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 DEPARTMENT OF LAND AND NATURAL RESOURCES
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'99 JUL 27 P4:54

OFFICE OF ENVIRONMENTAL QUALITY CONTROL

June 29, 1999

Office of Environmental Quality Control
 State of Hawaii
 235 S. Beretania Street, Suite 702
 Honolulu, HI 96813

Dear OEQC:

**NOTICE OF DETERMINATION
 FINDING OF NO SIGNIFICANT IMPACT**

PROJECT NAME: Commercial Harvesting of Forest Products and Subsequent Reforestation, Waiakea Timber Management Area, Island of Hawaii

PROPOSING AGENCY: State Department of Land and Natural Resources
 Division of Forestry and Wildlife

APPROVING AGENCY: State Department of Land and Natural Resources

DETERMINATION: Finding of No Significant Impact

PROJECT LOCATION: Waiakea Timber Management Area (approximately 12,000 acres in portions of the Waiakea, Upper Waiakea, and Olaa Forest Reserves), about five miles southwest of Hilo, Hawaii

TAX MAP KEY NUMBERS: Parts of TMKs 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22

SIGNED,

Division of Forestry and Wildlife - Department of Land and Natural Resources
NOTICE OF DETERMINATION - FINDING OF NO SIGNIFICANT IMPACT
 05/12/99

83

PROJECT ACTION DESCRIPTION:

The Division of Forestry and Wildlife proposes to harvest timber and non-timber forest products from approximately 12,000 acres within the Waiakea Timber Management Area, and to subsequently reforest the harvested areas.

The State's goal is to assist in the creation of a sustainable forest industry that enhances the productivity and health of Hawaii's forests, restores and protects the forest environment, creates value and jobs through local processing from each tree harvested, and strengthen forest communities.

The Division will require that all forest management activities comply with the measures listed in the State's *Best Management Practices for Maintaining Water Quality in Hawaii* for activities such as pre-harvest planning, road improvement and maintenance, timber harvesting, site preparation and regeneration, fire management, and use of fuels and chemicals. Implementation of the BMP insures that environmental safeguards are utilized, such as effective soil erosion control practices, safe use and storage of chemicals, and visual buffers along major transportation corridors.

Within the WTMA, native forest stands will be accessible for traditional gathering of forest resources, research, hunting, and recreation. Commercial timber management activities will not be conducted in those areas containing 50 percent or more native forest cover.

The reforestation project was initiated about 35 years ago for the purpose of producing high quality hardwood timber species. Now that there are merchantable trees that can be harvested and made into high value wood products, this forest will be managed for timber resources as well as for all the other forest resources and uses that can provide public use, benefits, and enjoyment (e.g., research, education, recreation, and economic development).

REASONS SUPPORTING THE DETERMINATION:

- 1. The proposed project does not involve an irrevocable commitment to loss or destruction of any natural or cultural resource.**

Timber harvesting operations create a temporary disturbance in the forest. Because operations will be implemented in a manner sensitive to the surrounding environment, the impact will be minimized in scope and time.

The State's *Best Management Practices for Maintaining Water Quality in Hawaii* will be adhered to minimize soil movement, erosion, and compaction during tree thinning and harvesting; road construction and maintenance; and site preparation and replanting. Soil resources will be protected by proper engineering in the design and location of roads, skid trails, and landings, and by not operating during periods of excessively wet soil conditions.

The proposed project will have little or no significant negative impact on water quality. To minimize nonpoint source pollution from sediments, the required practices include avoiding any disruption of natural drainages, preventing excessive soil displacement, providing drainage in case of slope instability, and providing culverts, dips, water bars, and cross drainages to minimize erosion. To minimize water quality degradation from nutrients and pesticides, practices include efficient and safe pesticide and fertilizer use. Careful chemical selection and application as outlined in the BMP will be required.

The proposed project is not expected to have any significant long-term negative impacts on native plant species within the WTMA. Although both native and non-native plants may be damaged and/or destroyed during thinning, timber harvesting, site preparation for replanting, and road construction and maintenance, most will grow back naturally. Timber tree seedlings will be planted as soon as the timber harvesting has been completed in each harvesting unit except in areas of selection tree harvesting

Forest disturbance will temporarily reduce the use of the area by animal species. Insect and animal populations will stabilize as the disturbed areas are replanted with tree seedlings or are reestablished with natural plant species.

