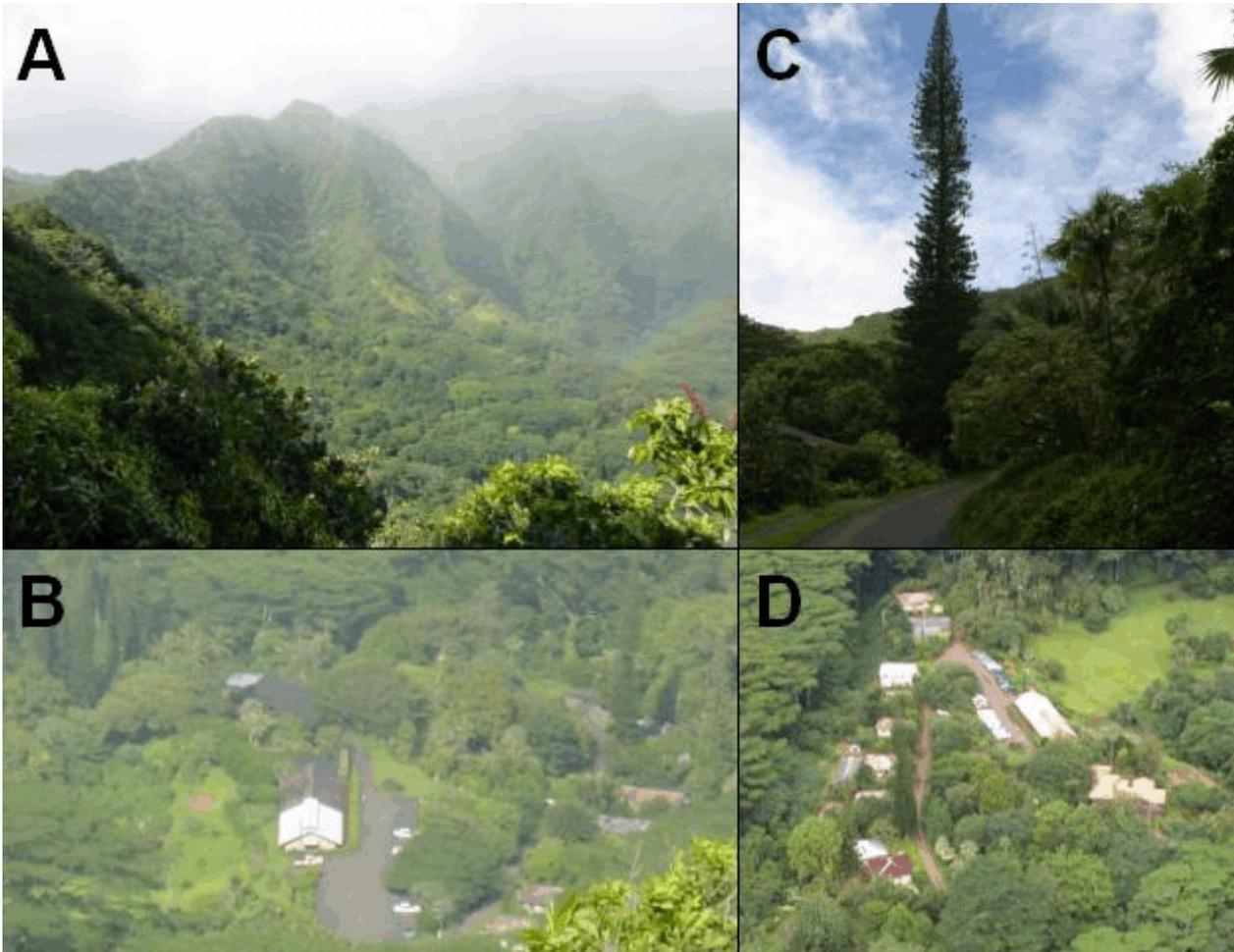
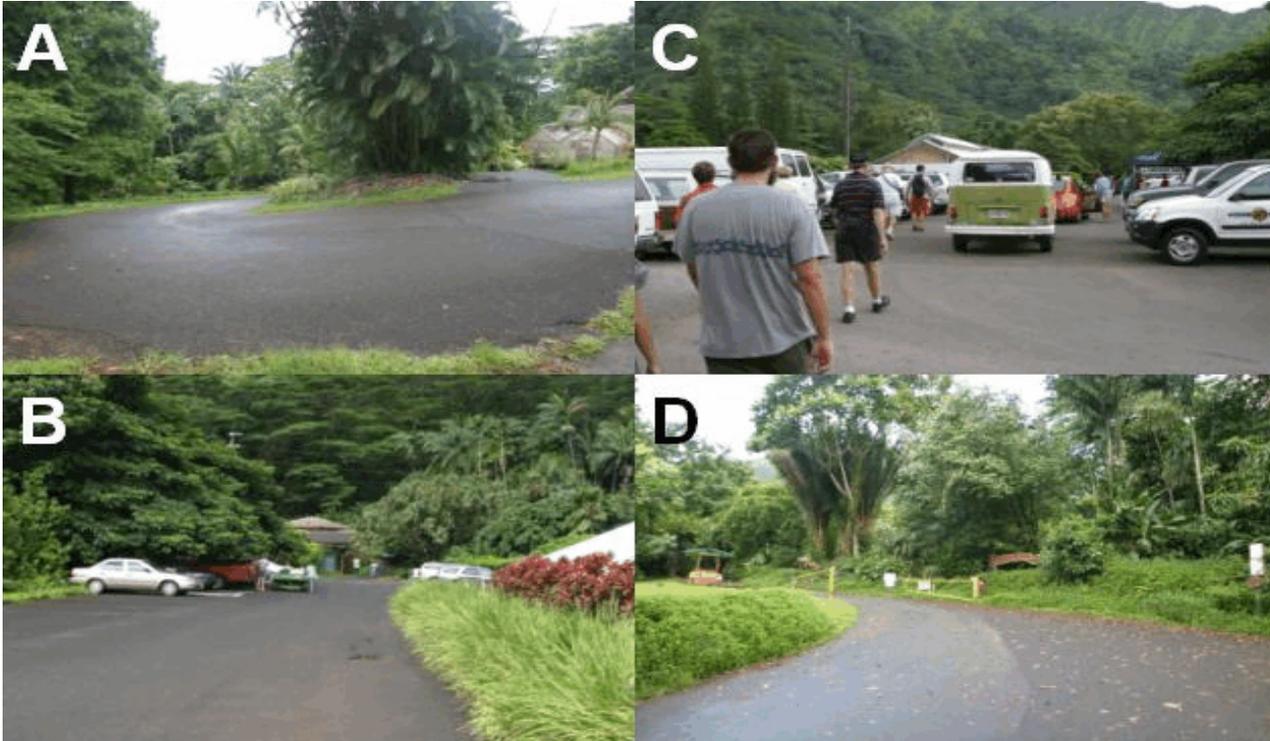


Figure 4. Roads & Parking. **A** Entrance road at stone garage and cottage A. **B** Paved parking lot. **C** Paved Parking lot during a busy day. **D** Entrance road, gate and kiosk.



Road & Parking

Figure 5. Paths & Trails. **A** Beginning of jeep trail and trail to Rain Shelter & Fern Valley. **B** Gravel path through Hawai'i Native Ecosystem Garden. **C** Steps in Children's Garden. **D** Stairs along path from Children's Garden.



Pathways

Figure 6. Projects in Progress. **A** Site for Education Hale in edge of Hawaiian Ethnobotany Garden. **B** Lo'i on west side of 'Aihualama stream. **C** Site for Educational Shelter in Hawai'i Ecosystem Garden. **D** Hazardous Albizia tree cut up after falling in a storm.



Figure 7. Cottage A. **A** View from Children's Garden. **B** View from driveway next to Snail Green Houses. **C** Front view from entry road.



Cottage A

Figure 8. Cottage B. **A** Front view from entry road. **B** View from Children's Garden. **C** View from edge of entry road.



Cottage B

Figure 9. Cottage C. **A** Front view from entry road. **B** View from back next to conservation green house. **C** View from Children's Garden of lanai addition.



Cottage C

Figure 10. Cottage D. **A** View from entry road. **B** View of seed conservation lab from adjacent drive way. **C** View from entry road showing lanai. **D** Sign in front of building.



Cottage D

Figure 11. Cottage E. **A** View from entry road. **B** View from entry road. **C** View from side next to Cottage D.



Cottage E

Figure 12. Cottages F&G. **A** View of Cottage F from entry road. **B** Side view of Cottage F. **C** View of Cottage G from entry drive way. **D** Side view of Cottage G.

Cottage F

Cottage G

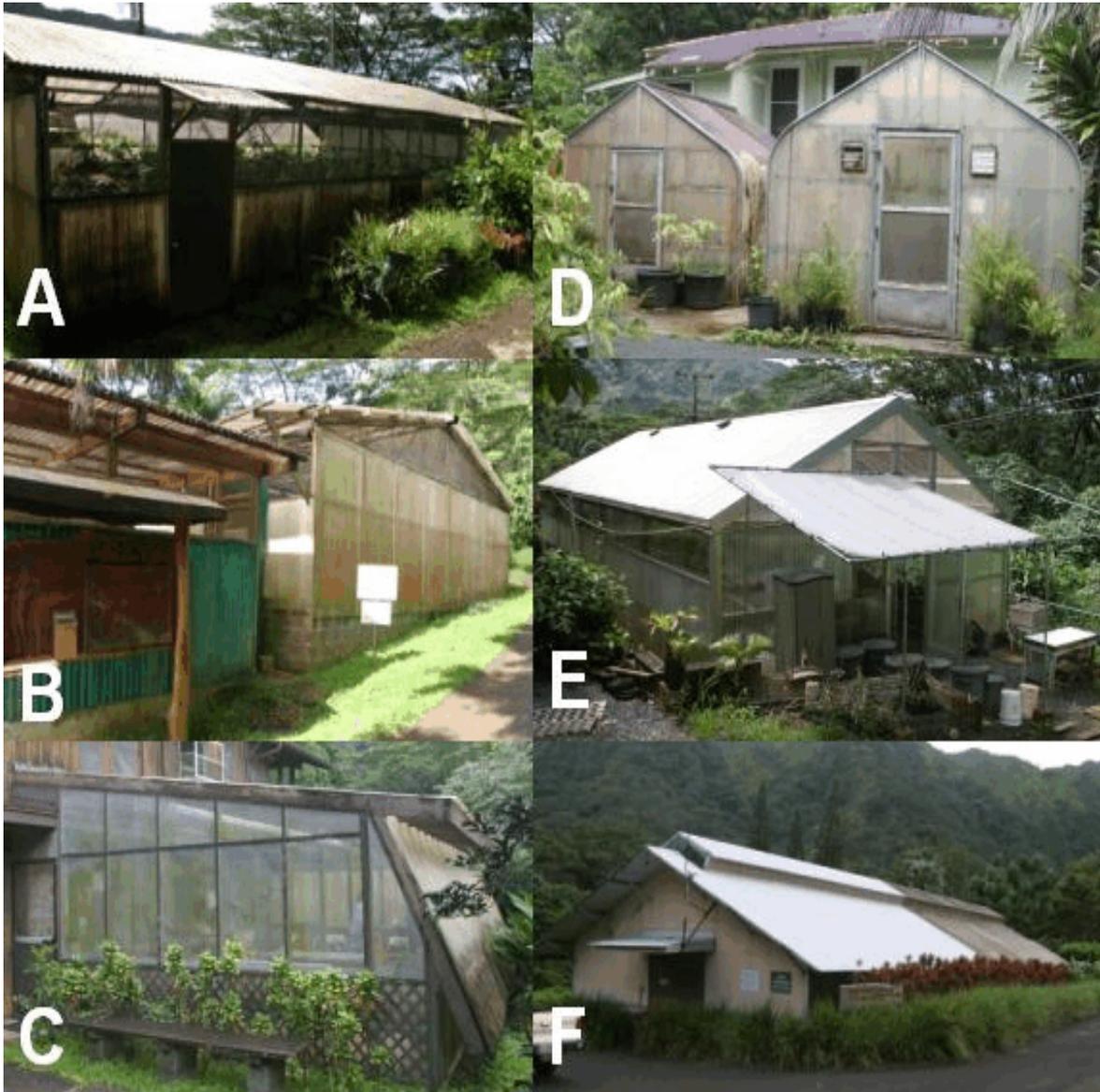


Figure 13. Cottage H. **A** Front view of entry into administrative offices. **B** Aerial view. **C** Side view of class room and greenhouse. **D** Front view of entry into gift shop.

Cottage H



Figure 14. Greenhouses. **A** Greenhouse adjacent to Cottage G. **B** Green building (left) is the potting shed in front of the pre-1964 greenhouse and greenhouse adjacent to cottage G (right) is the certified greenhouse. **C** Greenhouse attached to Cottage H. **D** Snail greenhouses next to Cottage A. **E** Conservation greenhouse behind Cottage C. **F** Main greenhouse next to the parking lot.



Greenhouses

Figure 15. Children's Learning Center. **A** Side view from Children's Garden. **B** View of main entrance.

Children's Learning Center



Figure 16. Shelters in Current Use. **A** Rain shelter at mouth of Fern Valley. **B** Spice Garden Pavilion being used as a class room for University students. **C** Spice Garden Pavilion with pond and fountain in foreground is part of the Hong Yip Young Memorial Garden. **D** Rain shelter being used as a class room for University students.



Figure 17. Maintenance Facilities. **A** Work shed across entry road from Cottage B when in use for construction of wood benches. **B** Garage and storage shed across entry road from Cottages D&E. **C** Work shed across entry road from Cottage B when storing equipment **D** Stone garage across from Cottage A. (Not shown is garage and work shed located below Cottage G.)

Sheds & Garages



Figure 18. Vehicles used in Arboretum. **A** University bus bringing college students for course in Arboretum. **B, D, E** Gas-electric work vehicles used for grounds maintenance. **C** Light 4-wheel drive truck used for grounds maintenance and deliveries.

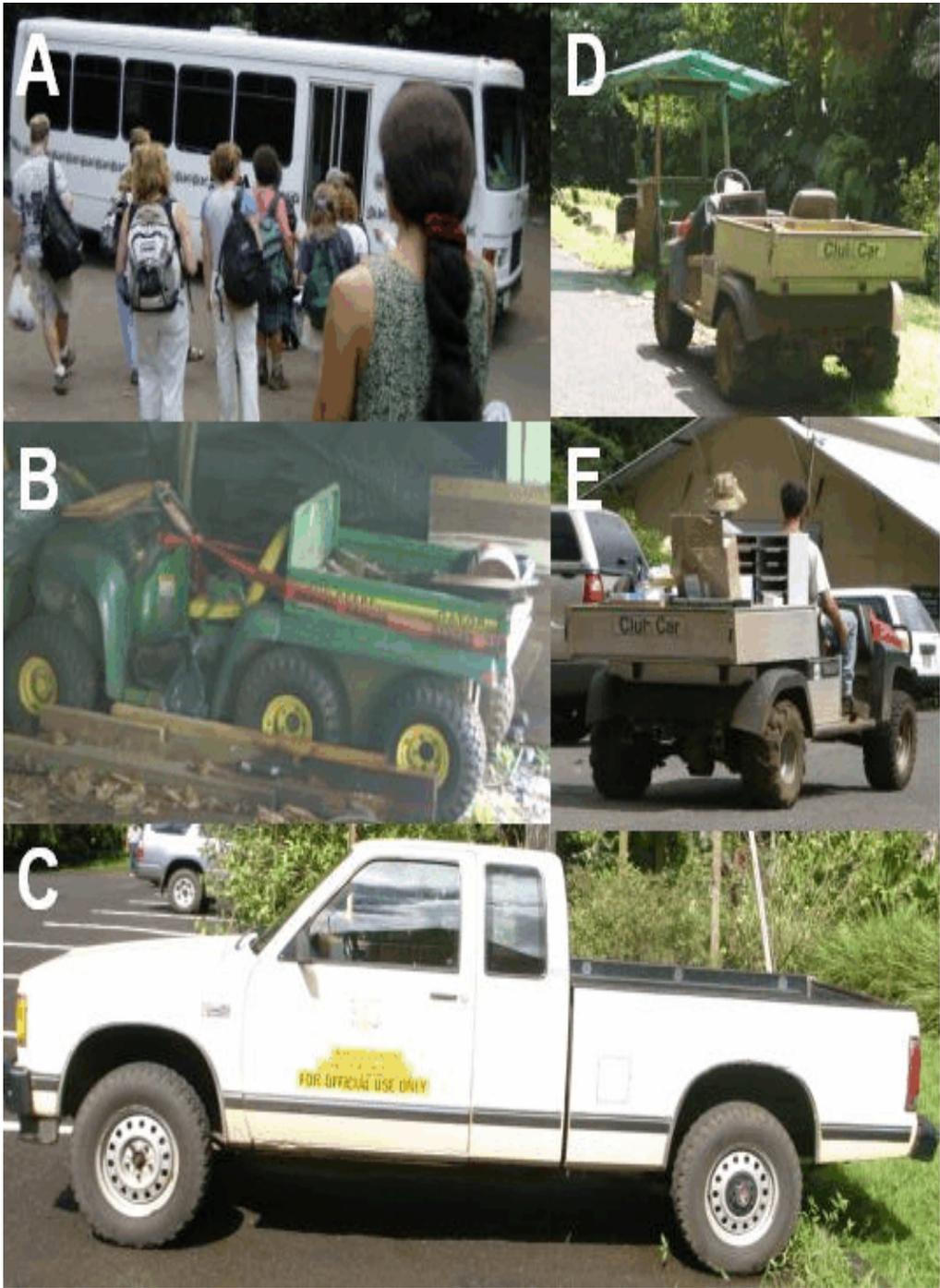


Figure 19. Miscellaneous Infrastructure. **A** New septic system behind Cottage H. **B** Portable toilet brought in for events and larger courses. **C** Garbage bin serviced each week by the University. **D** Gas tank near cottage A. **E** Air conditioner on Cottage A. **F** Air conditioner on Cottage H.



Figure 20. Miscellaneous Activities in the Arboretum. **A** Wireless Internet access antenna on Main Greenhouse. **B** Temporary weather station on great lawn. **C** Materials science experiment behind greenhouse. **D** Tents temporarily set up in Arboretum for an event. **E** Cut flowers from plant collections intended for use by the local community.

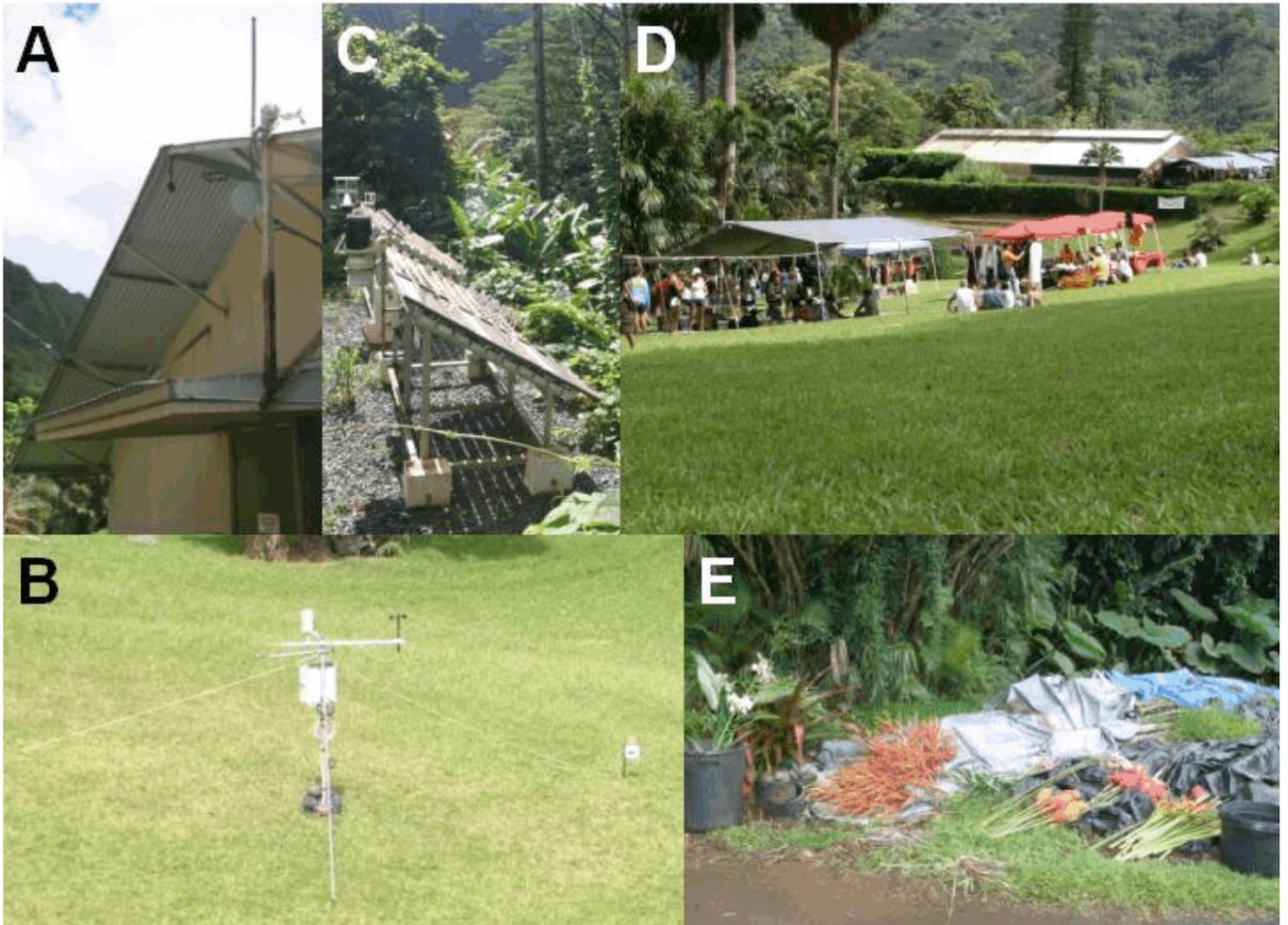


Figure 21. Paths & Trails. **A** Handicap accessible gravel path through Children's Garden. **B** Concrete slab stepping-stone pathway. **C** Stone and dirt trail.