Within the project area, there are no known historic or archaeological sites. But should timber harvesting or any other forest management activity uncover evidence of historic and/or archaeological sites, all further work in the area will be halted immediately, and the findings will be reported promptly to the State's Division of Historic Preservation for evaluation.

2. The proposed project does not curtail the range of beneficial uses of the environment.

Opportunities for public enjoyment and outdoor recreation activities, such as hunting, biking, hiking, and sightseeing, will continue. Gathering plant material from the project area for personal, cultural, religious, and traditional uses will still be encouraged.

85

Timber harvesting activities will encourage production of young herbaceous vegetation and create edges between vegetation types. Both of these habitat conditions favor the production of game species such as wild turkeys, Kalij pheasants, wild pigs, and others.

There will be some restrictions on some public uses in the areas where timber harvesting activities are being conducted. These restrictions will include limiting the use of access roads that will be used for transporting the timber products to the processing sites. The restrictions will be temporary, and will include only areas where safety and efficiency of the forestry operations are at issue.

There will be increased opportunity for field studies within the WTMA, especially in regard to introduced timber species in Hawaii. Permanent growth plots will be established by DOFAW in all principal timber types that will be thinned or harvested.

3. **The proposed project does 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.**

Chapter 344 of the Hawaii Revised Statutes states

It shall be the policy of the State, through its programs, authorities, and resources to:

- (1) *Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii.*

The management criteria of the proposed project are based on sound forest stewardship and sustainable, long-term productivity. The project serves to enhance the environmental quality of the area, and to provide social and economic opportunities for the surrounding human communities.

The project's impacts are primarily positive for the State and for DOFAW's Land and Natural Resource 172 "Forest Products Development" program. The Division's mission statement is "to grow high quality forest products in sustained yield systems and practices to create job opportunities in rural areas and to broaden Hawaii's economic

base." This project will provide employment opportunities, the timber resources will be managed for sustained yield, and the State's economic base will be enhanced.

4. The proposed project does not substantially affect the economic or social welfare of the community or state.

The economic and social welfare of the community and state will actually be improved with the implementation of the proposed project. This forest has an estimated economic stumpage value of several million dollars. The actual stumpage value depends on the wood products that will be made from the timber resources. The value-added economic gain to the local economy will be many times that of the actual stumpage value. This timber resource will be utilized to manufacture locally desired wood products and be managed for sustained yield to provide employment and to increase the economic base of the State. Annual wood production from the harvest of *Eucalyptus* in the WTMA will contribute to supporting a local wood manufacturing company that obtains its wood requirements from a variety of sources.

5. The proposed project does not substantially affect public health.

To minimize water quality degradation from nutrients and pesticides, required practices include efficient and safe pesticide and fertilizer use. Strict compliance will be adhered to regarding the selection, use and storage of chemicals for all forest management activities as specified in the State's BMP. The Division will report all violations to the State's Department of Labor and Industrial Relations, Occupational Safety and Health regulating agency of any improper use of chemicals in the project area.

All safety and health laws and regulations regarding workers and the public will be strictly enforced.

6. The proposed project does not involve substantial secondary impacts (such as population changes or effects on public facilities).

The primary secondary impacts concern the increased use of access roads in the area, but these impacts are temporary and insignificant.

7. The proposed project does not involve a substantial degradation of environmental quality.

Adherence to the State's BMP and to the management objective of sustainable, long-term productivity will insure that there will not be a significant degradation of the physical environment. Timber harvesting will decrease the current density of biological

resources, but this impact will be temporary, and will actually lead to a healthier forest community.

8. The proposed project does not have considerable cumulative adverse effects.

The cumulative effects are positive, rather than adverse. (See Criteria #1.) A primary short term benefit of this project is the immediate creation of jobs for the people that will be hired by the forest industry companies that will be harvesting and processing timber into valuable wood products. This benefit will extend into the long-range because the timber resources will be managed for sustained yield. Other long-range benefits will be the establishment of a larger forest product industry that will encourage private landowners to grow and market their timber resources locally. This response from private landowners will further increase the value of the State's local forest product industry. Commercial timber management can be a beneficial land use alternative, as forests increase the land's value for watershed, wildlife, forest recreation, aesthetics, and storage of carbon.