Pathways

Figure 22. Signs. **A** Parking lot entrance sign. **B** Notice board for trail information. **C** Example of one of thousands of plant identification and information signs. **D** Example of one of hundreds of temporary plant identification and information signs. **E** Example of larger visitor information signs. **F** Visitor safety notification sign at trail head. **G** Example of a visitor direction sign. **H** Examples of informational signs for safety. **I** Entry kiosk with welcome sign and plea for visitor donations.



Signs

Figure 23. Memorials & Artwork. **A, B, F** Memorial markers next to memorial trees. **C** A sundial in the spice garden. **D** A walking Buddha statue in the forest near the rain shelter. **E** One of many memorial benches.



Memorials

Figure 24. Benches. **A-F** Benches in the Lower Grounds area that are used by visitors and maintained by volunteers.



Figure 25. 'Awa Festival. **A** Holua sledding on lawn. **B** 'Awa ceremony and Hula by Halau Mele. **C** Dr. Sam Gon as part of Halau Mele. **D** A participant in the 'Awa Festival.



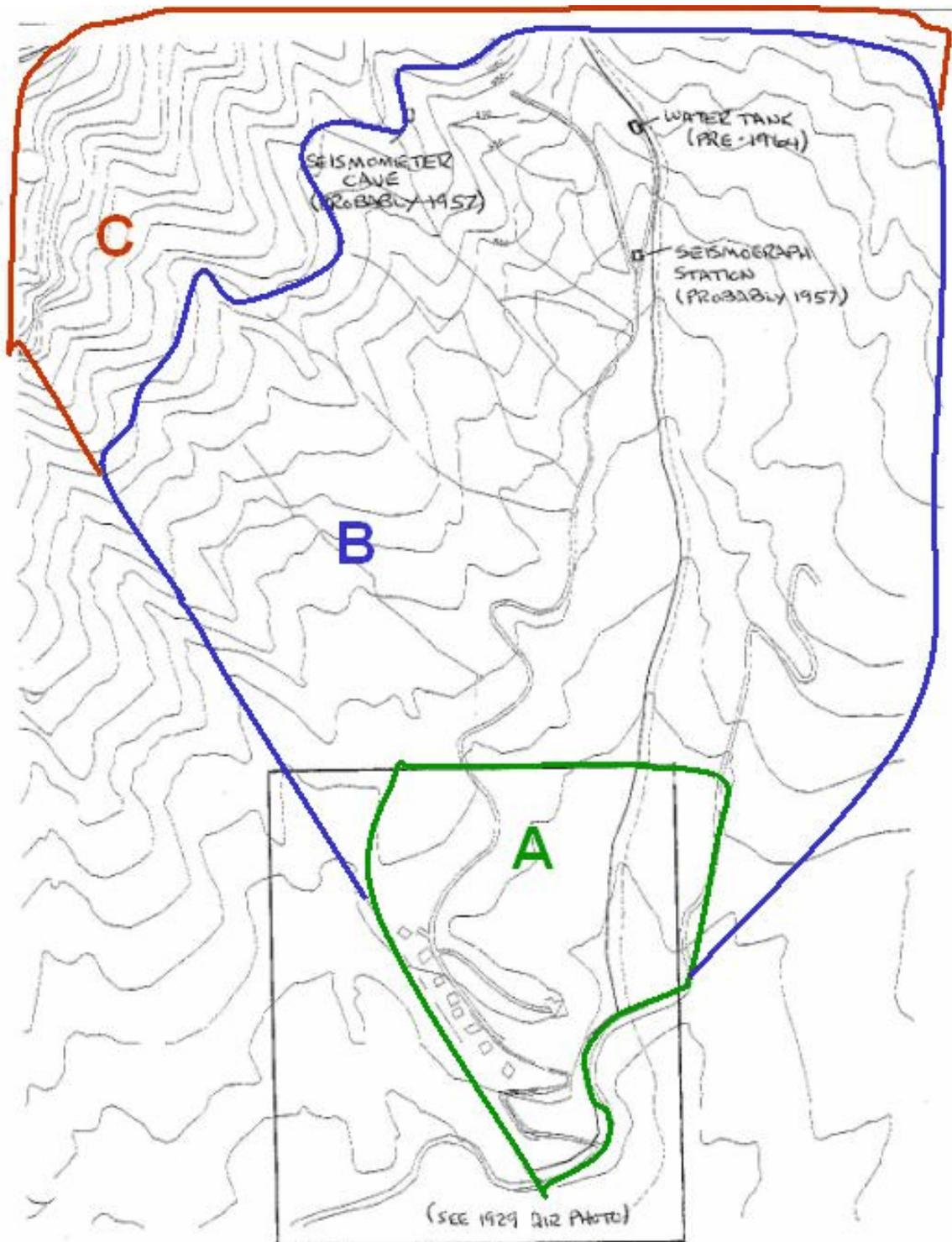
'Awa Festival

Figure 26. 'Awa Festival. **A** Hula. **B** Learning to pound wauke bark in kapa. **C** Musicians. **D** Learning to pound poi.

'Awa Festival

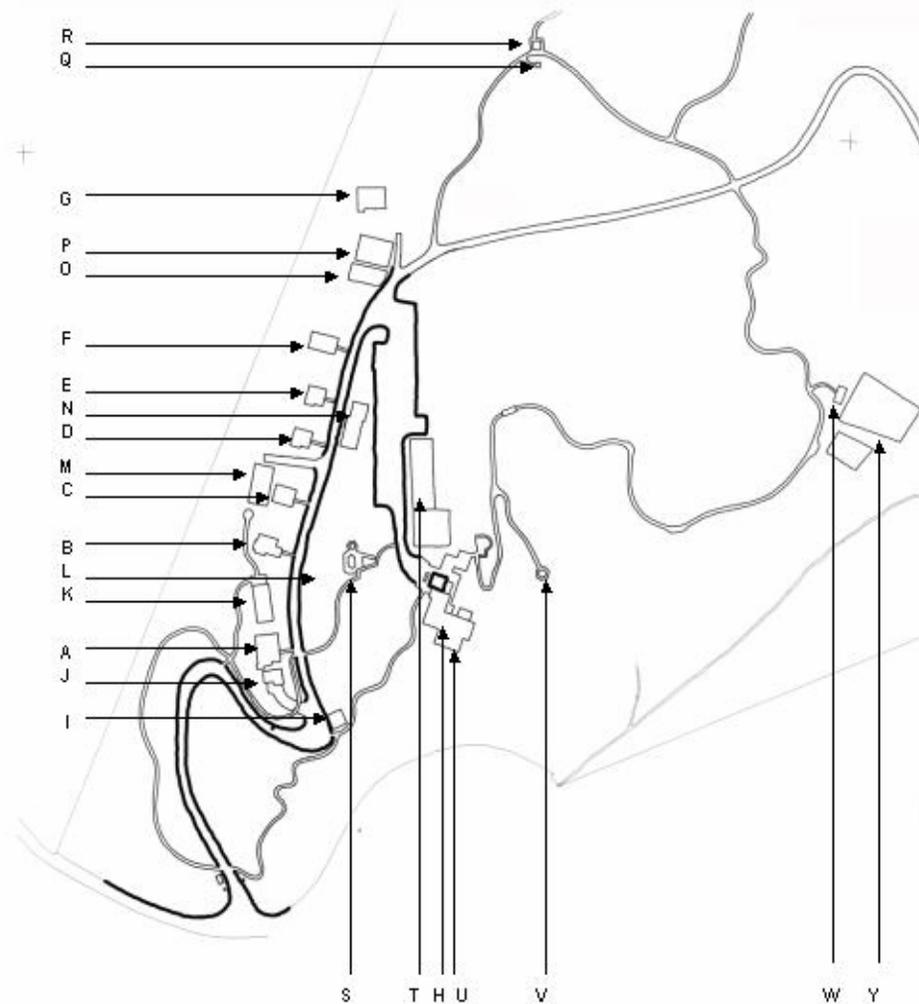


Appendix 1. Map of Lyon Arboretum Management Areas. **A** Lower Grounds, public botanical garden. **B** Research section, collections and experimental areas. **C** Native Forest restoration section.

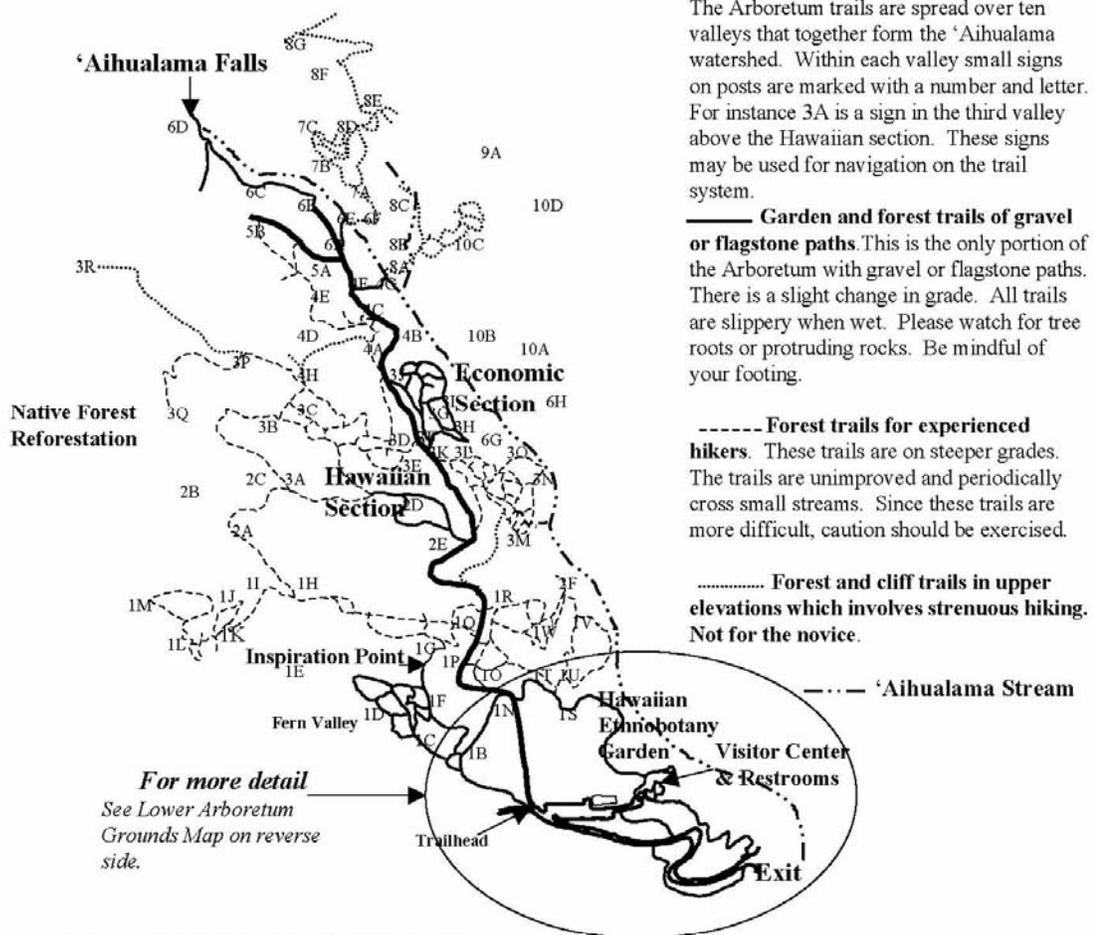


Appendix 2. Map of the Lyon Arboretum before 1964. **A-H** Cottages A-H. **I** Stone Garage. **L, N** Garages/Workshops. **O** Greenhouses. **Y** Lo'i.
J, K, M, P, Q, R, S, T, U, V, W: Not present in 1964

Lyon Arboretum Lower Grounds



Upper Arboretum Hiking Trail Map



The Arboretum trails are spread over ten valleys that together form the 'Aihualama watershed. Within each valley small signs on posts are marked with a number and letter. For instance 3A is a sign in the third valley above the Hawaiian section. These signs may be used for navigation on the trail system.

— Garden and forest trails of gravel or flagstone paths. This is the only portion of the Arboretum with gravel or flagstone paths. There is a slight change in grade. All trails are slippery when wet. Please watch for tree roots or protruding rocks. Be mindful of your footing.

- - - - Forest trails for experienced hikers. These trails are on steeper grades. The trails are unimproved and periodically cross small streams. Since these trails are more difficult, caution should be exercised.

..... Forest and cliff trails in upper elevations which involves strenuous hiking. Not for the novice.

- - - - 'Aihualama Stream

LYON ARBORETUM SAFETY GUIDELINES

TRAILS: The paths throughout the Arboretum are comprised of various surfaces. There are gravel lined paths, flagstone paths and dirt trails cut through vegetation. In places, these paths and trails are uneven due to protruding roots or rocks or erosion. Other paths, especially the dirt trails, are narrow. The paths and trails can be slippery because of mud, debris or rainfall. It is important to wear appropriate footwear. Be aware of downed limbs and falling branches. Please exercise caution throughout the Arboretum.

BITES/STINGS: Mosquitoes, bees, wasps, and other insects may be encountered. Insect repellent is recommended. Harmful animals such as spiders or centipedes may be hidden under leaf litter or rocks.

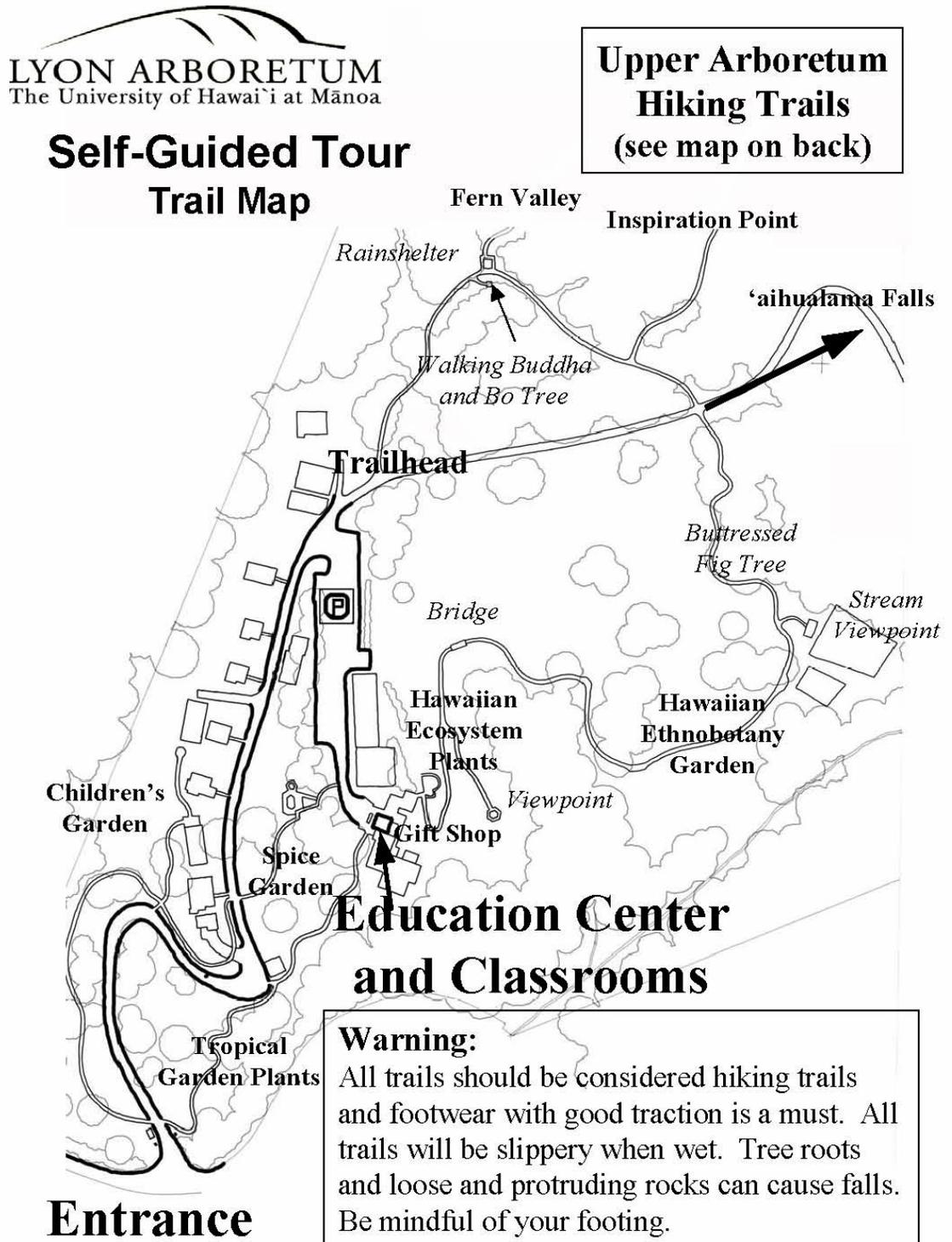
STREAMS: Avoid entering streams and ponds, especially if you have open cuts or wounds. Harmful bacteria like leptospirosis might be present. **DO NOT** drink stream water. Never cross a flooded stream. Gentle flowing streams can quickly become deep muddy torrents. Avoid crossing swift flows when the water level is above your knees.

PLANTS: Do not eat or taste any of the plants. **REMOVAL OF PLANTS IS PROHIBITED.**

ROCK SLIDES AND FALLING ROCKS: Avoid the base of steep cliffs, narrow canyons and waterfalls whenever possible. Fallen rocks and mud slides indicate hazards.

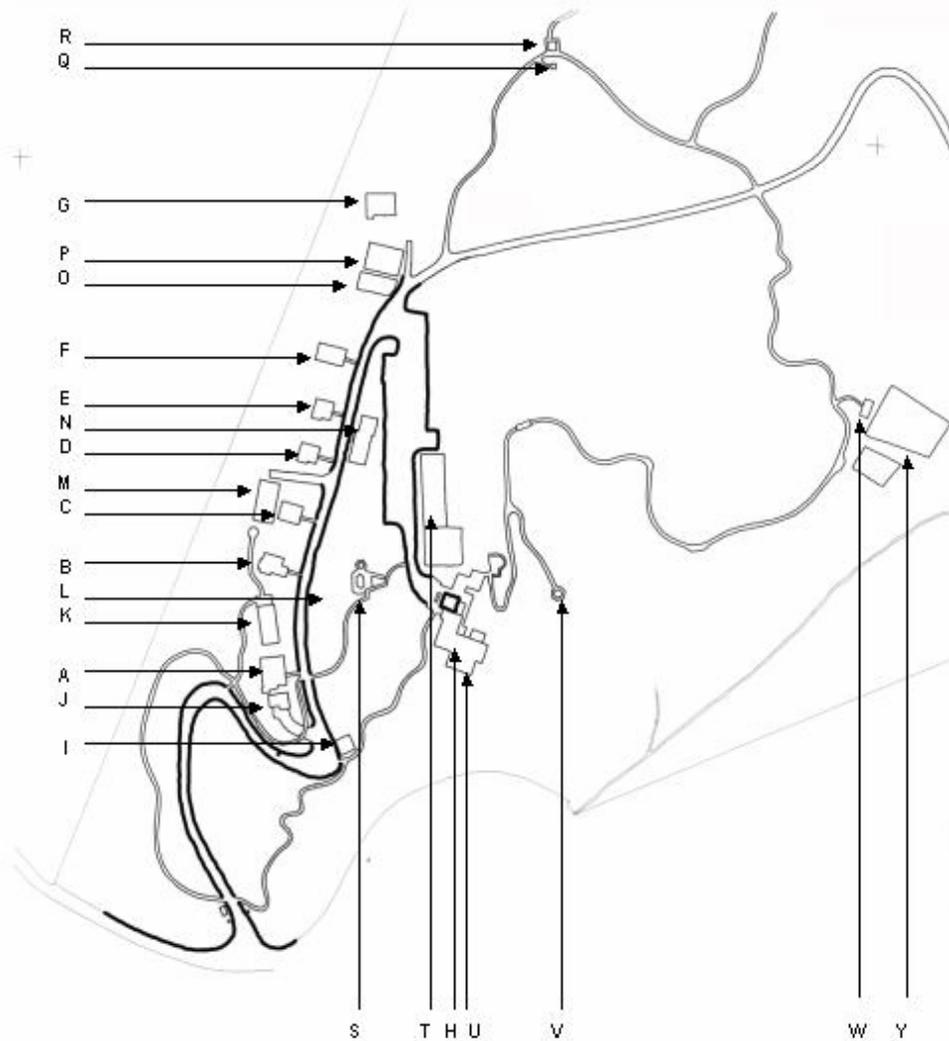
THE FOLLOWING ACTIVITIES ARE PROHIBITED:

- Destruction, disturbance or pollution of waterways
- Introduction of outside plants
- Introduction of outside animals, birds, fish or aquatic animals



Appendix 3. Part C. Map of Lyon Arboretum in 2004. **A-H** Cottages A-H. **I** Stone Garage. **L,N** Garages/Workshops. **J,M,O,P,U** Greenhouses. **K** Children's Learning Center. **Q** Walking Buddha. **R,S,V,W** Existing & planned rain shelters. **Y** Lo'i.

Lyon Arboretum Lower Grounds



APPENDIX C

Pre-Consultation Period Comments and Responses



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

MAR 18 2005

REF: OCCL:DH

Correspondence: OA-05-183

George Atta, AICP
Executive Vice President
Group 70 International
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Atta,

SUBJECT: Pre-Consultation for a Draft Environmental Assessment and Conservation District Use Application for Subject Parcels TMK's: (1) 2-9-55:006 and 007, Manoa Valley, Island of Oahu

The Department of Land and Natural Resources (DLNR), Office of Conservation and Coastal Lands (OCCL) is in receipt of your letter, dated March 15, 2005, regarding pre-consultation for a Draft Environmental Assessment (DEA) and Conservation District Use Application (CDUA) for Subject Parcels TMK's: (1) 2-9-5:006 and 007, Manoa Valley, Island of Oahu.

The OCCL notes that both subject parcels lies within the State Land Use (SLU) Conservation District, Resource subzone. The OCCL notes on December 10, 2004, Board of Land and Natural Resources (Board) ordered the University of Hawaii to submit and execute an after-the-fact (ATF) Conservation District Use Application (CDUA) and Management Plan for subject parcels TMK: (1) 2-9-055:006 and 007 by June 10, 2005. The OCCL looks forward to the submittal of the ATF CDUA by this date.

Should you have any questions on any of these conditions, please feel free to contact Dawn Hegger of our Office of Conservation and Coastal Lands at 587-0380.

Aloha,

A handwritten signature in blue ink, appearing to read "Samuel J. Lemmo".

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

cc: Oahu Land Agent
City and County of Honolulu
Department of Planning and Permitting



Francis S. Oda,
Arch. D., FAIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Hitoshi Hida, AIA
Roy H. Nihei, AIA, CSI
James I. Nishimoto, AIA
Ralph E. Portmore, AICP
Stephen H. Yuen, AIA
Linda C. Miki, AIA
George I. Atta, AICP
Charles Y. Kaneshiro, AIA, LEED
Jeffrey H. Overton, AICP
Christine M. Ruotola, AICP
James L. Stone, AIA, LEED

Paul P. Chorney, AIA
Philip T. Cuccia
Pete C. Galvez, AIA
Sutobin Halim
Roy A. Inouye, AIA, CSI
Stephen H. Kelly, AICP
Katherine M. MacNeil, AIA
Frank B. McCue
Kathryn A. Nam
Donna D. Pennington
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

April 12, 2005

Mr. Samuel J. Lemmo, Administrator
State of Hawai'i
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawai'i 96809

RE: Pre-Consultation for Draft Environmental Assessment and Conservation District Use Application, Harold L. Lyon Arboretum, Manoa Valley, Honolulu, Hawai'i TMK: (1) 2-9-055:006 and (1) 2-9-055:007

Dear Mr. Lemmo:

Thank you for your letter received on March 18, 2005 regarding the early consultation request for the Harold L. Lyon Arboretum Draft Environmental Assessment of after-the-fact permits and current uses of the 190-acre site.

The following is offered in response to the comments provided in your letter:

- 1) We acknowledge your comment that both of the subject parcels lie within the State Land Use Conservation District, Resource subzone.
- 2) In addition to this Draft EA the University of Hawai'i is submitting and executing an after-the-fact (ATF) Conservation District Use Application in accordance to the order on December 10, 2004 by the Board of Land and Natural Resources.

Your comments and this response letter will be included in the Draft EA. We will forward you a copy of the Draft EA for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

A handwritten signature in cursive script that reads "George I. Atta".

George I. Atta, AICP
Executive Vice President/Principal

Cc: Dean Charles Hayes
Ronald K. Lau



DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

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

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Ref. No. P-10875

April 1, 2005



Mr. George Atta
Executive Vice President/Principal
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Atta:

Subject: Pre-Consultation for Draft Environmental Assessment and
Conservation District Use Application
Harold L. Lyon Arboretum
TMK: (1) 2-9-055: 006 and (1) 2-9-055: 007
Manoa Valley, Honolulu, Hawaii

The Office of Planning has reviewed the materials transmitted as part of the Pre-Consultation Notice for the above Draft Environmental Assessment of after-the-fact permits and proposed uses of the 190-acre site. We offer the following comments.

We are pleased that the University of Hawaii at Manoa is accepting responsibility for complying with the Conservation District regulations. The Office of Planning is hopeful that the Resource subzone will allow the botanical research and instructional facilities that have comprised the previous fifty years of University activity at the site. We believe the public has benefited from the achievements of distinguished faculty that have devoted their academic careers to work at Lyon Arboretum.

The Draft Environmental Assessment (DEA) should address the extent that the proposed rehabilitation and replacement of deteriorated facilities will impact the fragile environment of the site, both the natural environment and the botanical collections that are growing on the site.

The DEA should address the impact of public visitors who may be allowed on-site for tours of the arboretum's plantings, including any increase in impervious surfaces for parking and rain shelters; and any anticipated increase in wastewater generation. The

Mr. George Atta
Page 2
April 1, 2005

DEA should also discuss the need for security for staff and plants, since the location is isolated from the main campus.

We look forward to the opportunity to review and comment on the DEA. If you have any questions, please call Mary Alice Evans at 587-2802.

Sincerely,



Mary Lou Kobayashi
Administrator

c: Peter Young, DLNR



April 12, 2005

Ms. Mary Lou Kobayashi, Planning Program Administrator
State of Hawai'i
Department of Business, Economic Development, and Tourism
Office of Planning
P.O. Box 2359
Honolulu, HI 96804

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Christine M. Ruotola, AICP

James L. Stone, AIA, LEED

RE: Pre-Consultation for Draft Environmental Assessment and Conservation District Use Application, Harold L. Lyon Arboretum, Manoa Valley, Honolulu, Hawai'i TMK: (1) 2-9-055:006 and (1) 2-9-055:007

Dear Ms. Kobayashi:

Thank you for your letter of April 1, 2005 regarding the early consultation request for the Harold L. Lyon Arboretum Draft Environmental Assessment of after-the-fact permits and current uses of the 190-acre site.

We acknowledge your support of the botanical research and instructional facilities of the Harold L. Lyon Arboretum.

The following is offered in response to the comments provided in your letter:

- 1) The Draft EA will include a discussion on the extent that the proposed rehabilitation and replacement of deteriorated facilities will impact the fragile environment of the site, both the natural environmental and botanical collections that are growing at the site. The Draft EA will describe existing mitigation measures used to minimize impacts to the natural environment and botanical collections.
- 2) The Draft EA will address potential impacts of public visitors and tour operations at the site, including increase in impervious surfaces for parking and rain shelters; and any anticipated increase in wastewater generation. A discussion on proposed mitigation measures for potential impacts of increased public visitors will also be included.

Your comments and this response letter will be included in the Draft EA. We will forward you a copy of the Draft EA for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.

George I. Atta, AICP
Executive Vice President/Principal

Cc: Dean Charles Hayes, Ronald K. Lau

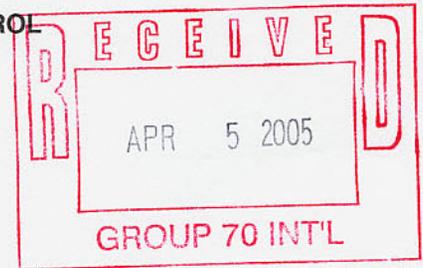
LINDA LINGLE
GOVERNOR OF HAWAII



GENEVIEVE SALMONSON
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us



April 4, 2005

George Atta
Group 70 International, Inc.
Honolulu, HI 96813-4307

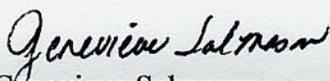
Subject: Pre-Consultation for Draft Environmental Assessment and
Conservation District Use Application – Harold L. Lyon
Arboretum

Dear Mr. Atta:

We have received the description of the subject project by your letter dated March 15, 2005.

We have no comments to offer at this time, but will reserve further comments when the documents are submitted. Thank you for the opportunity to review your request and should you have any questions, please feel free to call our office at 586-4185.

Sincerely,


Genevieve Salmonson
Director



GROUP 70
INTERNATIONAL

Francis S. Oda,
Arch. D., FAIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Hitoshi Hida, AIA

Roy H. Nihei, AIA, CSI
James I. Nishimoto, AIA
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Stephen H. Yuen, AIA
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Katherine M. MacNeil, AIA
Frank B. McCue
Kathryn A. Nam
Donna D. Pennington
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

April 12, 2005

Ms. Genevieve Salmonson, Director
State of Hawai'i
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

**RE: Pre-Consultation for Draft Environmental Assessment and Conservation
District Use Application, Harold L. Lyon Arboretum, Manoa Valley,
Honolulu, Hawai'i TMK: (1) 2-9-055:006 and (1) 2-9-055:007**

Dear Ms. Salmonson:

Thank you for your letter of April 4, 2005 regarding the early consultation request for the Harold L. Lyon Arboretum Draft Environmental Assessment of after-the-fact permits and current uses of the 190-acre site.

Your comments and this response letter will be included in the Draft EA. We will forward you a copy of the Draft EA for your review upon its completion. We appreciate your participation in the environmental review process.

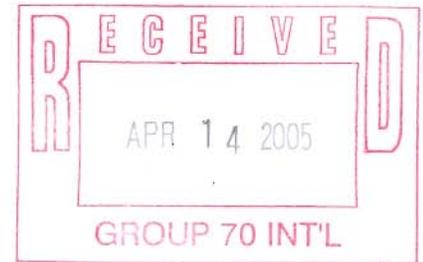
Sincerely,
GROUP 70 INTERNATIONAL, INC.

George I. Atta, AICP
Executive Vice President/Principal

Cc: Dean Charles Hayes
Ronald K. Lau



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



HRD05/1770

April 12, 2005

George I. Atta, AICP
Executive Vice President/Principal
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, HI 96813-4307

Re: Pre-Consultation for Draft Environmental Assessment and Conservation District Use Application, Harold L. Lyon Arboretum, Manoa Valley, Island of O'ahu TMK: 2-9-055:006, 2-9-055:007

Dear Mr. Atta:

The Office of Hawaiian Affairs (OHA) is in receipt of your request for early consultation regarding the draft environmental assessment being prepared for the application of an "after-the-fact" Conservation District Use Application (CDUA) and Management Plan for the subject parcels. This action stems from the notice of seven alleged violations of land use statutes stemming from the University of Hawaii's failure to obtain the requisite approvals for:

- Renovations and alterations to cottages "B, C, D, H and F" including a wood workshop/garage;
- Construction of the children's learning center;
- All landscaped features (memorial garden, water features, signs, statues, benches, trails and pathways, and drainage);
- Commercial uses and grounds;
- Construction of a visitor kiosk, rain shelter and pavilion;
- Erection of a prefabricated storage shed; and
- Construction of a "large greenhouse/ headhouse/ shadehouse/ acclimation yard.

From reviewing the work that has occurred to date, it does not appear that any native rights existing in the area will be adversely affected. Overall, the arboretum serves the purpose of education and propagation, and where native species are concerned, the work is especially important.

George I. Atta
April 12, 2005
Page 2

We do recommend, however, that any future work or improvements occur with the proper approvals prior to the commencement of activities. OHA would like to be informed of any future work at the arboretum, especially work requiring a CDUA.

If you have any questions or concerns, please contact Kai Markell, Policy Advocate, at 594-1945 or kaim@oha.org. Once again, thank you for your patience during our review and assessment of this important matter.

‘O wau iho nō,



Clyde W. Nāmu‘o
Administrator



April 12, 2005

Mr. Clyde W. Nāmu'ō, Administrator
State of Hawai'i
Office of Hawaiian Affairs
711 Kapi'olani Boulevard, Suite 500
Honolulu, Hawai'i 96813

RE: Pre-Consultation for Draft Environmental Assessment and Conservation District Use Application, Harold L. Lyon Arboretum, Manoa Valley, Honolulu, Hawai'i TMK: (1) 2-9-055:006 and (1) 2-9-055:007

Dear Mr. Nāmu'ō:

Thank you for your letter of April 12, 2005 regarding the early consultation request for the Harold L. Lyon Arboretum Draft Environmental Assessment of after-the-fact permits and current uses of the 190-acre site.

We acknowledge your support of the botanical research and instructional facilities of the Harold L. Lyon Arboretum, where native species are concerned.

This CDUA and Draft EA process anticipates future work or improvements to occur with the proper approvals, which would most likely occur prior to the commencement of activities. We acknowledge your interest in any future work at the Arboretum, especially work requiring a CDUA.

Your comments and this response letter will be included in the Draft EA. We will forward you a copy of the Draft EA for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

A handwritten signature in cursive script that reads "George I. Atta".

George I. Atta, AICP
Executive Vice President/Principal

Cc: Dean Charles Hayes
Ronald K. Lau

Francis S. Oda,
Arch. D., FAIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
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Stephen H. Kelly, AICP
Katherine M. MacNeil, AIA
Frank B. McCue
Kathryn A. Nam
Donna D. Pennington
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111
<http://www.honoluluupd.org>
www.honolulu.gov

MUFI HANNEMANN
MAYOR



BOISSE P. CORREA
CHIEF

GLEN R. KAJIYAMA
PAUL D. PUTZULU
DEPUTY CHIEFS

OUR REFERENCE BS-KP

March 23, 2005



Mr. George Atta
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Atta:

This is in response to the Pre-Consultation for the Draft Environmental Assessment and Conservation District Use Application for the University of Hawaii at Manoa.

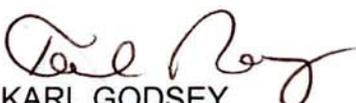
This proposal should have negligible impact on the facilities and services of the Honolulu Police Department.

If there are any questions, please call Major Bart Huber of District 7 at 529-3362 or Mr. Brandon Stone of the Executive Bureau at 529-3644.

Thank you for the opportunity to review and comment.

Sincerely,

BOISSE P. CORREA
Chief of Police

By 
KARL GODSEY
Assistant Chief of Police
Support Services Bureau



April 12, 2005

Mr. Karl Godsey, Assistant Chief of Police
City and County of Honolulu
Police Department
801 South Beretania Street
Honolulu, Hawai'i 96813

Francis S. Oda, Arch. D., FAIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Hitoshi Hida, AIA
Roy H. Nihei, AIA, CSI
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George I. Atta, AICP
Charles Y. Kaneshiro, AIA, LEED
Jeffrey H. Overton, AICP
Christine M. Ruotola, AICP
James L. Stone, AIA, LEED

RE: Pre-Consultation for Draft Environmental Assessment and Conservation District Use Application, Harold L. Lyon Arboretum, Manoa Valley, Honolulu, Hawai'i TMK: (1) 2-9-055:006 and (1) 2-9-055:007

Dear Mr. Godsey:

Thank you for your letter of March 23, 2005 regarding the early consultation request for the Harold L. Lyon Arboretum Draft Environmental Assessment of after-the-fact permits and current uses of the 190-acre site.

We acknowledge that this proposal should have negligible impact on the facilities and services of the Honolulu Police Department.

Your comments and this response letter will be included in the Draft EA. We will forward you a copy of the Draft EA for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

George I. Atta
George I. Atta, AICP
Executive Vice President/Principal

Cc: Dean Charles Hayes
Ronald K. Lau

Paul P. Chorney, AIA
Phillip T. Cuccia
Pete C. Galvez, AIA
Sutobin Halim
Roy A. Inouye, AIA, CSI
Stephen H. Kelly, AICP
Katherine M. MacNeil, AIA
Frank B. McCue
Kathryn A. Nam
Donna D. Pennington
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843



MUFI HANNEMANN, Mayor

EDDIE FLORES, JR., Chairman
RANDALL Y. S. CHUNG
SAMUEL T. HATA
HERBERT S. K. KAOPUA, SR.
DAROLYN H. LENDIO

RODNEY K. HARAGA, Ex-Officio

CLIFFORD S. JAMILE
Manager and Chief Engineer

DONNA FAY K. KIYOSAKI
Deputy Manager and Chief Engineer

April 1, 2005



Mr. George I. Atta
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Atta:

Subject: Your Letter Dated March 15, 2005 Regarding Pre-Consultation for Draft Environmental Assessment and Conservation District Use Application, TMK: 2-9-055: 006 and 2-9-055:007 Manoa Valley

Thank you for the opportunity to participate in the pre-consultation for the environmental review process.

The existing water system is presently adequate to accommodate the development.

The development may require approval by the Department of Planning and Permitting (DPP) before the Board of Water Supply process the building permit on the development. The availability of water will be confirmed when the building permit is approved.

When water is made available, the applicant will be required to pay our Water System Facilities Charges for resource development, transmission and daily storage.

The project is subject to Board of Water Supply Cross-Connection Control and Backflow Prevention requirements prior to the issuance of the Building Permit.

The on-site fire protection requirements should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

If you have any questions, please contact Joseph Kaakua at 748-5440.

Very truly yours,

Keith S. Shida
Principal Executive
Customer Care Division



April 12, 2005

Mr. Keith S. Shida
City and County of Honolulu
Board of Water Supply
630 South Beretania Street
Honolulu, Hawai'i 96843

RE: Pre-Consultation for Draft Environmental Assessment and Conservation District Use Application, Harold L. Lyon Arboretum, Manoa Valley, Honolulu, Hawai'i TMK: (1) 2-9-055:006 and (1) 2-9-055:007

Dear Mr. Chang:

Thank you for your letter of April 1, 2005 regarding the early consultation request for the Harold L. Lyon Arboretum Draft Environmental Assessment of after-the-fact permits and current uses of the 190-acre site.

The following is offered in response to the comments provided in your letter:

- 1) The proposed application is for retroactive approval of a conservation district use permit (CDUP) for activities that are ongoing. They do not represent new development as the activities cited have been in use or operation for several decades.
- 2) The Honolulu Fire Department has also been contacted as a part of this pre-consultation process and on-site fire protection requirements will be addressed accordingly.

Your comments and this response letter will be included in the Draft EA. We will forward you a copy of the Draft EA for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

George I. Atta
George I. Atta, AICP
Executive Vice President/Principal

Cc: Dean Charles Hayes
Ronald K. Lau

Francis S. Oda,
Arch. D., FAIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Hitoshi Hida, AIA
Roy H. Nihei, AIA, CSI
James I. Nishimoto, AIA
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Stephen H. Yuen, AIA
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Jeffrey H. Overton, AICP
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Roy A. Inouye, AIA, CSI
Stephen H. Kelly, AICP
Katherine M. MacNeil, AIA
Frank B. McCue
Kathryn A. Nam
Donna D. Pennington
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU

3375 KOAPAKA STREET, SUITE H425 • HONOLULU, HAWAII 96819-1869
TELEPHONE: (808) 831-7761 • FAX: (808) 831-7750 • INTERNET: www.honolulufire.org



MUFI HANNEMANN
MAYOR

ATTILIO K. LEONARDI
FIRE CHIEF

JOHN CLARK
DEPUTY FIRE CHIEF

March 29, 2005



Mr. George I. Atta, AICP
Executive Vice President/Principal
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Atta:

Subject: Preconsultation for Draft Environmental Assessment and
Conservation District Use Application
Lyon Arboretum
Manoa, Oahu, Hawaii
Tax Map Key: 2-9-055: 006 and 007

We received your letter dated March 15, 2005, requesting our comments on the above-mentioned subject.

The Honolulu Fire Department has no objections to the above-mentioned project.

Should you have any questions, please call Battalion Chief Lloyd Rogers of our Fire Prevention Bureau at 831-7778.

Sincerely,

ATTILIO K. LEONARDI
Fire Chief

AKL/SY:bh



April 12, 2005

Mr. Attilio K. Leonardi, Fire Chief
City and County of Honolulu
Fire Department
3375 Koapaka Street, Suite H425
Honolulu, Hawai'i 96819-1869

Francis S. Oda,
Arch. D., FAIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Hitoshi Hida, AIA

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Katherine M. MacNeil, AIA
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Donna D. Pennington
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

RE: Pre-Consultation for Draft Environmental Assessment and Conservation District Use Application, Harold L. Lyon Arboretum, Manoa Valley, Honolulu, Hawai'i TMK: (1) 2-9-055:006 and (1) 2-9-055:007

Dear Mr. Leonardi:

Thank you for your letter of March 29, 2005 regarding the early consultation request for the Harold L. Lyon Arboretum Draft Environmental Assessment of after-the-fact permits and current uses of the 190-acre site.