9. The proposed project does not substantially affect a rare, threatened, or endangered species, or its habitat.

There are no known threatened and endangered plant species presently growing in the project area. Botanical surveys will be conducted throughout areas that will be immediately impacted by timber harvesting activities to insure that no rare or T&E plant species are accidentally destroyed. If a rare or T&E plant species is encountered within introduced timber plantations, a buffer zone of 50 feet of undisturbed vegetation will be fenced around the individual or population; an additional area of one acre of undisturbed vegetation will be left for the protection of the individual or population. Known locations of rare or T&E plant species will be visited to collect seed or cuttings for propagation as needed. Such activity will lead to out planting in areas that are actively managed for rare plant species.

The impacts of timber harvesting on native bat and bird populations are expected to be minimal. Surveys for threatened and endangered bats and birds will be made by qualified and competent professionals in DOFAW prior to the commencement of harvest activities to augment the current available information on these species. If any rare animal roosting trees or active nests are encountered, a no-harvest zone (250 feet in radius) will be established around each site.

10. The proposed project does not detrimentally affect air or water quality or ambient noise levels.

The proposed project will have little or no significant negative impact on water quality. To minimize nonpoint source pollution from sediments, the required practices include avoiding any disruption of natural drainages, preventing excessive soil displacement, providing drainage in case of slope instability, and providing culverts, dips, water bars, and cross drainages to minimize erosion. To minimize water quality degradation from nutrients and pesticides, practices include efficient and safe pesticide and fertilizer use. Careful chemical selection and application as outlined in the BMP will be required.

11. The proposed project does not affect nor is likely to suffer damage by being located in an environmentally sensitive area such as a floodplain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

The Waiakea Timber Management Area is not located in or near any of the above-mentioned environmentally sensitive areas.

12. The proposed project does not affect scenic vistas and viewplanes identified in county or state plans or studies.

The WTMA is not identified as a scenic vista or viewplane. However, visual impacts to the area will be mitigated by limiting the size of the timber harvesting blocks. (See the harvesting information above.)

13. The proposed project does not require substantial energy consumption.

Petroleum fuels will be used during most of the forest management activities, but this energy consumption is not expected to be substantial (especially when the benefits and uses of the wood and timber products are considered).

AUG 8 1999

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FINAL ENVIRONMENTAL ASSESSMENT

for

***(73)** COMMERCIAL HARVESTING OF FOREST PRODUCTS *
and
SUBSEQUENT REFORESTATION *

of

***(1)** WAIAKEA TIMBER MANAGEMENT AREA *
ISLAND OF HAWAII

May 12, 1999

Prepared by:
State of Hawaii
Department of Land and Natural Resources
Division of Forestry and Wildlife

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FINAL ENVIRONMENTAL ASSESSMENT

**COMMERCIAL HARVESTING OF FOREST PRODUCTS AND
SUBSEQUENT REFORESTATION**

WAIAKEA TIMBER MANAGEMENT AREA, ISLAND OF HAWAII

TABLE OF CONTENTS

I. SUMMARY	1
II. INTRODUCTION	4
A. BACKGROUND INFORMATION.....	4
1. <i>Division of Forestry and Wildlife</i>	4
2. <i>Waiakea Timber Management Area</i>	4
B. STATEMENT OF OBJECTIVES.....	5
III. DESCRIPTION OF THE AFFECTED ENVIRONMENT	7
A. PROJECT LOCATION	7
B. PHYSICAL SITE CHARACTERISTICS.....	7
C. BIOLOGICAL RESOURCES.....	8
1. <i>Flora</i>	8
2. <i>Fauna</i>	10
D. CULTURAL AND SOCIAL RESOURCES	12
1. <i>Public land use</i>	12
2. <i>Education and research</i>	13
3. <i>Historical and archaeological resources</i>	13
E. ECONOMIC RESOURCES	13
F. ACCESS ROADS.....	14
IV. PROPOSED ACTION	15
A. TIMBER HARVESTING	15
1. <i>Silvicultural Guidelines</i>	16
2. <i>Roads</i>	17
B. REPLANTING/REFORESTATION	18
1. <i>Species selection</i>	18
2. <i>Site preparation</i>	18
3. <i>Timber stand improvement</i>	19
4. <i>Long-term forest management practices</i>	19
C. NATIVE FOREST MANAGEMENT	20
V. ENVIRONMENTAL IMPACTS OF PROPOSED ACTION;.....	22
A. IMPACTS ON PHYSICAL RESOURCES	22
1. <i>Soil</i>	22
2. <i>Water quality</i>	22
B. IMPACTS ON BIOLOGICAL RESOURCES	23
1. <i>Flora</i>	23
2. <i>Fauna</i>	24