Your comments and this response letter will be included in the Draft EA. We will forward you a copy of the Draft EA for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

George I. Atta
George I. Atta, AICP
Executive Vice President/Principal

Cc: Dean Charles Hayes
Ronald K. Lau

DEPARTMENT OF PARKS AND RECREATION
CITY AND COUNTY OF HONOLULU

KAPOLEI HALE • 1000 ULUOHIA STREET, SUITE 309 • KAPOLEI, HAWAII 96707
TELEPHONE: (808) 692-5561 • FAX: (808) 692-5131 • INTERNET: www.honolulu.gov

MUFI HANNEMANN
MAYOR



LESTER K.C. CHANG
DIRECTOR

DANA TAKAHARA-DIAS
DEPUTY DIRECTOR

April 8, 2005

Mr. George I. Atta, AICP
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813

Dear Mr. Atta:

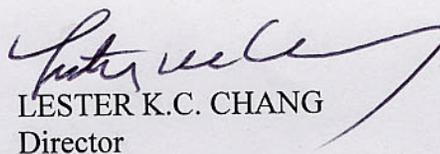
Subject: Pre-Consultation Draft Environmental Assessment and Conservation District
Use Application-Harold L. Lyon Arboretum
TMK 2-9-055:006 and 2-9-055:007

Thank you for the opportunity to review and comment on the Pre-Consultation Draft
Environmental Assessment and Conservation District Use Application related to the Harold L.
Lyon Arboretum.

The Department of Parks and Recreation has no comment and as the proposed actions
will not impact our facilities or programs. You can remove us as a consulted party to the balance
of the EIS process.

Should you have any questions, please contact Mr. John Reid, Planner, at 692-5454

Sincerely,



LESTER K.C. CHANG
Director

LKCC:mk
(98471)



April 12, 2005

Mr. Lester K.C. Chang, Director
City and County of Honolulu
Department of Parks and Recreation
Kapolei Hale
1000 Uluohia Street, Suite 309
Kapolei, HI 96707

**RE: Pre-Consultation for Draft Environmental Assessment and Conservation
District Use Application, Harold L. Lyon Arboretum, Manoa Valley,
Honolulu, Hawai'i TMK: (1) 2-9-055:006 and (1) 2-9-055:007**

Dear Mr. Chang:

Thank you for your letter of April 8, 2005 regarding the early consultation request for the Harold L. Lyon Arboretum Draft Environmental Assessment of after-the-fact permits and current uses of the 190-acre site.

Your comments and this response letter will be included in the Draft EA. As requested, we will remove you as a consulted party in subsequent reviews. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

A handwritten signature in cursive script that reads "George I. Atta".

George I. Atta, AICP
Executive Vice President/Principal

Cc: Dean Charles Hayes
Ronald K. Lau

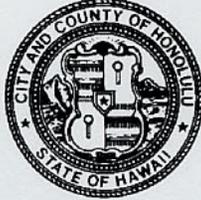
Francis S. Oda,
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Roy A. Inouye, AIA, CSI
Stephen H. Kelly, AICP
Katherine M. MacNeil, AIA
Frank B. McCue
Kathryn A. Nam
Donna D. Pennington
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

DEPARTMENT OF FACILITY MAINTENANCE
CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 215, Kapolei, Hawaii 96707
Phone: (808) 692-5054 • Fax: (808) 692-5857
Website: www.honolulu.gov

MUFI HANNEMANN
MAYOR



LAVERNE HIGA, P.E.
ACTING DIRECTOR AND CHIEF ENGINEER

GEORGE K. MIYAMOTO
DEPUTY DIRECTOR

IN REPLY REFER TO:
DRM 05-275

March 31, 2005



Mr. George Atta, AICP
Executive Vice President
Group 70 International, Inc.
925 Bethel Street, 5th Floor
Honolulu, Hawaii 96813-4307

Dear Mr. Atta:

The Department of Facility Maintenance has received your notice regarding pre-consultation for the Draft Environmental Assessment for the Harold L. Lyon Arboretum.

We have no comments to offer at this time but please keep us informed as your project progresses.

Thank you for allowing us to participate.

Very truly yours,


LAVERNE HIGA, P.E.
Acting Director and Chief Engineer



April 12, 2005

Ms. Laverne Higa, P.E., Acting Director and Chief Engineer
City and County of Honolulu
Department of Facility Maintenance
1000 Uluohia Street, Suite 215
Kapolei, Hawai'i 96707

RE: Pre-Consultation for Draft Environmental Assessment and Conservation District Use Application, Harold L. Lyon Arboretum, Manoa Valley, Honolulu, Hawai'i TMK: (1) 2-9-055:006 and (1) 2-9-055:007

Dear Ms. Higa:

Thank you for your letter of March 31, 2005 regarding the early consultation request for the Harold L. Lyon Arboretum Draft Environmental Assessment of after-the-fact permits and current uses of the 190-acre site.

Your comments and this response letter will be included in the Draft EA. We will forward you a copy of the Draft EA for your review upon its completion. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

A handwritten signature in cursive script that reads "George I. Atta".

George I. Atta, AICP
Executive Vice President/Principal

Cc: Dean Charles Hayes
Ronald K. Lau

Francis S. Oda,
Arch. D., FAIA, AICP
Norman G.Y. Hong, AIA
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Stephen H. Kelly, AICP
Katherine M. MacNeil, AIA
Frank B. McCue
Kathryn A. Nam
Donna D. Pennington
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

APPENDIX D

Draft Environmental Assessment Review Period Comments and Responses

LINDA LINGLE
GOVERNOR OF HAWAII



GENEVIEVE SALMONSON
DIRECTOR

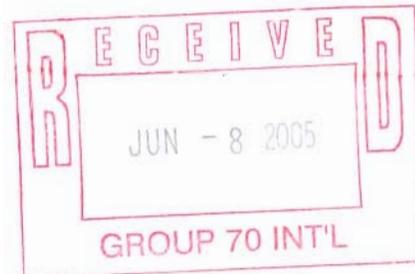
STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186
E-mail: oeqc@health.state.hi.us

June 7, 2005

Mr. Charles Hayes
Mr. Calvin Kashimoto
University of Hawai'i at Manoa
2545 McCarthy Mall
Bilger Hall, Room 102
Honolulu, Hawai'i 96822

Mr. George Atta
Group 70 International, Inc.
925 Bethel Street, Fifth Floor
Honolulu, Hawai'i 96813



Dear Messrs. Hayes, Kashimoto, and Atta:

The Office of Environmental Quality Control has received the after-the-fact draft environmental assessment for the Improvements at Harold Lyon Arboretum, Tax Map Keys (1st) 2-9-055:006 and 007, in the judicial district of Honolulu, and offers the following comments for your consideration and response.

GROWTH INDUCING AND CUMULATIVE MPACTS: Please discuss the secondary and cumulative impacts that may have arisen from the implementation of this project.

SUSTAINABLE BUILDING GUIDELINES: Please refer to, what features of the implementation of the project have incorporated guidance concerning sustainable building found on our internet website at <http://www.state.hi.us/health/oeqc/guidance/index.html>.

Thank you for the opportunity to comment. If there are any questions, please call Mr. Leslie Segundo, Environmental Health Specialist, at (808) 586-4185.

Sincerely,


GENEVIEVE SALMONSON
Director



GROUP 70
INTERNATIONAL

Francis S. Oda, Arch. D., AIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Hitoshi Hida, AIA
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Donna D. Pennington
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Alvin Sakutori
Scott Tangonan
Tom Young, AIA

June 20, 2005

Ms. Genevieve Salmonson, Director
State of Hawai'i
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

RE: Harold L. Lyon Arboretum Conservation District Use Application (CDUA)
Draft Environmental Assessment, April 2005
TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Manoa Valley, Honolulu, Island of O'ahu

Dear Ms. Salmonson:

Thank you for your letter of June 7, 2005 regarding your review of the Draft Environmental Assessment (DEA) for the Harold L. Lyon Arboretum after-the-fact permits and current uses of the 190-acre site.

The following are offered in response to your comments:

1. The cumulative and secondary impacts that may have arisen from the implementation of this project are provided in Section 4.0 of the FEA in relation to the affected environment. This project is for an after-the-fact approval of existing practices and does not have any significant cumulative impacts.
2. The construction and renovation activities evaluated in the EA are after-the-fact activities. If approved, new construction and/or renovation activities may incorporate sustainable building guidelines in the future.

Your comments and this response letter will be included in the Final EA. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

George I. Atta, AICP
Executive Vice President/Principal

Cc: Cliff Morden
Ronald K. Lau

To: Mica

LINDA LINGLE
GOVERNOR OF HAWAII



CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EPO-05-040

June 6, 2005

Mr. Charles Hayes, Interim Dean
University of Hawaii
College of Natural Sciences
2545 McCarthy Mall, Bilger Hall 102
Honolulu, Hawaii 96822

Dear Mr. Hayes:

SUBJECT: Draft Environmental Assessment
Harold L. Lyon Arboretum, University of Hawaii
Conservation District Use Application
Manoa Valley, Honolulu, Hawaii

Thank you for allowing us to review and comment on the subject document. We have following comments to offer and please also refer to our website for the Standard Comments (<http://www.state.hi.us/health/environmental/env-planning/landuse/landuse.html>). If there are any questions about these comments please contact Jiakai Liu with the Environmental Planning Office at 586-4346.

Waste Water Branch

We have reviewed the document on the subject project submitted which states in brief, as a part of the provisions set by the BLNR, the University of Hawaii is required to submit and execute an after-the-fact (ATF) Conservation District Use Application (CDUA) and Management Plan for the subject parcels. It further state the failure to obtain the appropriate approvals for the following:

- Renovations and alterations to cottages "B," "C," "D," "H," and "F" and a wood workshop / garage;
- Construction of the children's learning center;
- All landscaped features (memorial garden, water features, signs, statues, benches, trails and pathways, and drainage);
- Commercial uses of grounds;
- Construction of a visitor kiosk, rain shelter, and pavilion;
- Erection of a prefabricated storage shed; and

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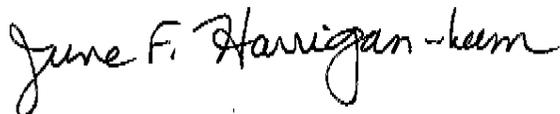
Mr. Hayes
June 6, 2005
Page 2

- Construction of a "large greenhouse/head house/shade house/acclimation yard."

We have the following comments to offer. We have a treatment individual wastewater system (IWS) for the subject property, Septic Tank File #3662 serving TMK: (1) 2-9-055: 006 only. We would prefer all domestic wastewater to be treated and disposed of via the City & County sewer service system. However, as that is unavailable at this time, we recommend that all generated domestic wastewater be treated and disposed of via treatment IWSs, therefore, cesspools serving any of the dwellings, units, and/or kiosks be upgraded to treatment IWSs. No new cesspools will be allowed. Existing cesspools may be converted to seepage pits, pending plan submittal and approval. We encourage the developer to utilize treated water for irrigation and other non-potable water purposes.

All wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems." We do reserve the right to review the detailed wastewater plans for conformance to applicable rules. Should you have any questions, please contact the Planning & Design Section of the Wastewater Branch at telephone 586-4294.

Sincerely,



JUNE F. HARRIGAN-LUM, MANAGER
Environmental Planning Office

c: WWB
EPO



June 20, 2005

Ms. June F. Harrigan-Lum, Manager
State of Hawai'i
Department of Health, Environmental Planning Office
P.O. Box 3378
Honolulu, Hawai'i 96801-3378

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Christine Mendes Ruotola, AICP

James L. Stone, AIA, LEED

**RE: Harold L. Lyon Arboretum Conservation District Use Application (CDUA)
Draft Environmental Assessment, April 2005
TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Manoa Valley, Honolulu, Island of O'ahu**

Dear Ms. Harrigan-Lum:

Thank you for your letter of June 6, 2005 regarding your review of the Draft Environmental Assessment (DEA) for the Harold L. Lyon Arboretum after-the-fact permits and current uses of the 190-acre site.

The following are offered in response to your comments:

1. The Septic Tank File #3662 serving TMK: (1) 2-9-055:006 has been identified in the EA as an individual wastewater system (IWS) for the subject property.
2. Since, City & County sewer service system is unavailable at this time, as requested, all generated domestic wastewater will be treated and disposed of via IWSs. Dwellings, units, and/or kiosks served by cesspools will be upgraded to IWSs.
3. We acknowledge that no new cesspools will be allowed. The EA is evaluating existing septic tank systems and septic tank leech fields hence it is an after-the-fact resolution process.
4. The use of treated water for irrigation and other nonpotable water purposes will strongly be considered.
5. All wastewater plans will conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems." The detailed wastewater plans will be available for review.

Your comments and this response letter will be included in the Final EA. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

A handwritten signature in cursive script that reads "George I. Atta".

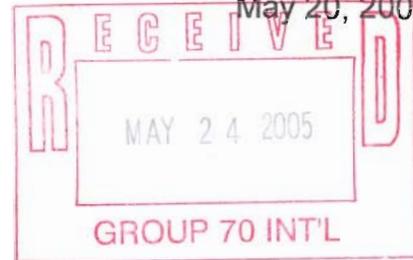
George I. Atta, AICP
Executive Vice President/Principal

Cc: Cliff Morden, Ronald K. Lau



Oahu Na Ala Hele
Trails & Access Program

May 20, 2005



University of Hawaii, College of Natural Sciences
2545 McCarthy Mall, Bilger Hall 102
Honolulu, Hawaii 96822

SUBJECT: Comments and Recommendation on Draft Environmental Assessment
Harold L. Lyon Arboretum, Manoa Valley, Honolulu, Hawaii

The staff of the Oahu Na Ala Hele Trails and Access Program (NAH) has reviewed the Draft Environmental Assessment (DEA), and we have the following comments:

Comments:

- NAH concurs with *Alternative Three*: The Arboretum should continue to resume uses and activities once it has established compliance.
- NAH will continue to consult the Arboretum on trail management activities. Including trail maintenance, risk assessments, and bridge or sign design.
- NAH will continue to collaborate with the Arboretum on special projects such as the Volunteer Service Network.
- NAH will help establish a formal Memorandum of Agreement for the management of those segments of state forestry trail that traverse through the Arboretum property.
- NAH is in support of an attended kiosk on the lower road to aid in mitigating traffic and security problems.
- NAH believes that it is possible for continued commercial use to have short-term or long-term adverse impacts on the Arboretum. The DEA needs to address this issue more specifically in order to determine what the level of acceptable change might be, as the future of the Arboretum could very well become more dependent on commercial activity.

Mahalo,

Aaron J. Lowe,
Oahu, Na Ala Hele Trails & Access Specialist



June 2, 2005

Mr. Aaron J. Lowe
State of Hawai'i
Department of Land and Natural Resources
O'ahu Division of Forestry & Wildlife
2135 Makiki Heights Drive
Honolulu, Hawai'i 96822

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Tom Young, AIA

**RE: Harold L. Lyon Arboretum Conservation District Use Application
Draft Environmental Assessment, April 2005
TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Manoa Valley, Honolulu, Island of O'ahu**

Dear Mr. Lowe:

Thank you for your letter of May 20, 2005 regarding your review of the Draft Environmental Assessment (DEA) for the Harold L. Lyon Arboretum after-the-fact permits and current uses of the 190-acre site.

We acknowledge your support of Alternative Three: The Arboretum should continue to resume uses and activities once it has established compliance.

Your comments regarding trail management will be accounted for in the Final EA. Specifically, your comments are included in Sections 2.3.5 and 3.16.

1. Thank you for your commitment to continue to consult the Arboretum on trail management activities. Including trail maintenance, risk assessments, and bridge or sign design.
2. Thank you for your commitment to continue to collaborate on special projects such as the Volunteer Service Network.
3. We will note that NAH will help establish a formal Memorandum of Agreement for the management of those segments of state forestry trail that traverse through the Arboretum property.
4. We concur with your statement, "NAH believes that it is possible for continued commercial use to have short-term or long-term adverse impacts on the Arboretum. Your concerns on the impacts of the commercial activities are addressed in the Final EA, more specifically in Section 2.3.7 and 4.0. A Master Plan for the Lyon Arboretum is in the process of being developed, which will determine what the level of acceptable change might be and determine what the future dependence on commercial activity at the Arboretum could become.

Letter to Mr. Aaron J. Lowe
SOH - DLNR
June 2, 2005
Page 2 of 2

Your comments and this response letter will be included in the Final EA. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.



George I. Atta, AICP
Executive Vice President/Principal

Cc: Cliff Morden
Ronald K. Lau

UNIVERSITY OF HAWAI'I AT MANOA
Environmental Center

June 7, 2005
EA: 316

Mr. Charles Hayes
University of Hawai'i
College of Natural Sciences
2545 McCarthy Mall, Bilger Hall 102
Honolulu, Hawai'i 96822

Dear Mr. Hayes:

Draft Environmental Assessment
University of Hawai'i, Harold L. Lyon Arboretum
Conservation District Use Application
Honolulu, O'ahu

This Draft Environmental Assessment (EA) submitted by the University as owner and administrator of Lyon Arboretum results from the provision of the after-the-fact Conservation District Use Application (CDUA). In accordance with Chapter 343, Hawai'i Revised Statutes (HRS) and the Department of Health's Hawai'i Administrative Rules Title 11-200, this EA evaluates and identifies technical, environmental, social, and economic aspects of Lyon Arboretum and possible impacts of unauthorized conservation district uses which may have occurred, and their significance. The anticipated determination is a Finding of No Significant Impact (FONSI).

The 193.5 acre Lyon Arboretum is a botanical research and instructional unit of the University currently maintained by the College of Natural Sciences. Lyon Arboretum is located at the end of Manoa Road within the Resource "R" subzone of the Conservation District and is bounded to the south, west, and east by private landowners.

General Comments

The University was charged by the State Department of Land and Natural Resources with violations of Chapter 13-5, Hawai'i Administrative Rules (HAR) and Chapter 183C, HRS, which regulate land uses in the Conservation District. Alleged violations include failure to obtain appropriate approvals for six renovation and construction projects and the commercial use of the grounds. In addition to a \$10,250 fine, the University is required to submit and execute an after-the-fact CDUA, a Management Plan, and will not allow further work to occur on the subject parcel within the Conservation District without approval from the Board of Land and Natural Resources.

June 9, 2005

Page 2 of 2

The violations result from work completed after 1964 to structures built between 1920 to 1929. The renovations and alterations to cottages and a workshop/garage improved the utility and safety of these structures. Other violations involve the modification of non-conforming structures and the construction of landscape features, storage sheds, shelters, and a greenhouse. Although unauthorized, the Environmental Center is in general agreement that all of these projects support the mission of Lyon Arboretum either to maintain or improve research, educational, and community service activities.

Specific Comments

The EA fails to provide information as to why permits were not submitted. The failure to proceed with project activities as required by State law appears to be a pattern of neglect by the University regarding the stewardship of Lyon Arboretum. As a result, Lyon Arboretum staff is forced to respond to existing or pending concerns without the benefit of proper funding and materials or a long-range management plan.

Of particular concern is the summary submitted by the State Office of the Auditor and the observation that "the university administration has not provided the strategic direction needed to fully explore and develop the arboretum's potential contribution to the institution's mission. Instead, the arboretum's course has been left to its caretakers – the facility's staff – without affirmative integration into the university's strategic mission." The summary continues with a lengthy indictment including "tolerance of the facility's physical deterioration," funding that has "barely sustained the status quo," "organizational disarray," "a disinterested university administration," substandard "financial and inventory accounting," and circumvention of "university policies and procedures." The clear implication is that in the eyes of the Auditor, basic maintenance and operational support for the Arboretum were subsidiary to other University priorities, to the ultimate detriment of the Arboretum's mission.

Among faculty, staff, and the botanical scientific community, Lyon Arboretum is recognized as a resource of considerable value to the University and the general public. Lyon Arboretum has a regional, national, and international reputation that requires a level of funding and administrative support to ensure proper protection and preservation of live and stored plant collections. Such support is currently not evident, and appears to have been lacking for a considerable period of time.

We recognize that appropriation of Lyon Arboretum as a tourist destination is tempting as a source of additional funding, but tourism is not part of the mission and could cause long-term degradation as a result of overuse. Expanded research, educational, and service activities as identified in the EA could increase visitation to a point that potentially exceeds the ecological and social carrying capacity of the arboretum when combined with tourism activities.

Lyon Arboretum is a valuable university asset already engaged in important academic pursuits in the fields of conservation biology, ethnobotany, restoration ecology, and environmental education. The research and educational objectives permit continuation of existing programs to

June 9, 2005
Page 3 of 3

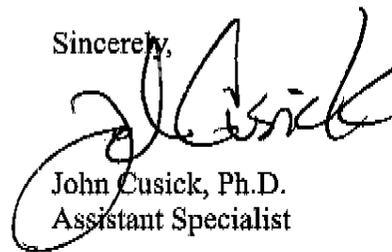
enhance faculty and student involvement, as well as expand K-12 field study programs. The herbarium is one facet of arboretum resources that would immediately benefit from improved funding, furthermore, the facilities are a logical location for a center dedicated to the rescue and propagation of rare and endangered native Hawaiian plant species. Support for the research staff and field crews will indicate intention by the State and the University to become more proactive in maintaining and perpetuating a world-class arboretum for future generations of residents and visitors.

Lyon Arboretum's one hundred year anniversary of the establishment by the Hawai'i Sugar Planters Association will be in 2018. By that time, a well-funded Lyon Arboretum could be established to play an integral role in the University Strategic Imperative theme of creating a Hawaiian sense of place which promotes an understanding of the *ahupua'a* land tenure system, concentrates on sustainable stewardship of terrestrial and marine environments, and aims the University to be an active leader among Pacific Islands and the broader Asia-Pacific regions. An obvious comparative advantage for the University is Lyon Arboretum.

In summary, although the Draft EA addresses basic shortcomings in prior processes regarding improvements at the Arboretum, we suggest that a more comprehensive master planning effort is needed to raise the level of commitment on the part of the University to ensure adequate operational support and facilities to continue and expand the crucial work ongoing at Lyon Arboretum. Both programmatic and fundamental maintenance needs of the Arboretum must be met with resources commensurate with a clear exposition of long-term goals for enhanced scholarship, basic research, educational opportunities across a wide spectrum of levels, and support for conservation efforts crucial to the sustainability of rare and endangered biological diversity.

Thank you for the opportunity to review this Draft EA.

Sincerely,



John Cusick, Ph.D.
Assistant Specialist

Cc: OEQC
UH Facilities, Grounds and Safety Office
Group 70
James Moncur



June 20, 2005

Mr. John Cusick, Assistant Specialist
State of Hawai'i
University of Hawai'i, Environmental Center
2500 Dole Street, Krauss Annex 19
Honolulu, Hawai'i 96822

**RE: Harold L. Lyon Arboretum Conservation District Use Application (CDUA)
Draft Environmental Assessment, April 2005
TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Manoa Valley, Honolulu, Island of O'ahu**

Dear Mr. Cusick:

Thank you for your letter of June 7, 2005 regarding your review of the Draft Environmental Assessment (DEA) for the Harold L. Lyon Arboretum after-the-fact permits and current uses of the 190-acre site.

The following are offered in response to your comments:

1. Information as to why permits were not submitted by the University for the Lyon Arboretum activities as required by State law is not available but most likely due to a combination of past practices, miscommunication and ignorance of requirements by the people involved. The Lyon Arboretum facilities and activities were in existence prior to the establishment of the 1964 State Land Use Law, therefore routine activities and maintenance were already in place. Most likely, the Staff at the Arboretum was unaware of the Department of Land and Natural Resources Conservation District Use regulations and rules. Miscommunication among the Arboretum staff and lack of communication among the subsections within DLNR added to the confusion that resulted in the cited violations. For instance, many Arboretum Staff reported that they had received approval from certain offices of DLNR. Based on this communiqué from one Division, they assumed all Departmental approvals had been granted. In conclusion, there was an overall ignorance of the Office of Coastal and Conservation Lands (OCCL) Conservation District Rules by the Arboretum Staff.
2. The State Office of the Auditor report is being acknowledged by the University. The University has received funding for maintenance and repair and is also looking for ways to develop a Long Range Development Plan for the Lyon Arboretum. The Lyon Arboretum Task Force is in the process of identifying questions in the Auditor's report and will be making recommendations for these issues. The Task Force is reviewing the long-term future of the Arboretum and the Conceptual focus of a future Long Range Development Plan. The fate of the Arboretum will also be determined in this process and will consider the following options: a) give the Lyon Arboretum to the City Botanical Garden System; b) allow the University the opportunity to commit and support the Arboretum; c) give the Arboretum back to the Hawai'i Sugar

Francis S. Oda, Arch. D., AIA, AICP
Norman G.Y. Hong, AIA
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Tom Young, AIA

Planter's Association Experiment Station (HSPA); or d) give the Arboretum to the National Tropical Botanical Garden Association. All of the above activities are intended to address the physical deterioration, organizational disarray and place within the University of Hawaii system.

3. We acknowledge your support for the Lyon Arboretum as a valuable resource to the University and the general public and hope to resolve the overlying issues with the after-the-fact resolution. We agree that the ecological values of the Arboretum are extremely important for education and research activities. The Arboretum is a major resource center for tropical plants with a Hawai'i/Pacific Basin/Asian focus. The Arboretum serves as an outdoor classroom to regular students, university classes and the public. In addition, the Arboretum coordinates, facilitates, and executes research, instruction, and service activities that utilize its collections and resources. The Arboretum provides an opportunity for importing, identifying, improving through breeding, and introduction to the public, plants useful for horticulture, research, education, or industry. In addition, the Arboretum preserves and propagates germplasm of endangered plant species, especially those native to Hawai'i. By developing a research and training program in restoration of Hawaiian ecosystems the Arboretum serves as a world-class educational center.
4. We acknowledge and agree with the comment that tourism is a secondary value to the ecological academic and educational values of the Arboretum. The activities at the Lyon Arboretum will be balanced with the ecological and social carrying capacity of the Arboretum. As stated in the mission of the Arboretum:

The Harold L. Lyon Arboretum coordinates, facilitates, and executes research, instruction, and service activities that utilize its collections and resources. Its major emphases are tropical plants, native Hawaiian plants, conservation biology, and Hawaiian ethnobotany. The Arboretum is responsible for:

- a. *Developing a major resource center for tropical plants with Hawaii/Pacific Basin/Asian focus, by enhancing its living plant collection, and establishing an appropriate reference library and herbarium. Making its collections and information available to a broad clientele including students, researchers, industry, and the general public, by performing and disseminating the results of research, by appropriate outreach and educational activities, and through plant and seed exchange programs.*
- b. *Serving as an outdoor laboratory for school and university students and classes.*
- c. *Importing, identifying, improving through breeding, and introduction to the public, plants useful for horticulture, research, education, or industry.*
- d. *Preserving and propagating germplasm of endangered plant species, especially those native to Hawaii. Special attention is given to the use of micropropagation and tissue culture technology in conservation of Hawaiian plants.*
- e. *Developing a research and training program in restoration of Hawaiian ecosystems. Serving as a University field station for terrestrial biology and stream biology.*

We will ensure that tourism and other commercial uses are limited and balanced to protect the primary mission of the Arboretum.

5. We appreciate your support for improvements to the herbarium and Arboretum facilities as a valuable university asset. We concur that support for research staff and field crews will indicate intention by the State and the University to become more proactive in maintaining and perpetuating a world-class arboretum for future generations of residents and visitors.
6. The Arboretum's one hundred year anniversary date, in 2018 is a realistic date for the University to have an established and well-funded Lyon Arboretum. We share your hope that this goal will be met by then.
7. As noted above, a Task Force is developing a process whereby a master plan will be developed for the Lyon Arboretum to ensure adequate operational support and facilities. This will show a commitment by the University that it plans to continue and expand the crucial work ongoing at Lyon Arboretum. We concur that both programmatic and fundamental maintenance needs of the Arboretum must be met with support for conservation efforts crucial to the sustainability of rare and endangered biological diversity. The EA is an after-the-fact resolution process and a master plan is being developed.

Your comments and this response letter will be included in the Final EA. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.



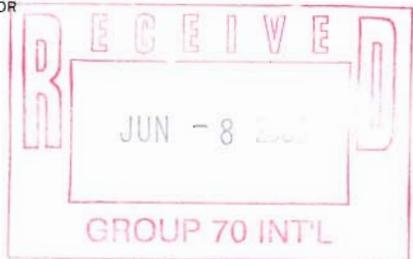
George I. Atta, AICP
Executive Vice President/Principal

Cc: Cliff Morden
Ronald K. Lau

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
PHONE: (808) 523-4432 • FAX: (808) 527-6743
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MUFI HANNEMANN
MAYOR



HENRY ENG, FAICP
DIRECTOR

DAVID K. TANOUE
DEPUTY DIRECTOR

2005/ELOG-1007 (rys)

June 7, 2005

Mr. Charles Hayes, Interim Dean
University of Hawaii, College of Natural Sciences
2545 McCarthy Mall, Bilger Hall 102
Honolulu, Hawaii 96822

Dear Mr. Hayes,

Draft Environmental Assessment
Harold L. Lyon Arboretum, University of Hawaii
Conservation District Use Application
Manoa Valley, Oahu, Hawaii; TMK: 2-9-055:006 and 007

We appreciate the opportunity to comment on the Draft Environmental Assessment, April 2005, for the Lyon Arboretum prepared by Group 70 and have the following comments.

1. Section 3.14 Utilities on page 3-21: The municipal wastewater system currently does not serve the subject property. Therefore, the applicant should contact the State Department of Health for wastewater disposal regulations and approvals.
2. Section 4.11.5 Mitigation on page 4-9: We suggest that application for listing on the Hawaii and/or National Register of Historic places should be considered.
3. Section 4.17 Hazardous Materials on page 4-13: We suggest adding a discussion of the mitigation plan for the disposal of asbestos in the event that it is uncovered during construction/renovation.
4. Section 6.4 City and County of Honolulu General Plan on pages 6-3 to 6-5: The first of the General Plans in the current format was adopted by resolution in 1977, not by ordinance in 1989. The General Plan provides objectives and policies for the people of the City and County of Honolulu and does not provide "courses of action" for the people of Hawaii. Specific implementation methods and courses of action are provided in the Development Plans, functional plans, and individual

public and private projects approved by ordinance or regulatory permits. GP objectives and policies are used to guide and coordinate City land use and infrastructure planning and regulation and City budgeting for operations and capital improvements. The Land Use Ordinance, not the Comprehensive Zoning Code, is the law that regulates land use within the City and County of Honolulu.

We suggest the text below for inclusion in Section 6.4:

“Adopted by resolution in 1977, the General Plan for the City and County of Honolulu sets forth the long-range objectives for the general welfare and prosperity of the people of Oahu and broad policies to attain those objectives. The General Plan provides objectives and policies intended to guide and coordinate City land use planning and regulation, and budgeting for operations and capital improvements. One element of this coordination is the Land Use Ordinance which is the legal instrument that regulates land use within the County.”

5. A new section, entitled “Primary Urban Center Development Plan (PUC DP)” should be added after Section 6.4. The FEA should provide a discussion of how the Arboretum project implements the vision and policies for the PUC DP (adopted on June 21, 2004 as Ordinance 04-14). The discussion should review how the project is consistent with the text of the Plan, not just whether the project is consistent with the Land Use Map. For example, the FEA should include a discussion on how the Arboretum supports the vision pertaining to protection and enhancement of Honolulu’s natural, cultural and scenic resources (Section 2.1, 3.1.2 and 3.1.3 of the PUC DP). The maps are conceptual and illustrate the vision and policies in the text of the Plan.
6. Section 6.5 City and County of Honolulu Zoning Districts on page 6-5: The Comprehensive Zoning Code is no longer in effect. Effective October 22, 1986, (Ordinance 86-96), it was superseded by the Land Use Ordinance. The Land Use Ordinance is required by Charter to be consistent with the GP and the eight DPs. The project site is located in the state Conservation Land Use District, and zoned P-1 Restricted Preservation. The adjacent parcels are also zoned P-1 Restricted Preservation, not Residential. The nearest urban parcels which are some distance “makai” of the site are zoned R-7.5 Residential, not RS-10.

Mr. Charles Hayes, Interim Dean
University of Hawaii, College of Natural Sciences
June 7, 2005
Page 3

While it is correct that the City and County does not have jurisdiction over P-1 zoned lands, which are located within the state designated conservation districts, it would be more complete to note that development standards in the P-1 District are governed by the appropriate state agency which is the State Department of Land and Natural Resources.

If you have any questions, please call staff planner Ray Sakai at 523-4047.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Henry Eng", written in a cursive style.

HENRY ENG, FAICP
Director of Planning and Permitting

HE:mo
375534

cc: Genevieve Salmonson, Director, OEQC
Kalvin Kashimoto, Director, UH Facilities, Grounds and Safety
George I. Atta, AICP, Principal; Group 70 International, Inc.



June 20, 2005

Mr. Henry Eng, FAICP, Director of Planning and Permitting
City and County of Honolulu
Department of Planning and Permitting
650 South King Street, 7th Floor
Honolulu, Hawai'i 96813

Francis S. Oda, Arch. D., AIA, AICP

Norman G.Y. Hong, AIA

Sheryl B. Seaman, AIA, ASID

Hitoshi Hida, AIA

Roy H. Nihei, AIA, CSI

James I. Nishimoto, AIA

Ralph E. Portmore, AICP

Stephen H. Yuen, AIA

Linda C. Miki, AIA

George I. Atta, AICP

Charles Y. Kaneshiro, AIA, LEED

Jeffrey H. Overton, AICP

Christine Mendes Ruotola, AICP

James L. Stone, AIA, LEED

**RE: Harold L. Lyon Arboretum Conservation District Use Application (CDUA)
Draft Environmental Assessment, April 2005
TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Manoa Valley, Honolulu, Island of O'ahu**

Dear Mr. Eng:

Thank you for your letter of June 7, 2005 regarding your review of the Draft Environmental Assessment (DEA) for the Harold L. Lyon Arboretum after-the-fact permits and current uses of the 190-acre site.

The following are offered in response to your comments:

1. For the FEA, Section 3.14 Utilities on page 3-21 will recommend that the State Department of Health be contacted for wastewater disposal regulations and approvals.
2. For the FEA, Section 4.11.5 Mitigation on page 4-9 has been modified to include that an application for listing on the Hawaii and/or National Register of Historic places will be considered.
3. The FEA is an after-the-fact process, therefore the disposal of asbestos uncovered during construction/renovation has already occurred and has been removed from the subject property. New construction/renovation activities will not occur until the Master Plan for the Lyon Arboretum is developed and approved by the University. This will involve another Environmental Assessment and CDUA and will be addressed at that time.
4. For the FEA, Section 6.4 City and County of Honolulu General Plan on pages 6-3 to 6-5 has been modified to state that the first of the General Plans was adopted by resolution in 1977. The suggested text for inclusion in Section 6.4 has been inserted. References to the comprehensive zoning code have been deleted.
5. A new section, entitled "Primary Urban Center Development Plan (PUC DP)" and a discussion of how the Arboretum project implements the vision and policies for the PUC DP has been inserted after Section 6.4. The following is the discussion included in the new Section 6.5 on page 6-6 on how the Arboretum supports the vision pertaining to protection and

Paul P. Chorney, AIA

Philip T. Cuccia, CSI, CDT

Kimberly Evans

Pete C. Galvez, AIA

Sutobin Halim

Roy A. Inouye, AIA, CSI, CDT

Stephen H. Kelly, AICP

Cami Kloster

Katherine M. MacNeil, AIA

Frank B. McCue

Kāwika McKeague

Kathryn A. Nam

Hiram C. Pajo

Donna D. Pennington

Kimberly Polkinhorn, AIA, LEED

Alvin Sakutori

Scott Tangonan

Tom Young, AIA

enhancement of Honolulu's natural, cultural and scenic resources (Section 2.1, 3.1.2 and 3.1.3 of the PUC DP).

The approval of the cited activities and improvements to the Arboretum advocates the following vision, policies, and guidelines of the PUC DP:

2.1 Honolulu's Natural, Cultural and Scenic Resources Are Protected and Enhanced

The mountain lands and shorelines that frame the city are protected and preserved, as are the natural, cultural and scenic areas and resources that lie within the urban area. Beaches and coastal waters, as well as historic sites and mountain lands, are actively managed and improved. Physical access to the mountains, the shoreline, streams and other resources is assured and continually enhanced.

Within the city, the open space network links mauka lands and shorelines to parks and open spaces within the urban area. Regional, beach and nature parks, the larger district parks, major campuses and golf courses provided green open space and recreational opportunities. The Civic Center, campuses and cemeteries also provide valuable open space. The public enjoys the Honolulu and Pearl Harbor waterfronts, with their promenades, bikeways and opportunities for entertainment. Stream greenbelts, numerous bikeways and pedestrian-friendly streets connect major parks and open spaces.

Culturally- and historically –important sites, landforms and structures continue to be preserved and enhanced. Historic and cultural districts are improved and interpreted for visitors.

People enjoy the panoramic view of Honolulu's mountain ridges, craters and coastlines from key vantage points. Within the city, view corridors are preserved through careful planning and design.

Discussion: The Arboretum promotes the vision of the PUC DP by preserving a natural, cultural and scenic area within the PUC. The major emphases at the Arboretum are tropical plants, native Hawaiian plants, conservation biology, and Hawaiian ethnobotany. As part of the mission, the Arboretum provides cultural educational opportunities and activities, which promote cultural values, customs, and arts that enrich the lifestyles of Hawai'i's people. The Arboretum is involved in the promotion of culture through its ethnobotanical gardens, conservation biology programs that preserve native species and its restoration ecology program for the hillsides it controls. In addition, it has engaged in restoration of ancient and historic lo'i and auwai for educational purposes. This has been done with the Hawaiian Charter School Hālau Kū Mānā. The Arboretum also teaches crafts that include native crafts and conducts classes on science and culture. Finally, the 'Awa Festival and similar events promotes culture and community.

3.1.2 Policies

Establish and maintain an integrated open space network throughout the Primary Urban Center comprised of the following elements:

- ***Preserve historic and cultural sites.*** *Preserve and protect sites that have high preservation value because of their good condition or unique*

features. Protection includes planning and design of adjacent uses to avoid conflicts or abrupt contrasts that detract from or destroy the physical integrity and historic or cultural value of the site. Retain, whenever possible, significant vistas associated with historic, natural and man-made features. Allow adaptive reuse of historic buildings to serve a new function and/or enhance interpretive value without destroying the historic value of a site.

- ***Preserve and protect natural resource and constraint areas.*** Establish an Urban Community Boundary to define the area for urban development. Place large contiguous areas of natural resource and constraint areas designated for Preservation, including all lands within the State Conservation District, outside of the Urban Community Boundary.
- ***Preserve panoramic views of natural landmarks and the urban skyline.*** Preserve views of the Ko'olau Wai'anae Mountain Ranges, Punchbowl, Diamond Head, Pearl Harbor and other natural landmarks. Maintain important view corridors within and across urban Honolulu and keep Downtown as the most prominent feature of the urban skyline. Views along the Pearl Harbor shoreline and the Pearl Harbor Historic Trail toward the mountains, shoreline, significant landmarks, and adjacent communities should be created and maximized wherever possible and appropriate.
- ***Improve access to shoreline and mountain areas.*** Provide continuous lateral access along the Honolulu waterfront and around the East Loch of Pearl Harbor, where urban activity is most intense. Maintain access to mountain hiking trails and increase opportunities for nature education and camping.
- ***Develop stream greenbelts.*** Develop and maintain greenbelts and pathways along streams, especially those running from the mountains to the sea through central Honolulu, as visual and physical linkages between mauka and makai open spaces.
- ***Provide parks and active recreation areas.*** Develop and maintain parks and other outdoor public spaces in a manner that expands opportunities for both active and passive recreation. Increase and enhance recreational open space in the most densely settled parts of the PUC.

3.1.3 Guidelines

3.1.3.1 Historic and Cultural Sites

- *Preserve and enhance the significant historic and aesthetic features of institutional campuses and campus clusters through zoning permit reviews for campus expansions or modifications.*

3.1.3.2 Mauka Conservation Areas

- *Prevent development on properties with average slopes of 40 percent or more, and on lands with slopes of 20 percent or more where development of the site would have a significant adverse visual impact when viewed from parks, major public streets, and other public places.*
- *Maintain public access points and hiking trails on the slopes of the Ko'olau Range in the areas beyond the Urban Community Boundary, and improve amenities for hiking, camping and nature study.*

- *In Preservation areas, avoid disturbance to native species and prevent the visual intrusion of structures, including utility and telecommunications installations, when seen from below and from hiking trails.*
- *Ensure access for traditional and customary practices and gathering rights, consistent with the provisions of the Constitution of the State of Hawai'i.*

Discussion: The mission of the Lyon Arboretum promotes the policies and guidelines of the PUC DP. The mission of the Arboretum strives to provide a natural site for educational, recreational, and community activities. The mission of the Arboretum not only seeks to protect botanical and biological resources, but to further understand them, and educate others so that we can further preserve and enhance natural environments. The Arboretum promotes preservation of natural resource by developing a major resource center for tropical plants with Hawai'i/Pacific Basin/Asian focus, and by enhancing its living plant collection. In addition, the Arboretum is consistent with the PUC DP policies and guidelines by being involved in the promotion of culture through its ethnobotanical gardens, conservation biology programs that preserve native species and its restoration ecology program for the hillsides it controls. For instance, it has engaged in restoration of ancient and historic lo'i and auwai for educational purposes. By preserving the Arboretum panoramic views of natural landmarks, such as the Ko'olau Mountains, would be maintained and preserved in the PUC. Finally, the Arboretum provides and promotes public access to mountain hiking trails and increased opportunity for nature education by serving as an outdoor laboratory for school and university students and classes and the public.