C.	IMPACTS ON CULTURAL AND SOCIAL RESOURCES.....	26
1.	<i>Public land use</i>	26
2.	<i>Education and research</i>	27
3.	<i>Historic and archaeological resources</i>	27
D.	IMPACTS ON ECONOMIC RESOURCES	27
VI.	ALTERNATIVES TO THE PROPOSED ACTION.....	29
A.	NO ACTION ALTERNATIVE.....	29
B.	EVEN-AGED MANAGEMENT THROUGHOUT THE WTMA.....	29
C.	PROPOSED ACTION.....	29
VIII.	DETERMINATION.....	31
	APPENDIX A: SITE AND LOCATION MAPS.....	A-1
	APPENDIX B: WTMA TIMBER INVENTORY	B-1
	APPENDIX C: COMMON COMPONENTS OF FORESTS IN THE WAIAKEA TIMBER MANAGEMENT AREA.....	C-1
	APPENDIX D: SUMMARY OF GAME AND NON-GAME WILDLIFE SPECIES PRESENT IN THE WTMA.....	D-1
	APPENDIX E: BEST MANAGEMENT PRACTICES FOR MAINTAINING WATER QUALITY IN HAWAII.....	E-1
	APPENDIX F: MARKET RESEARCH ON COMMODITY WOOD PRODUCTS.....	F-1
	APPENDIX G: PUBLIC COMMENTS AND DOFAW RESPONSES REGARDING THE DRAFT EA	G-1

FINAL ENVIRONMENTAL ASSESSMENT
COMMERCIAL HARVESTING OF FOREST PRODUCTS AND
SUBSEQUENT REFORESTATION
WAIAKEA TIMBER MANAGEMENT AREA, ISLAND OF HAWAII

LIST OF TABLES

TABLE B-1: VOLUME SUMMARY FOR TIMBER RESOURCES IN THE WTMA.....	B-2
TABLE B-2: DESCRIPTIVE STATISTICS FOR TIMBER TYPES IN THE WTMA.....	B-3
TABLE B-3: CRUISE PRECISION ANALYSES FOR THE WTMA TIMBER INVENTORY.....	B-5
TABLE B-4: COMPONENT MERCHANTABLE VOLUME FOR TIMBER TYPES IN THE WTMA	B-6

LIST OF FIGURES

FIGURE A-1: PROJECT LOCATION MAP	A-2
FIGURE A-2: WAIAKEA TIMBER MANAGEMENT AREA.....	A-3
FIGURE A-3: NATIVE FOREST AREAS WITHIN THE WTMA THAT WILL NOT BE COMMERCIALY HARVESTED.....	A-4
FIGURE B-1: WTMA TIMBER INVENTORY MAP	B-7

I. SUMMARY

Project Name: Commercial Harvesting of Forest Products and Subsequent Reforestation, Waiakea Timber Management Area, Island of Hawaii

Proposing Agency: State Department of Land and Natural Resources
Division of Forestry and Wildlife

Approving Agency: State Department of Land and Natural Resources

Determination: Finding of No Significant Impact

Project Location: Waiakea Timber Management Area (approximately 12,000 acres in portions of the Waiakea, Upper Waiakea, and Oloo Forest Reserves), about five miles southwest of Hilo, Hawaii

Tax Map Key Numbers: Parts of TMKs 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22

Land Use Designations:

TMK Number	STATE	COUNTY
1-8-12:3	CONSERVATION	No zoning designation applied
2-4-8:22	CONSERVATION	No zoning designation applied
2-4-8:1	Mainly CONSERVATION; except for a remnant parcel along makai boundary of Parcel 22 that is zoned AGRICULTURE	No zoning designation applied
2-4-8:10	AGRICULTURE	Mainly A-3a with a small portion along the mauka border that is not zoned by the County