6. For the FEA, Section 6.5 has been modified to include the Land Use Ordinance. The adjacent parcels have been modified as zoned P-1 Restricted Preservation and the nearest urban parcel has been modified as zoned R-7.5 Residential. The last sentence in the section has been modified to state that the development standards in the P-1 District are governed by the appropriate state agency which is the State Department of Land and Natural Resources.

Your comments and this response letter will be included in the Final EA. We appreciate your participation in the environmental review process.

Sincerely,

GROUP 70 INTERNATIONAL, INC.



George I. Atta, AICP
Executive Vice President/Principal

Cc: Cliff Morden
Ronald K. Lau

DEPARTMENT OF FACILITY MAINTENANCE

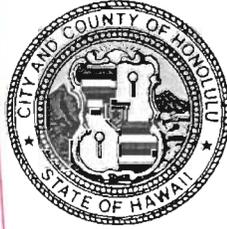
CITY AND COUNTY OF HONOLULU

1000 ULUOHIA STREET, SUITE 215, KAPOLEI, HAWAII 96707

TELEPHONE : (808) 692-5054 FAX: (808) 692-5857

Website: www.honolulu.gov

MUFI HANNEMANN
MAYOR



LAVERNE HIGA, P.E.
DIRECTOR AND CHIEF ENGINEER

GEORGE K. MIYAMOTO
DEPUTY DIRECTOR

IN REPLY REFER TO:
DRM 05-590

June 3, 2005

Mr. Charles Hayes
University of Hawaii
College of Natural Sciences
2545 McCarthy Mall, Bilger Hall 102
Honolulu, Hawaii 96822

Dear Mr. Hayes:

Subject: **Harold L. Lyon Arboretum, University of Hawaii
Conservation District Use Application
Draft Environmental Assessment (DEA)**

Thank you for the opportunity to review and comment on the DEA dated April 2005 for the Harold L. Lyon Arboretum Conservation District Use Application.

We have no comments to offer at this time as the improvements proposed in the DEA are within privately owned property and will have negligible impact on our facilities and operations.

Should you have any questions, please call Charles Pignataro of Division of Road Maintenance, at 484-7697.

Very truly yours,

A handwritten signature in black ink that reads "Laverne Higa".

LAVERNE HIGA, P.E.
Director and Chief Engineer

cc: Group 70 International Inc.



Francis S. Oda, Arch. D., AIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Hitoshi Hida, AIA
Roy H. Nihei, AIA, CSI
James I. Nishimoto, AIA
Ralph E. Portmore, AICP
Stephen H. Yuen, AIA
Linda C. Miki, AIA
George I. Atta, AICP
Charles Y. Kaneshiro, AIA, LEED
Jeffrey H. Overton, AICP
Christine Mendes Ruotola, AICP
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Katherine M. MacNeil, AIA
Frank B. McCue
Kāwika McKeague
Kathryn A. Nam
Hiram C. Pajo
Donna D. Pennington
Kimberly Polkinhorn, AIA, LEED
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

June 20, 2005

Ms. Laverne Higa, P.E., Director and Chief Engineer
City and County of Honolulu
Department of Facility Maintenance
1000 Uluohia Street, Suite 215
Kapolei, Hawai'i 96707

**RE: Harold L. Lyon Arboretum Conservation District Use Application (CDUA)
Draft Environmental Assessment, April 2005
TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Manoa Valley, Honolulu, Island of O'ahu**

Dear Ms. Higa:

Thank you for your letter of June 3, 2005 regarding your review of the Draft Environmental Assessment (DEA) for the Harold L. Lyon Arboretum after-the-fact permits and current uses of the 190-acre site.

We appreciate your comment that the improvements proposed in the DEA will not impact any of the Department of Facility Maintenance's facilities or operations.

Your comments and this response letter will be included in the Final EA. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

A handwritten signature in cursive script that reads "George I. Atta".

George I. Atta, AICP
Executive Vice President/Principal

Cc: Cliff Morden
Ronald K. Lau

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU

3375 KOAPAKA STREET, SUITE H425 • HONOLULU, HAWAII 96819-1869
TELEPHONE: (808) 831-7761 • FAX: (808) 831-7750 • INTERNET: www.honolulufire.org



MUFI HANNEMANN
MAYOR



ATTILIO K. LEONARDI
FIRE CHIEF

JOHN CLARK
DEPUTY FIRE CHIEF



May 18, 2005

Mr. Charles Hayes, Interim Dean
University of Hawaii
College of Natural Sciences
2545 McCarthy Mall, Bilger Hall 102
Honolulu, Hawaii 96822

Dear Mr. Hayes:

Subject: Draft Environmental Assessment
Project: Harold L. Lyon Arboretum, University of Hawaii
Location: Manoa, Oahu, Hawaii
Tax Map Key: 2-9-055: 006 and 007

We received a letter dated May 4, 2005, from Mr. George I. Atta of Group 70 International, Inc. requesting that our comments on the above-mentioned subject be submitted to you.

Enclosed for your reference is a copy of our letter dated March 29, 2005, to Mr. Atta. The Honolulu Fire Department has no additional comments.

Should you have any questions, please call Battalion Chief Lloyd Rogers of our Fire Prevention Bureau at 831-7778.

Sincerely,

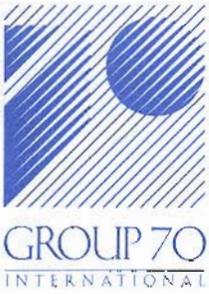
A handwritten signature in black ink that reads 'Attilio K. Leonard'.

ATTILIO K. LEONARDI
Fire Chief

AKL/SY:bh

cc: Ms. Genevieve Salmonson, Director
State of Hawaii, Department of Health, Office of Environmental Quality Control
Mr. Calvin Kashimoto, Director, University of Hawaii, Facilities, Grounds and Safety
Mr. George I. Atta, AICP, Principal, Group 70 International, Inc.

Enclosure



June 2, 2005

Mr. Attilio K. Leonardi, Fire Chief
City and County of Honolulu
Fire Department
3375 Koapaka Street, Suite H425
Honolulu, Hawai'i 96819-1869

Francis S. Oda,
Arch. D., FAIA, AICP

Norman G.Y. Hong, AIA

Sheryl B. Seaman, AIA, ASID

Hitoshi Hida, AIA

Roy H. Nihei, AIA, CSI

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James L. Stone, AIA, LEED

Paul P. Chorney, AIA

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Katherine M. MacNeil, AIA

Frank B. McCue

Kathryn A. Nam

Donna D. Pennington

Alvin Sakutori

Scott Tangonan

Tom Young, AIA

**RE: Harold L. Lyon Arboretum Conservation District Use Application
Draft Environmental Assessment, April 2004
TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Manoa Valley, Honolulu, Island of O'ahu**

Dear Mr. Leonardi:

Thank you for your letter of May 4, 2005 regarding your review of the Draft Environmental Assessment for the Harold L. Lyon Arboretum after-the-fact permits and current uses of the 190-acre site.

We appreciate your comment that this project does not impact any of the Fire Department's project or existing facilities.

Your comments and this response letter will be included in the Final EA. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

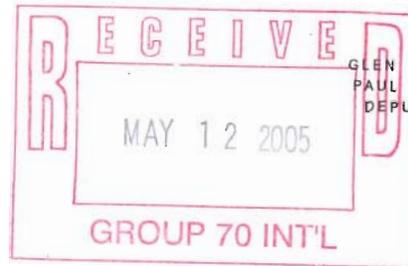
George I. Atta
George I. Atta, AICP
Executive Vice President/Principal

Cc: Cliff Morden
Ronald K. Lau

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111
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MUFI HANNEMANN
MAYOR



BOISSE P. CORREA
CHIEF

GLEN R. KAJIYAMA
PAUL D. PUTZULU
DEPUTY CHIEFS

OUR REFERENCE BS-KP

May 9, 2005

Mr. Charles Hayes, Interim Dean
University of Hawaii, College of
Natural Sciences
2545 McCarthy Mall, Bilger Hall 102
Honolulu, Hawaii 96822

Dear Mr. Hayes:

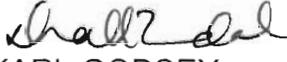
Thank you for the opportunity to review and comment on the Draft Environmental Assessment for the Harold L. Lyon Arboretum in Manoa Valley.

This project should have no significant impact on the facilities or operations of the Honolulu Police Department.

If there are any questions, please call Major Bart Huber of District 7 at 529-3796 or Mr. Brandon Stone of the Executive Bureau at 529-3644.

Sincerely,

BOISSE P. CORREA
Chief of Police

By 
for KARL GODSEY
Assistant Chief of Police
Support Services Bureau

cc: Mr. Calvin Kashimoto
University of Hawaii
Ms. Genevieve Salmonson
OEQC
✓ Mr. George Atta
Group 70 International, Inc.

Serving and Protecting with Aloha



June 2, 2005

Mr. Boisse P. Correa, Chief of Police
City and County of Honolulu
Police Department
801 South Beretania Street
Honolulu, Hawai'i 96813

**RE: Harold L. Lyon Arboretum Conservation District Use Application
Draft Environmental Assessment, April 2005
TMK: (1) 2-9-055:006 and (1) 2-9-055:007
Manoa Valley, Honolulu, Island of O'ahu**

Dear Mr. Correa:

Thank you for your letter of May 9, 2005 regarding your review of the Draft Environmental Assessment (DEA) for the Harold L. Lyon Arboretum after-the-fact permits and current uses of the 190-acre site.

We appreciate your comment that this project does not impact any of the Police Department's project or existing facilities.

Your comments and this response letter will be included in the Final EA. We appreciate your participation in the environmental review process.

Sincerely,
GROUP 70 INTERNATIONAL, INC.

A handwritten signature in cursive script that reads "George I. Atta".

George I. Atta, AICP
Executive Vice President/Principal

Cc: Cliff Morden
Ronald K. Lau

Francis S. Oda,
Arch. D., FAIA, AICP
Norman G.Y. Hong, AIA
Sheryl B. Seaman, AIA, ASID
Hitoshi Hida, AIA
Roy H. Nihei, AIA, CSI
James I. Nishimoto, AIA
Ralph E. Portmore, AICP
Stephen H. Yuen, AIA
Linda C. Miki, AIA
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Charles Y. Kaneshiro, AIA, LEED
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Christine M. Ruotola, AICP
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Paul P. Chorney, AIA
Phillip T. Cuccia
Pete C. Galvez, AIA
Sutobin Halim
Roy A. Inouye, AIA, CSI
Stephen H. Kelly, AICP
Katherine M. MacNeil, AIA
Frank B. McCue
Kathryn A. Nam
Donna D. Pennington
Alvin Sakutori
Scott Tangonan
Tom Young, AIA

APPENDIX E

Summary of the Herbarium at the Lyon Arboretum

William McClatchey



LYON ARBORETUM
The University of Hawai`i at Manoa

3860 Manoa Road · Honolulu, Hawai'i 96822-2279
Telephone (808) 956-6704 · FAX (808) 956-3923

Date: December 29th, 2004

To: Charles Hayes, Interim Dean
College of Natural Sciences

From: Will McClatchey, Associate Director
Lyon Arboretum

Regarding: The Arboretum herbarium and Karen Shigematsu

Karen Shigematsu is the Arboretum staff member responsible for management of the herbarium, library, archives, and database system. She also works in a variety of sections of the living collections and helps on larger group projects.

The herbarium is one of the most important parts of a botanical garden or arboretum. The herbarium serves as a references collection for plants that are growing in the gardens, as a focal point for researchers conducting work on plants, as a site for identification of plants involved in criminal cases, accidental poisonings, etc., and in a few cases (such as at the exceptional herbarium of the Delaware State University) the herbarium is a focus of community educational opportunities. Herbaria are maintained in climate controlled facilities with staff adequate to support the maintenance and expansion of the collection as well as providing services needed by visiting researchers and members of the public. A well maintained herbarium is a hub of research activity, serving as the basis of research grant proposals (NSF, NIH, DoA, etc.). Conversely, a lack of an adequate herbarium facility reduced success in grant applications for a wide range of research that can normally cite an herbarium as a critical part of institutional support.

The herbarium of the Lyon Arboretum is internationally recognized for its collections as cited in Index Herbariorum. However, the University has failed to provide adequate support for the herbarium. When I first entered the herbarium in spring of 2002, I was shocked to see the condition. Karen was having to work in a cramped room in a very old wooden building. Although appropriate herbarium cases were in use, several had broken doors, and most had dead insects and insect casings on the top of the cabinets because of a constant "rain" from the infested ceiling above. The herbarium room was air-conditioned but not humidity controlled. Feeling the sheets of the specimens, it was clear that the room had an excessive level of moisture and that the specimens were suffering from this. Herbarium supplies used in maintenance and development of

collections were present, but were also stored in poor conditions. Conditions became so bad that in the spring of 2003, I hired a rental truck and moved most of the collections (in their cases) out of the Arboretum building in which they were stored and into the 4th floor hallway of the St. John building. The collections are in the way in St. John and cannot be stored there for much longer. Shortly after this event, the building was condemned and has not been accessible since. Although 17 of the herbarium cabinets were moved to St. John, another 5 remain in the condemned building. In addition, several boxes of specimens are in the condemned building and are not in storage cabinets. Their value probably decreases with each passing day.

Karen has worked as an herbarium manager under very poor conditions and without her tireless efforts the herbarium would have sunk into a pile of pulp long ago. She is to be commended for her hard work against impossible odds.

I recommend that the University of Hawaii, recognize the critical role of the herbarium for effective research in the Arboretum and that the herbarium be given top priority for development of a new facility on the Arboretum grounds. A new herbarium should have the following minimum features:

- Air conditioning and humidity control designed to produce positive pressure in the facility.
- New storage cabinets that are insect free.
- A flushing ventilation system that allows for periodic fumigation of collections without harm to staff.
- Sufficient space for normal research activities and reasonable expansion of collections in the future.
- Separate rooms for herbarium collections, processing of new specimens, and offices for researchers and the herbarium manager.
- Sufficient space for library and reference materials.
- Sufficient space for visitor work areas (desks, tables, etc.).
- Restroom facilities dedicated for the herbarium.

Furthermore, the University should provide a dedicated budget for the herbarium. The typical budget of a University herbarium (such as that at the University of Florida, UC Berkeley, University of Arizona, Oregon State University, etc.) includes the following:

- Support for at least one herbarium curator. This is a PhD researcher whose work focuses on the taxonomy, classification, and nomenclature of plants. The curators work includes supervision of the herbarium manager and making major decisions about the herbarium. Curators are also responsible for production of grant proposals that support the facility and staff and for supervision of graduate students working on their research.
- Support for an herbarium manager. This is a MS researcher whose work focuses on management of the herbarium on a daily basis, supervision of students and volunteers working in the herbarium, and management of the quality, quantity, and expansion of the herbarium collection. The manager is usually the primary interface between the herbarium and researchers, members of the public, and others seeking to use the

herbarium for short-term purposes. The manager also provides plant identification services for the University and the community. [The Lyon Arboretum is fortunate to already have Karen Shigematsu in this position.]

- Support for at least one FTE of student workers. These students are able to learn the basic skills needed to work with plant collections while providing the bulk of labor needed to develop and maintain the collections.
- A working budget that is proportionate to the number of collections that need to be maintained. A reasonable budget would be one dollar per specimen in the collection. This budget will be used for maintenance and development of the collection.

Finally, I recommend that as soon as possible, Karen be provided with a dedicated budget of at least \$10,000 per year that she can use for purchasing supplies and hiring student workers to assist her in reviving the Arboretum herbarium.

APPENDIX F

Summary of Visitor Data Collected
by Kiosk Workers at the Lyon Arboretum

David Bowles

SUMMARY OF LYON ARBORETUM KIOSK DATA

February 16, 2005

Prepared by David Bowles for Dr. McClatchey

RE: SUMMARY OF KIOSK

The following is a summary of the visitor data collected by Kiosk workers during a 9month period from October 2003 to June 2004. The Kiosk project (initiated by the Directors at Lyon Arboretum) was created to more closely manage the visitors by covering risk management thus providing a safer and more secure environment for both the general public and the University of Hawaii.

This summary is organized in the following topics; coverage of Risk Management, benefits of the Kiosk, summary of Kiosk data, and a listing of each of the attachments to this document.

NOTE: Unfortunately this data does not include all of the visitors to Lyon in that it does not include data collected from the Education department of school groups, classes, and some meetings. Unfortunately these efforts were not able to be coordinated in such a way to bring all the data together.

SUMMARY:

There are several important management concerns solved for University of Hawaii.

- **First (Safety)** and foremost there was an opportunity to have initial contact with every visitor, have a risk and release form signed, pass out maps and safety guidelines.
- **Second (Security)** by having a physical presence at the entrance there will be an enhance security presence.
- **Third (Emergency)**, by having a physical presence at the entrance each visitor at Lyon would have a person to contact in case of emergencies since sometimes it is not possible to find other staff members out in the field.
- **Fourth (Increases Donations)** there was an opportunity to solicit donations from visitors thus increasing revenue generated at Lyon Arboretum.

In summary the majority of all visitors (48%) to Lyon Arboretum were visiting for their personal enjoyment. Of the visitors, which stopped and gave donations, 75% were from either the mainland or international. Of these visitors 59% were seniors (55 and over).

1.COVERAGE OF RISK MANAGEMENT:

The Kiosk project, initiated by directors at Lyon Arboretum, was created in order to more closely manage the visitors. All visitors were stopped at the Kiosk prior to entry of Lyon Arboretum grounds creating an opportunity to inform the public of any safety concerns.

1. All visitors signed a risk and release form
2. Each visitor could be informed of any safety concerns.

This complete coverage of signing a risk and release was not possible by collecting signatures at the Gift shop or Cottage H due to its location away from the parking lot. Frequently visitors

were observed driving up, parking and start walking through the grounds without even signing in at Cottage H.

2.BENEFITS OF KIOSK:

Direct benefit to UH from staffing the Kiosk:

1. Initial contact with everyone visiting Lyon Arboretum
2. Risk and release signed by every visitor
3. Visitor count data collected (see attachments)
4. Collection of donations
5. Physical presence near intersection with Manoa Falls trail entrance possibly reducing of crime
6. Human contact for visitors to Manoa Falls Trail available to answer questions
7. Phone available for emergency

3.SUMMARY OF DATA FROM KIOSK

The data was collected during open hours at a Kiosk located near the front entrance to Lyon Arboretum during a 9-month period from Oct 2003 to June 2004.

1. Every visitor to Lyon was counted in one of the following 12 categories.

Donations solicited

1. Kiosk
2. Commercial tours

Donations NOT solicited

3. Staff
4. Volunteers
5. LAA
6. UH
7. Service
8. Turnaround
9. Membership
10. Appointment
11. Gift shop
12. Other NP

The data was collect on paper then transferred into an MSAccess Database where the data was available for reporting to the Directors.

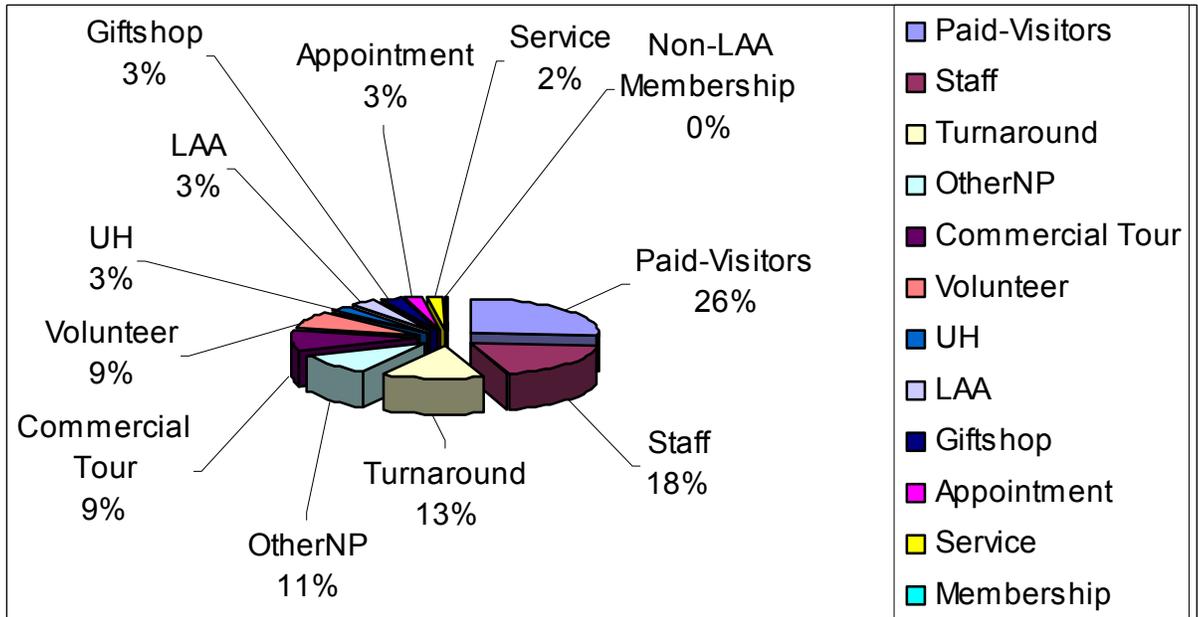
4. LIST OF ATTACHMENTS:

The following 3 attachments summarize the data collected.

Usage of Lyon by different groups:

1. Percentage of All visitors by category
2. Percentage of visitors (giving donations) by where from (Local, International, Mainland)
3. Percentage of visitors (giving donations) by age group

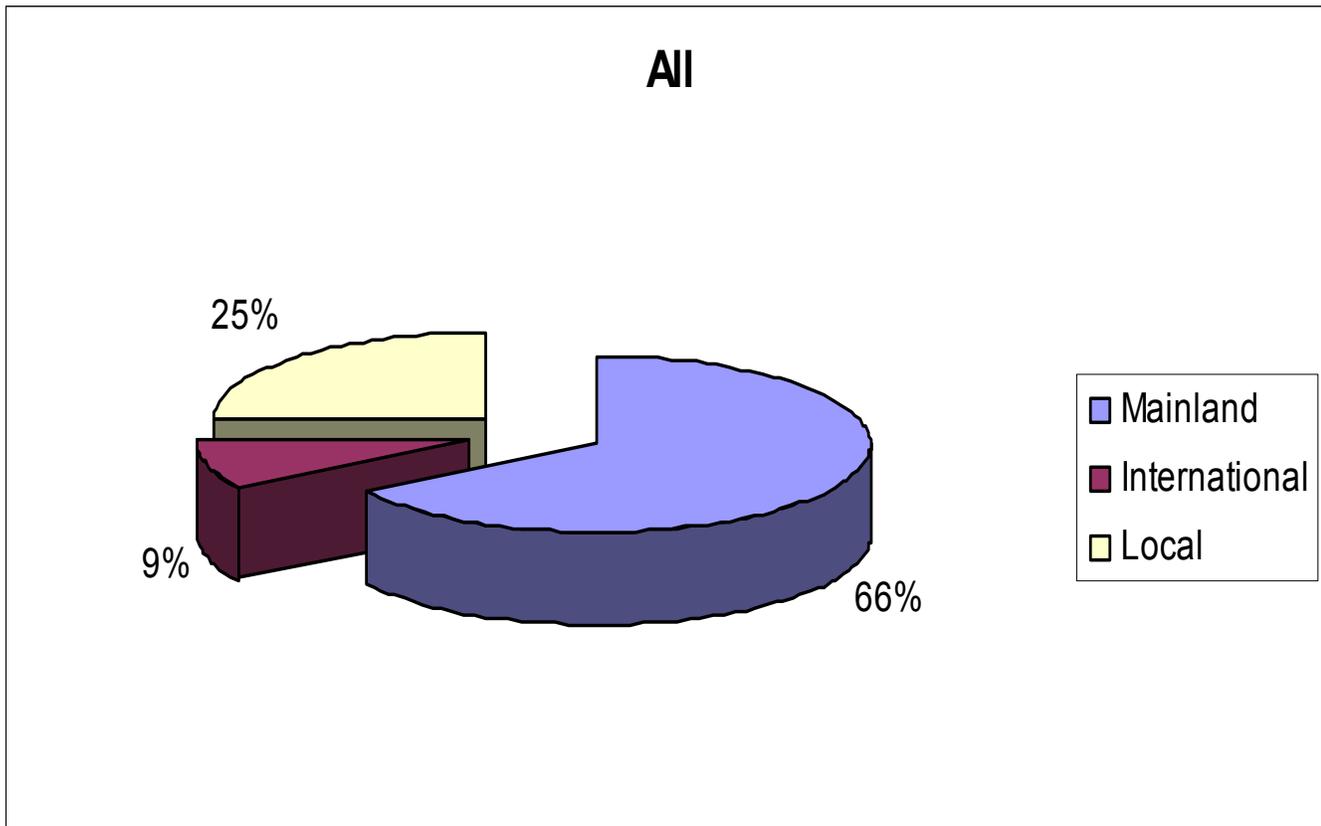
Percentage of all visitors



26% of the visitors were giving donations
13% of visitors were just driving through
9% of visitors were with Commercial tours
48% of All visitors were General Public

Nearly half of all the visitors to Lyon Arboretum came for their enjoyment of the grounds.

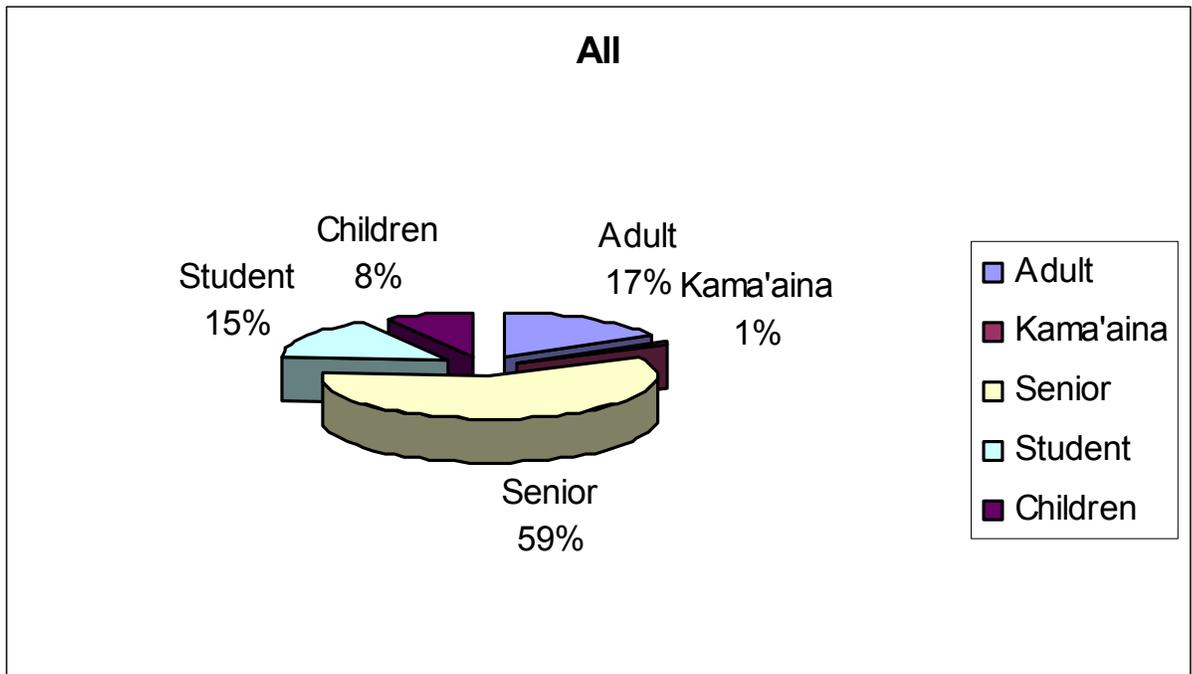
Percentage of visitors (local, international, mainland) who gave donations



The majority (**75%**) of the general public giving donations to Lyon Arboretum were either from the mainland or international. **25%** of all general public visitors were local.

The largest percentage of general public visitors visiting Lyon Arboretum for enjoyment are either international or from the mainland.

Percentage of visitors by age



By far the majority of general public visitors are seniors of age 55 and over (59%).

APPENDIX G

Planting Plan for the Ethnobotany Section

Planting Plan for the Ethnobotany Section
(Beatrice Krauss Hawaiian Ethnobotany Garden and the Lo`i Restoration Site)
On the grounds of the Lyon Arboretum
Submitted by Kawika Winter, April 2005

Ethnobotany is the scientific study of the relationship between plants and cultures. There are four main areas of ethnobotany: cultural, medical, ecological, and cognitive. There is great potential for each of these areas within the ethnobotany section of Lyon Arboretum.

A goal of the ethnobotany section at Lyon Arboretum is to provide an area for the relationship between plants and Hawaiian culture to flourish as a means for research, education, and cultural perpetuation. An integral component of this is the active presence of practitioners of Hawaiian culture.

Planting within the ethnobotany section should accurately reflect the methodologies in which Hawaiians do, or did, sustainably manage natural resources such as plants, soil/nutrients, fresh water, etc. To not strive for an accurate representation would be counterproductive to the said goals of research, education, and cultural perpetuation.

Plantings in the ethnobotany section consist of two main categories of plants: 1) “canoe plants” that the early Polynesians brought to Hawai`i, and 2) native plants that are important in Hawaiian culture. Both categories are planted in such a way, and in numbers, that allow for cultural practitioners to actively use the plants and plant parts for the said purposes of research, education, and cultural perpetuation.

The “canoe plants” consist mainly of crop plants that have been grown by humans for several millennia. Many of these could not maintain healthy growth, or perhaps not even survive, without active cultivation (which includes harvesting and replanting) by human hands. These include, but are not limited to, **Kalo** (*Colocasia esculenta*), **Uala** (*Ipomoea batatas*), **Awa** (*Piper methysticum*), **Kō** (*Saccharum officinarum*), **Mai`a** (*Musa* spp.), and **Uhi** (*Discorea* sp.). Planting of “canoe plants” would include ongoing harvesting and replanting with the mindset that the plants will be actively used by cultural practitioners.

The native plants that are important to Hawaiian culture include the endemic and indigenous plants of Hawai`i which play integral roles in the practices of **hula** (dance), **lua** (martial arts), **lā`au lapa`au** (herbal medicine), house construction, **kākau** (tattooing), **kūkū kapa** (tapa making), **lawai`a** (fishing), **kālai wa`a** (canoe carving), other forms of **kālai** (carving in general), **ho`omana** (religion), and others. Planting of native plants will be done with the mindset that they will be actively used by cultural practitioners.

APPENDIX H

Lyon Arboretum Renovations Preliminary Cost Estimates

LYON ARBORETUM RENOVATIONS - PRELIMINARY COST ESTIMATE

January 24, 2005

Description	Estimated Cost	Comments
<u>SUMMARY</u>		
Priority 1 - 2005/ 2006	1,300,000	
Priority 2 - 2006/ 2007	<u>1,257,000</u>	
TOTAL ESTIMATED COST	2,557,000	See breakdown below
 <u>PRIORITY 1 - 2005/ 2006</u>		
1.1 Septic Tank		
Construction	60,000	The cesspool serving Buildings A & B meets the Federal definition of a large capacity cesspool because it is a non-residential cesspool serving more than 20 persons per day, and must be replaced with a septic tank or sewer connection. A sewer connection is not feasible.
General Contractor	15,000	Includes bond, supervision, inspections, temporary facilities & controls, insurance, permits, Sub-Contractor mark-Up, Overhead & Profit.
Subtotal Septic Tank - Construction	<u>75,000</u>	
Consultants' Fees	22,500	Topographical survey, civil engineer, mechanical engineer, environmental consultant.
Subtotal Septic Tank	97,500	
Subtotal Septic Tank (Rounded)	98,000	
 1.2 Renovation of Cottages		
Cottage A	252,000	
Cottage G	220,000	
Cottage H	234,000	
General Contractor	120,020	Includes bond, supervision, inspections, temporary facilities & controls, insurance, permits, Sub-Contractor mark-Up, Overhead & Profit.
Subtotal Cottages - Construction	<u>826,020</u>	
Consultants' Fees	<u>123,903</u>	Architect, structural engineer.
Subtotal Cottages	949,923	
Subtotal Cottages (Rounded)	950,000	

LYON ARBORETUM RENOVATIONS - PRELIMINARY COST ESTIMATE

January 24, 2005

Description	Estimated Cost	Comments
1.3 Electrical Upgrades		
Cottage A	27,000	
Cottage G	24,000	
Cottage H	69,000	
General Contractor	20,400	Includes bond, supervision, inspections, temporary facilities & controls, insurance, permits, Sub-Contractor mark-Up, Overhead & Profit
Subtotal Electrical Upgrades - Construction	140,400	
Consultants' Fees	21,060	Electrical engineer.
Subtotal Electrical Upgrades	161,460	
Subtotal Electrical Upgrades (Rounded)	162,000	
1.4 ADA Upgrades		
Cottage H - Visitor Center	67,000	
Accessible entrance walkway & landing		
Accessible route from office to classroom		
Classroom entrance door & threshold		
Accessible restrooms		
General Contractor	11,390	Includes bond, supervision, inspections, temporary facilities & controls, insurance, permits, Sub-Contractor mark-Up, Overhead & Profit
Subtotal ADA - Construction	78,390	
Consultants' Fees	11,759	Architect, structural engineer.
Subtotal ADA Upgrades	90,149	
Subtotal ADA Upgrades (Rounded)	90,000	
<u>SUBTOTAL PRIORITY 1</u>	1,300,000	

LYON ARBORETUM RENOVATIONS - PRELIMINARY COST ESTIMATE

January 24, 2005

Description	Estimated Cost	Comments
<u>PRIORITY 2 - 2006/ 2007</u>		
2.1 Renovation of Cottages		
Cottage B	126,000	
Cottage C	126,000	
Cottage D	99,000	
Cottage E	110,000	
Cottage F	167,000	
Storage Shed	12,000	
Work Shed	4,000	
General Contractor	122,360	Includes bond, supervision, inspections, temporary facilities & controls, insurance, permits, Sub-Contractor mark-Up, Overhead & Profit.
Subtotal Cottages - Construction	766,360	
Consultants' Fees	153,272	Architect, structural engineer.
Subtotal Cottages	919,632	
Subtotal Cottages (Rounded)	920,000	
2.2 Electrical Upgrades		
Cottage B	16,000	
Cottage C	16,000	
Cottage D	13,000	
Cottage E	12,000	
Cottage F	21,000	
General Contractor	14,820	Includes bond, supervision, inspections, temporary facilities & controls, insurance, permits, Sub-Contractor mark-Up, Overhead & Profit
Subtotal Electrical Upgrades - Construction	92,820	
Consultants' Fees	18,564	Electrical engineer.
Subtotal Electrical Upgrades	111,384	
Subtotal Electrical Upgrades (Rounded)	112,000	

LYON ARBORETUM RENOVATIONS - PRELIMINARY COST ESTIMATE

January 24, 2005

Description	Estimated Cost	Comments
2.3 Parking & Roadway Upgrades		
Resurface Parking Lot	85,000	
Resurface Roadway	57,000	
General Contractor	32,660	Includes bond, supervision, inspections, temporary facilities & controls, insurance, permits, Sub-Contractor mark-Up, Overhead & Profit.
Subtotal Parking & Roadway Upgrades - Construction	<u>174,660</u>	
Consultants' Fees	<u>50,000</u>	Topographical survey, civil engineer.
Subtotal Parking & Roadway Upgrades	224,660	
Subtotal Parking & Roadway Upgrades (Rounded)	225,000	
<u>SUBTOTAL PRIORITY 2</u>	1,257,000	
<u>SUMMARY</u>		
Priority 1 - 2005/ 2006	1,300,000	
Priority 2 - 2006/ 2007	<u>1,257,000</u>	
TOTAL ESTIMATED COST	2,557,000	

APPENDIX I

“Work-in-Progress” Land Management Plan for the Lyon Arboretum

The following appendix is a work-in-progress, and is not to be considered a final draft. As such, this has not yet been approved by the interim director of Lyon Arboretum, the Office of the Vice-Chancellor, or the Board of Regents. A final draft is anticipated by August 2005.

Land Management Plan
for the
Harold L. Lyon Arboretum
of the
University of Hawaii

Draft

Approved by
Interim Director of the Lyon Arboretum
Vice-Chancellor for Research and Graduate Education
University of Hawaii at Mānoa

June 2005

Land Management Plan for the Harold L. Lyon Arboretum of the University of Hawaii at Mānoa

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INTRODUCTION

The University of Hawaii at Mānoa is the only public land, sea and space grant university in the United States. It also has the distinction of having the only biological field research facility in a tropical rainforest owned and operated by a university in the country. Established in 1918, the Harold L. Lyon Arboretum's 193.5 acres in upper Mānoa Valley includes native and introduced forests as well as managed collections of native and non-native plants

Lyon Arboretum is a research and educational unit of the University of Hawaii at Mānoa. It also serves as a public botanical garden and recreation area for the local community and visitors from abroad. The arboretum is open to the public from 9 a.m. to 4 p.m. Monday through Friday except holidays. The Arboretum has been managed by the University for about 50 years, prior to which the land mostly consisted of sugarcane plantations that had been planted with a diverse range of alien trees as part of experiments in watershed restoration. The trees have since grown to form an artificial forest. There are small patches of native forest on the highest and steepest slopes. The lowest areas have been landscaped for educational and research purposes and also serve as a site of visitor education about botanical diversity, ecology, and related environmental issues.

This Land Management Plan is divided into three parts: Land Uses, Facilities, and Educational and Visitor Activities. The Land Uses are stated in general terms as these are often developed as plants grow and visualization of needs are expanded. Detailed management plans had been previously prepared, but not accepted (e.g., McClatchey & Hayes "Land Management of the Lyon Arboretum", Appendix B to the EA/ATF-CDUA: 56 pp.), and treat some aspects of the above parts from a historical perspective. The goal of this document is to state present management practices used for care and maintenance of Lyon Arboretum.

Function and Purpose of Lyon Arboretum

Lyon Arboretum exists to protect and preserve the critical watershed of upper Mānoa Valley; to use its world-class plant collection to promote plant conservation; and to inspire appreciation, understanding, and study of a unique botanical environment. This is carried out through the careful management of the living collections, research conducted by our staff and partner organizations, and education programs that reach the community at all levels. All buildings and structures of Lyon Arboretum are used to enhance our ability to carry out these objectives.

Management Objectives

Three objectives have been established for the planning and carrying out of the management of Lyon Arboretum.

1. To improve the existing habitats within the arboretum such that the environment is aesthetically pleasing for visitors while maintaining the focus on our function of making the living collections available for educational and research purposes.
2. To use the arboretum as a fundamental component of research programs conducted by arboretum personnel and in association with partner organizations including the University of Hawaii.
3. To use the arboretum to provide educational opportunities to the public with both formal class settings and informal self-guided tours.

Management Guidelines

The following Management Guidelines are utilized to assist the Lyon Arboretum in the judicious implementation of its programs and improvements.

1. Habitat improvement in the arboretum must be performed in a manner that will not adversely impact terrestrial or aquatic environments of the arboretum or its scenic value.
2. The implementation of the planting, research, or educational programs carried out at the arboretum must be done in a manner that will not adversely impact terrestrial or aquatic environments of the arboretum or its scenic value.
3. Maintenance of the arboretum must be performed in a manner that will not adversely impact terrestrial or aquatic environments of the arboretum or its scenic value.
4. All organic litter generated in the arboretum should be recycled through a passive composting program; wood of suitable size may be used in cultural programs as appropriate. Nutrients from composting returns to the soils from which they came.
5. The construction of all physical facilities in the arboretum must be performed in a manner that will not adversely impact terrestrial or aquatic environments of the arboretum or its scenic value.

Commercial Activities and Donor Programs

Lyon Arboretum has commercial interests and receives donations, the monies generated from which are then used to support the various activities at the arboretum.

Financial support from the University of Hawaii has historically not been adequate to maintain all the activities necessary to keep the arboretum operational. As such, the commercial activities and donations have provided a vital link for fulfilling the function and purpose set forth above. Funds received are used for hiring additional staff support, purchasing of equipment and supplies, funding of research programs carried out at the arboretum, providing educational programs to the community for adults and children, others? At present, all commercial activities of the arboretum are suspended pending the outcome of the After-the-Fact Conservation District Use Application. However, the arboretum continues to receive charitable donations.

Lyon Arboretum is affiliated with three non-profit organizations: the Lyon Arboretum Association, the Garden Club of Honolulu, and the Bromeliad Society. Lyon Arboretum Association (LAA) has had a long association with the arboretum and maintains office space within the arboretum headquarters. In the past, money raised by the arboretum from commercial activities and from donors were handled by LAA. LAA then used these funds to pay for the activities carried out at the arboretum beyond the budget provided by the University of Hawaii including hiring additional staff, purchase of equipment and supplies, support for education and research programs, and grants to individuals for research carried out at Lyon Arboretum. Over the past five years or more, the relationship between the Arboretum and LAA became strained as there developed a mutual distrust of each others intent. This has resulted in accounts for the Arboretum being established with the Research Council of the University of Hawaii (RCUH) and the University of Hawaii Foundation (UHF) where some funds gained through donations are now being channeled. With recent changes in administration at Lyon Arboretum (i.e., resignation of the past director and appointment of a new interim director), relations between the Arboretum and LAA are improving. However, the handling of funds in the future will change as various options are explored further.

The two other non-profits have not had as direct relationship with Lyon Arboretum. The Garden Club of Honolulu, a charter member of the Garden Club of America, maintains an office in the arboretum headquarters and holds monthly board meetings and general meetings in one of the classrooms. They have generously contributed to the arboretum in the past making possible the purchase of much needed equipment. The Hawaii branch of the Bromeliad Society has monthly meetings held in one of the classrooms at the arboretum.