Agencies and Organizations Consulted During EA Process:

Federal: U.S. Department of Agriculture
Forest Service, Institute of Pacific Islands Forestry
Natural Resources Conservation Service

U.S. Department of Interior
Fish and Wildlife Service
Geological Survey, Biological Resources Division
National Park Service, Hawaii Volcanoes National Park

State: Department of Land and Natural Resources
 Division of Forestry and Wildlife - Hawaii
 Land Division - Hawaii
 Historic Preservation Division - Hawaii
 Natural Area Reserve System Commission

 Department of Business, Economic Development, and Tourism

 Office of Hawaiian Affairs
 Land and Natural Resource Division

 University of Hawaii - Hilo

 University of Hawaii-Manoa, Cooperative Extension Service

County: Hawaii County Mayor's Office
 Planning Department

Private: Ahualoa Sawmill
 Bird Hunter's of Hawaii
 Bishop Museum
 Conservation Council for Hawaii
 Hawaii Audubon Society
 Hawaii Forest Industry Association
 Hawaii Forestry and Communities Initiative
 Hawaii Hunting Association
 Hawaiian Kingdom Office on Health, Education, and Economic
 Development
 Pig Hunters of Hawaii
 Sierra Club, Moku Loa Group
 Society of American Foresters-Hawaii
 The Nature Conservancy of Hawaii
 Upper Puna-Volcano Regional Forest Management Advisory Council
 Wildlife Conservation Association of Hawaii - Hilo Chapter
 Winkler Wood Products

Project Action Summary:

The Division of Forestry and Wildlife proposes to harvest timber and non-timber forest products from approximately 12,000 acres within the Waiakea Timber Management Area, and to subsequently reforest the harvested areas.

The State's goal is to assist in the creation of a sustainable forest industry that enhances the productivity and health of Hawaii's forests, restores and protects the forest environment, creates value and jobs through local processing from each tree harvested, and strengthen forest communities. With the downsizing of the sugar industry, Hawaii has a unique window of opportunity to create commercial forests that are environmentally sustainable and economically profitable for the potential investor, small and large landowners, and the people of Hawaii.

The Division will require that all forest management activities comply with the measures listed in the State's *Best Management Practices for Maintaining Water Quality in Hawaii* for activities such as pre-harvest planning, road improvement and maintenance, timber harvesting, site preparation and regeneration, fire management, and use of fuels and chemicals. Implementation of the BMP insures that environmental safeguards are utilized, such as effective soil erosion control practices, safe use and storage of chemicals, and visual buffers along major transportation corridors.

Within the WTMA, native forest stands will be accessible for traditional gathering of forest resources, research, hunting, and recreation. Commercial timber management activities will not be conducted in those areas containing 50 percent or more native forest cover.

The reforestation project was initiated about 35 years ago for the purpose of producing high quality hardwood timber species. Now that there are merchantable trees that can be harvested and made into high value wood products, this forest should be managed for timber resources as well as for all the other forest resources and uses that can provide public use, benefits, and enjoyment (e.g., research, education, recreation, and economic development).

The Division will establish protective buffer zones, approximately 150 feet in width, within the planted hardwood timber forest if the harvest area is adjacent to high quality native forest. Skid trails and/or timber haul roads will not be permitted within these buffers zones.

II. INTRODUCTION

A. BACKGROUND INFORMATION

1. Division of Forestry and Wildlife

Hawaii's Division of Forestry and Wildlife (DOFAW) is one of the eight line Divisions of the Department of Land and Natural Resources. It is the largest land management entity in the State of Hawaii, with direct responsibility for approximately 800,000 acres of State-owned public trust lands. These lands are managed through an integrated system of forest and natural area reserves, plant and wildlife sanctuaries, and wilderness and game management areas. Within this system lie the vast majority of America's tropical rainforests, and the world's most unique and threatened biodiversity. Natural systems managed include lowland and montane rainforests, tropical dry forests and woodlands, coastal strand and alpine communities, and introduced forest plantations. On the Island of Hawaii, DOFAW has the direct management responsibility for over 700,000 acres of which over 400,000 acres are within the forest reserve system. The Waiakea Timber Management Area represents less than three percent of the forest reserve acreage managed by DOFAW on the island of Hawaii.