Several commercial activities have been carried out in the past. A **gift shop** in the main building at Lyon Arboretum has been open to the public since the 1970's. Items sold included books about Hawaii, gardening, and the natural environment, memorabilia of the arboretum and Hawaii, forest products from Lyon Arboretum, and items produced by weekly workgroups that come to the arboretum (i.e., jams and jellies, lei's, seed crafts, and oshibana). Lyon Arboretum sponsors a **plant sale** for the community three times per year. Plants grown at the arboretum (native as well as horticultural plants) are prepared for sale at these events. Two of the sales occur at sites other than Lyon Arboretum (because of space considerations) and include many of the commercial vendors from around Oahu. In addition to the commercial aspect, there is also

opportunity for public education about the plants, the environment, and information about invasive alien species. Patrons are also informed of the Lyon Arboretum Association and other opportunities to support the arboretum. **Education programs** are offered for both adults and children. Approximately 100 to 150 adult workshops are offered year round and provide a wide variety of classes that may be attended by 15 to 20 people for a nominal fee (usually \$10-\$20). The Children's Learning Center offers classes for youth primarily during the summer months, the cost per child \$3 per day. **Other activities** that have brought money into the arboretum in the past include fees for class tours of the arboretum, ecotourism groups that visit the arboretum, and cut flowers or foliage. A visitor entrance fee has been charged in the past, but is currently suspended.

Donations are received from community members for a wide variety of purposes. In some cases, these are made to specific programs being conducted at the arboretum, in others these are made as general contributions. Daily visitors often leave donations. Flowers contributed for weddings often bring donations from private groups. Docent led tours were offered twice weekly, and visitors often left donations following the tour. Special programs for Tribute Gifts or Endowments are also available.

Lyon Arboretum also has a Memorial Program whereby a portion of the arboretum is set aside as a memorial garden. Specific trees within the arboretum may also be designated as a living memorial. Memorial benches may be placed in a safe location within the arboretum. Trees or benches will be inscribed with the persons name and maintained for the life of the tree or a specified time period for the benches. Monies from the memorial program are kept separate from other arboretum funds, and are used to create the memorial and for its upkeep (cleaning and repair as needed, and maintaining the grounds around memorial trees and the trees health as needed).

ARBORETUM GROUNDS

The 193.5 acres of Lyon Arboretum consists of three zones, the precise boundaries of which have fluctuated over the years.

- The **lower zone (Zone 1)**, referred to as the “public section”) receives the most human activity, has better access trails, more labeling, and a higher concentration of plants for show. Most of this area was previously sugar cane (1920-1935 or later, but was not part of the tree-planting). Haukulu section 41 was originally sugar cane, was long abandoned, and became the Ethnobotanic Section in the mid-1970's.
- The **middle zone (Zone 2)**, referred to as the “research section”) consists of the original tree-planting sections. Sections 1-21 in Haukulu (west of `Aihualama Stream), and all the `Aihualama Sections (east of `Aihualama Stream) were planted directly to trees, without previous sugar cane planting. Haukulu sections 22-32 were in sugar cane from the early 1920s until the mid-1930s or slightly later, and then were planted to trees. Most of Haukulu sections 33-39 were originally in sugar cane, but

were converted to trees since the University of Hawai`i took over the Arboretum. Haukulu section 40 consists of early unaccessioned plantings next to Aroid Valley, with an unplanted mucky area on the floodplain of `Aihualama Stream. An area above the original plantings in valleys 7 and 8 (`Aihualama) has been cleared and become part of the collection area, including a collection of timber bamboo.

- The **upper zone (Zone 3)**, referred to as the “restoration section”) is generally above the originally planted sections. Patches of native forest, heavily invaded by exotics, exist and are becoming the core of restoration efforts.

The grounds are used by the arboretum staff or associates in six primary but largely overlapping activities. These are addressed below in the sections of Land Usage, Tree Management, Trails, Weed Control, Research Plant Collections, and Restoration.

Land Usage

Several considerations are common to all three of the arboretum zones. These include 1) building the diversity of the collections, 2) minimizing soil erosion, 3) use of ground covers to control alien weeds, 4) avoid planting species with the potential to become invasive in the Hawaiian environment, and 5) try to make plantings look aesthetically pleasing and as “natural” as possible. Other considerations hold more weight in one zone more than another and are addressed below in bulleted form.

Chemicals are used as infrequently as possible on the arboretum grounds. Fertilizers are used at the time of planting, and rarely thereafter. Insecticides and fungicides are rarely used on the grounds, and only for severe local infestations. Insecticides and fungicides are occasionally used in the greenhouses as natural controls for such are not possible.

Much of the day-to-day activities on the arboretum grounds is taken up by routine maintenance including mowing and edging, removal of fallen branches or palm fronds, and new plantings. Mowing/weed-eating occurs every three weeks during winter months and every 2 weeks during the summer months and consumes roughly 14% of the grounds maintenance efforts. Other activities are usually unscheduled and take place as needed (branch/frond removal – 3%) or when opportunities arise (new plantings based on plants being available, area cleared, weather – 1%).

Zone 1 (lower, “public”)

- Plantings should be aesthetically pleasing and impeccably maintained.
- Plants should “grab” the viewer and peak their interest.
- Labels and signs should provide information.
- Paths should be all-weather trafficable, and ADA compliant where possible.
- In the lo`i restoration area and Hawaiian Ethnobotanic Section, Hawaiian cultural practices become part of the land management.

Zone 2 (middle, “research”)

- Collections should be organized in some fashion: systematically, geographically, or by function, but this should not be rigidly applied – interplantings can increase the diversity and aesthetics of the area.
- Increasing diversity of the collections.
- Plantings should be maintainable and mappable.
- Trails should be kept open and safe, but surfacing is the minimum needed to make them trafficable.
- Labeling is important, but need not be “fancy” or oriented to the public.

Zone 3 (upper, “restoration”)

- Only plants native to the central Koolau Mountains should be used. This may be relaxed on a temporary basis for exotic plants that perform a function such as groundcovers for weed control or non-invasive trees that provide shade during establishment growth of natives.
- Different restoration strategies need to be coordinated.
- Aesthetics is not a consideration.
- Labeling is mostly for research purposes only.
- Trails need to be very carefully constructed to avoid harming roots of native trees.

Tree Management

Because of its history as an introduction site for exotic species, the Arboretum is ground zero for a number of invasive tree species. Most of these are pioneer species that grow quickly to the size (6” diameter at ground level) requiring a permit for removal. There are quite a few of these trees throughout the Arboretum that we would like to remove as time and resources permit. The gaps created are filled with more desirable trees and understory plants. A list of the trees and palms seen as most problematic and in eventual need of removal is as follows:

Alphitonia excelsa (or *A. philippinensis*)
Archontophoenix alexandrae (palm)
Arenga pinnata (palm)
Cecropia obtusifolia and *C. peltata*
Cinnamomum burmannii and *C. verum*
Elaeocarpus angustifolius and *E. serratus*
Erythrina poeppigiana
Falcataria moluccana (albizia)
Ficus microcarpa and *F. rubiginosa*
Heliocarpus popayanensis
Livistona chinensis (palm)
Macaranga mappa and *M. tanarius*
Prunus grisea

Rhus taitensis (formerly called *Dracontomelon* sp.)
Roystonea regia and *R. oleracea* (palm)
Schefflera actinophylla and *S. taiwaniana*
Syagrus romanzoffiana (palm)
Trema orientalis

It is desirable in some cases that invasive alien trees such as *Ficus microcarpa* and *Schefflera actinophylla* that occur along stream banks remain there to prevent erosion. In these cases, it is necessary to severely prune them reducing their canopy to a “lollipop”, thus keeping the roots alive and allowing sufficient light to pass through for growth of plants in the adjacent area. Stream banks that are open may have other more desirable (e.g., non-invasive) species planted to serve this purpose. Maintenance of trees throughout the arboretum occurs regularly and occupies approximately 10% of the staff effort.

Limbs from some of the older trees break off frequently, especially during high winds or heavy rains. This is particularly true of the older albizia trees on the grounds. When this occurs, immediately action is necessary as the broken branches could pose a potential health/accident risk to visitors of the arboretum and untreated trees could be susceptible to further damage. As such, it is necessary to remove branches from trails, trim the broken branch in the tree, and/or treat the remaining portion of the tree to prevent rot or insect infestation. There are peak times for this activity throughout the year, but on average things of this nature are dealt with on a weekly basis and occupy approximately 3% of the staff time (not including staff efforts in removal of branches addressed above).

Pruning (removal of excess, spent, or unwanted plant parts) of shrubs and trees in zones 1 and 2 largely occurs seasonally for particular species, but phonological differences among species requires this effort to be maintained year round. Optimal time for this is when shrubs and trees are not flowering or have lost their leaves. Trees are pruned to remove broken, damaged, dead, crossing, superfluous, or unsafe branches. Gingers and heliconias (giant herbs that are shrub-like or tree-like) are thinned of old, flowering growth when they have passed their prime flowering stage. Palms are pruned to remove dead, damaged, or dying leaves. In all three cases, more pruning is necessary following high winds. Certain shrubs and hedges (mock orange, *Mussaenda*, *Dombeya*, *Grewia*) are pruned on a yearly basis to maintain their size and shape. These activities occupy approximately 5% of staff efforts.

Trails

Within the Arboretum there are an estimated 7.5 miles of trails of varying quality. Trail construction and maintenance is far behind what it should be, due to constraints of money and manpower. Trails should exist throughout the entire Arboretum to allow access for maintenance, monitoring of invasive species, and for pig control. In the lower areas, these trails should be American with Disabilities Act (ADA) compliant where possible, or at a minimum smooth, hardened, and well-defined for public access.

Compacted fine gravel has not held up well where the flow of water is periodically heavy. Broken concrete stepping stones are often displaced by tree roots. It seems a patchwork of surfaces is the best solution given our limited resources. Poured concrete or large slabs are needed on ADA trails where water erosion is a possibility; compacted gravel could service the remainder of the ADA trails. For non-ADA trails, grass creeping over the compacted gravel will protect it from erosion, but the trail must be defined by markers such as rocks or plants. A mixture of a sufficient thickness of large gravel with soil, covered by grass (in sunny areas) or low groundcovers (in shady areas), may be sufficient for most walking paths. This is especially true where tree roots may shift stepping stones or break poured concrete. Those trails used for off-the-road vehicular access may need reinforcement with stepping stones and large rocks.

Trail construction and maintenance would be comparable to that employed by *Na Ala Hele* of the State Division of Forestry and Wildlife (DOFAW). In areas where trail construction is considered more advanced, *Na Ala Hele* staff will be consulted on the best alternatives prior to proceeding. Discussions have been held with Aaron Lowe of *Na Ala Hele* about ways to work together on development of a trail plan. An agreement in principle was reached to collaborate our efforts to enhance visitor experiences and regulations in the Mānoa watershed area.

Trail clearing and maintenance occurs on an as needed basis. Often volunteer organizations (e.g., Boy Scout Troops) are engaged to assist in this. These activities occupies approximately 4% of the staff effort.

Weed Control

Weeds are a constant and complex problem at all levels of growth: ground cover, large herbs and shrubs, and trees. Weeding activities occur year round in zone 1 and as time permits in zone 2. Groundcover establishment is a priority. In areas with groundcovers or closely planted desirable plants, the weeding is done by hand and with small gardening tools such that as little soil is exposed as possible. In areas without desirable plants, RoundUp Pro at 3 ounces per gallon is used as a temporary control and preferably before the weeds have gone to seed. For larger weeds that are cut, Garlon 3A (8% trichlopyr) is immediately applied only to the surface of the cut. Sometimes temporary shade is established, using heliconias, gingers, or ti, to control the weeds. Trees are planted in openings among these covers. Eventually the trees cast enough shade to allow removal of the temporary covers. In steep areas more permanent covers of philodendrons, bromeliads, or ferns are established.

Weeding efforts are continuous at Lyon Arboretum. Species targeted for weeding are invasive aliens with the potential of overrunning an area on the grounds or those that disrupt the aesthetic continuity of a section. Weeding efforts on the grounds occupies approximately 40% of the staff effort.

Clearing or re-clearing the grounds of invasive alien species is done when possible (primarily in zone 2, but also zone 1) to prepare the section for plantings that soon follow. We define **clearing** as opening areas that have been clogged with invasive growth for more than 10 years. Removing invasive growth after 2-10 years would be called **re-clearing**. Clearing often requires use of chain saws, bow saws, loppers, and pruning shears; cut stumps are treated with Garlon 3A (8% trichlopyr) to kill the roots and prevent re-sprouting or sucker growth. Small plants that can be pulled up without excessively disrupting the soil are removed by hand. Brush is piled within the cleared site for passive composting in locations that will not interfere with plantings or trail access, and is kept out of streams and gullies. Clearing and re-clearing occur infrequently and as staff time or volunteer support is available, primarily before an area is to be re-vegetated with native plants or other collections. Clearing and re-clearing sections in this manner occupies up to 20% of the staff effort.

Research Plant Collections

Lyon Arboretum's research plant collections include over 15,000 accessions of plants. All plants in the Arboretum are maintained and potentially used in research; research oriented requests come in from all parts of the world to inquire about the collections and how access to them may be gained. There is no predictable manner to determine which collections may be useful as exploratory research in plant systematics and medical related fields continues to expand. Thus, we never know what a researcher might be interested in. Some collections, such as *`awa*, were brought in for specific research projects, but most of the collections have been built up over the years and are used occasionally by researchers, much as a general library accumulates books and people drop in to read them.

The original "collection" was the trees planted in the early days as a reforestation trial. Some heliconias, gingers, aroids, palms, cycads, and vines were also introduced, but were not taken seriously enough to be accessioned. With the establishment of the early trees, forming an almost closed canopy in most places, further tree additions have been limited by the open space available. The collections that have been built up over the last 30 years are those of the understory, the very plants that were under-appreciated in the beginning: heliconias, gingers, aroids, palms, cycads, vines, bromeliads, ferns, and miscellaneous. Many plants were tried, and the emphasis today is on those that showed they could thrive under the rainforest conditions of the Arboretum.

A process of selection has determined the direction of the Arboretum. We do not grow beach strand plants, alpine plants, or desert plants on the arboretum grounds although some of these may be represented in plants grown in the micropropagation facility to be used in restoration projects elsewhere in the Hawaiian Islands. The main philosophy is to develop collections of plants that do well in the Arboretum environment, avoiding invasive species. The Arboretum has the environment ideally suited to the growth of useful, interesting, and endangered plants from all over the wet tropics. To prevent it from being used as a sanctuary for such species would be to deny an

opportunity for global conservation, and to deny the people of Hawai`i and visitors a window on the tropics of the world. In the case of native plants, we will occasionally push the envelope and try to grow beach, alpine, or dry forest species, but are usually reminded that we live in a rain forest.

Although it has been mentioned in previous reports (i.e., Appendix to *Land Management* plan prepared by McClatchey and Hayes, 2004), there have never been “controlled burns” in the Arboretum. A controlled burn can be done on existing, in place vegetation. Unplanned burns have occurred historically and a permit was obtained to burn cut branches in the lo`i restoration area, the latter occurring in several attempts without great success.

Restoration

Restoration projects have been and continue to be conducted at Lyon Arboretum. These are classified into two types: ethnobotanical restoration and native habitat restoration. The grounds of the arboretum have been used historically by native Hawaiians for collection of herbs for medicinal purposes and for cultivation of crops. An ancient Hawaiian *lo`i* is known to exist in the lower part of *‘Aihualama* section in Zone 1. This *lo`i* has been the subject of restoration efforts by arboretum volunteers from *Halau Ku Mana*, a charter school operating at neighboring Paradise Park.

Native habitat restoration projects are being carried out in the upper zone, or zone 3. The goal of these projects is to remove alien vegetation when practical and replace them with vegetation that is native to the area and habitat. The terrain where these projects are conducted is very rough and, in some places, near vertical. The activities that follow are characteristic of restoration efforts.

Land to be used in restoration activities is cleared of all or most alien vegetation. Invasive trees are cut down with some being left for temporary shade. The stumps are treated with Garlon 3A® herbicide to effectively kill the alien species. Weeds and seedlings that occur are treated with an application of RoundUp Pro® to kill smaller plants.

Small trails are formed to gain access to areas and to limit erosion caused by human traffic in traveling to and from the restoration site. These are dug with shovels. Vegetative debris is piled up to form a low hedge on the contours and reduce erosion from run-off. Where necessary, trex- or flex-board for trail construction is used to improve traction and trail stabilization.

Water catchments are established within the restoration area. Trash can size containers are placed to collect water. This water is used for both herbicide application as well as watering of plants used in outplanting. As plants become established and weeds no longer pose a threat to the area, these water containers are removed from the

site. In some cases, weather stations may be set up near the restoration site to collect environmental data for assistance in monitoring the progress of the plantings.

ARBORETUM FACILITIES

The core facilities at the Arboretum include eight cottages, seven greenhouses, equipment sheds and barns, rain shelters, environmental monitoring stations, and an open air education building. These facilities house the offices, laboratories and work stations for the employees.

Cottages

Seven of the cottages (Cottages A – G) originally designed to house sugar cane plantation workers were constructed in the 1920's. Although several still or potentially serve as living quarters, others have since been converted to other uses. Cottage A houses the library and the Arboretum herbarium. Cottage D was modified to a laboratory for the tissue culture and micropropagation laboratory and the seed storage laboratory. Cottage E is used for storage and had been utilized by one of the clubs (Hui Hana Hawaii) that frequently use the Arboretum as a meeting/work room. Cottage G was converted to offices that were used by arboretum staff. Cottages B, C, and F have been or are still being used as living quarters. Recent inspections of the cottages have determined that several are unsafe for occupancy (Cottages A, B, C, E, and G) and have been closed until significant repairs to the structures have been made.

Cottage H, also called the Main Office, is the main building at the Arboretum and is the location where many of the activities take place. Found within Cottage H are the reception office for visitors, a gift shop, two classrooms, and five offices. In addition to its use by the Arboretum staff, this building is used frequently by schools, agencies, and clubs for class or organization meetings and for carrying out workshop activities.

Greenhouses

There are seven greenhouses at the Arboretum. The main greenhouse is used for potting and growing plants used for sales and research. A second greenhouse is used for growth of rare and endangered species associated with the work conducted in the micropropagation facility. Two greenhouses are used for growing plants intended for planting on the grounds of Lyon Arboretum. A greenhouse is adjacent to the lower classroom of cottage H and is used in teaching. Two other greenhouses were established for the growth of native Hawaiian plants to rear endangered Hawaiian tree snails.

Other

Two other facilities are of note. An open air educational building was recently constructed as a Children's Learning Center. This had been used regularly to teach school children, primarily K-6, about biology, how plants grow, and the importance of our environment in their lives (see PART 4, below). An environmental monitoring station at the arboretum is checked daily and reported to the National Oceanic and Atmospheric Administration (NOAA). Data reported include temperature highs and lows, and daily precipitation. A storage shed and work shed are also present.

Facility Repairs and Maintenance

A Master Plan will be developed that will include a set of goals for restoration of some buildings, demolition of some buildings, and construction of replacement facilities that are more suitable for modern educational and research activities. The plan will also address targeted levels of researchers, students in courses, and visitors on the grounds as well as means for minimizing traffic while maximizing usage of limited parking. Preparation for the plan will involve consideration of options such as placing some facilities underground, incorporation of energy conservation technologies, incorporation of recycling and recycled materials, and determination of ideal locations for each facility. Since funding has not been secured for major changes, the Master Plan will be in flux and serve as a goal subject to change and revised approval by DLNR and the University of Hawaii. Until such time as funds are secured, it will be necessary make repairs and/or renovations to the existing facilities to insure a safe work environment for the arboretum staff to carry out their daily work activities.

The cottages presently require repairs so that arboretum work may continue. Only cottages D, F, and H are presently usable, and they too are in need of additional repairs. The other cottages (A, B, C, E, and G) have been closed until repairs can be made to be in compliance with health and safety standards. Repairs needed include: structural renovations for cottages A, B, C, E, and G, the work shed, and the storage shed; electrical upgrades to all cottages; replacing the cesspool for cottages A and B and the Children Learning Center with a septic tank. Upgrades for compliance with ADA standards are also necessary. Parking and roadways leading to the Arboretum are also in need of repair. The total estimated costs for these repairs is \$2,557,000.

Educational and Visitor Activities

The Arboretum educational and visitor activities include classes of PreK-12 students, teacher workshops, University courses, local community access, tourists, and small ecotourism groups learning about plants, plant environments, and conservation issues. Currently, visitors not associated with the University are encouraged to provide a donation each time they visit. Membership in the Lyon Arboretum Association is also

indicated as an alternative method to showing support for the Arboretum. The Arboretum offers a range of K-12 teacher training courses, courses for children, and adult education courses dealing with topics tightly or loosely associated with plants, conservation, and biodiversity. Most students in courses had been asked to pay a tuition fee, the tuition and donations being used to pay for grounds maintenance, education program staff, and supplies and materials. (*Fees associated with these activities are presently suspended.*) Educational and visitor programs of all types are limited in scale by the small size of the Arboretum parking lot and the limited facilities.

Since there is no plan nor funding available to increase the number of parking spaces, the potential number of visitors will remain very constrained. A Master Plan will be developed that will address this issue and will include plans for improving the quality of environmental, conservation, native species, and cultural educational activities conducted in the Arboretum. The plan will include strategies for collaboration with other agencies and private ventures to creatively educate tourists, teachers, and university students.