Principal responsibilities for DOFAW include forest product development to include nursery seedling production, watershed and endangered species protection, natural area reserve development and enhancement, wildland fire suppression, public trails and access, and game management programs. Cooperative natural resource programs are also planned and implemented on privately owned forest lands through natural area partnerships, forest stewardship programs, urban forestry projects, service forestry, and other agreements.

2. Waiakea Timber Management Area

This final environmental assessment concerns the harvesting and reforestation of approximately 12,000 acres within the Waiakea Timber Management Area (WTMA). The original purpose of the Waiakea Timber Management Area (WTMA) was to establish a forest resource base that could provide a constant wood supply for Hawaii's forest products industry. From 1956 through 1960, the Waiakea Arboretum was used to test adaptability and growth potential of 84 introduced timber species in Hawaii (Richmond, 1963). Initial results of these tests provided information for selecting timber species to be planted within the WTMA. Major planting efforts began in 1959 and continued through 1968. More than 16,000 acres were reforested with 7 million tree seedlings. On the Island of Hawaii, more than 11,000 acres were reforested in the Waiakea, Upper Waiakea, and Oloa Forest Reserves with species such as Queensland maple, Australian red cedar, tropical ash, blackwood koa, Hawaiian koa, and *Eucalyptus*

species such as *deglupta*, *grandis*, *saligna*, and lemon gum. Currently, the Waiakea Timber Management Area comprises 11,704 acres of non-native forest plantations and approximately 480 acres of undisturbed native forest.

Although native forest initially was cleared for the establishment of non-native forest plantations in Waiakea, DOFAW's Hawaii Branch has not cleared any native forest since the early 1970's. Moreover, clearing native forest is no longer a DOFAW policy. The Division introduced legislation, enacted in 1997 (Hawaii Revised Statutes, Chapter 183, Part II, Section 16.5), which prohibits the conversion of native forests to introduced forest plantations on public lands.

During the 1970's, DOFAW's reforestation project was greatly reduced due to the Federal and State governments' endangered species laws. DOFAW's Hawaii Branch has continued to replant areas that were harvested or that did not meet DOFAW's reforestation standards. In the early 1980's, approximately 330 acres of land that formerly had been leased to the Puna Sugar Company also was planted. Some WTMA plantation units were weeded or fertilized in the early years, but the majority were allowed to grow without any timber stand improvement (TSI) activity. Today, approximately 60 to 80 acres of understocked forest plantation lands are being replanted annually.

From 1985 to 1988, Puna Sugar Company and the State entered into a timber harvest agreement for 1,500 acres of *Eucalyptus*. The harvested trees were converted into wood chips and used to produce power at a local electrical generator plant. This area has subsequently been replanted with *Eucalyptus*. Little to no harvesting of other planted hardwoods has occurred with the exception of small-scale timber salvage operations, where commercial value did not exceed \$1,000. Tree fern harvesting occurred in the early 1970's with approximately 16,000 cubic feet of logs removed and sold for use in the flower and landscape industry. In some of the planted areas, tree ferns subsequently have grown back vigorously.

B. STATEMENT OF OBJECTIVES

DOFAW's vision for the WTMA is to provide a model for Hawaii's developing forest industry by being

environmentally sustainable, economically profitable, accommodating the needs of Hawaii's people, and fitting within a landscape of forest watersheds and healthy native ecosystems.

The Division wants to implement its mandate of broadening the State's economic base by producing, improving, and assisting in the production of high quality forest products to support a sustainable forest industry that maintains and creates jobs while

generating revenue for the State of Hawaii. The Waiakea Timber Management Area, a parcel of over 12,000 acres on the Island of Hawaii, has been created for commercial forest products harvesting. Located within the Waiakea, Upper Waiakea, and Oloo Forest Reserves as well as the Puu Makaala Natural Area Reserve (total area of these four reserves is 58,740 acres), the WTMA has been planted and maintained since the early 1960's with introduced timber species with commercial forestry in mind. In 1997, a forest timber survey was conducted to determine timber species volume and to obtain data on tree species size and density. The timber survey data reveal that there is a gross volume of over 16 million cubic feet of merchantable timber resources in the WTMA for trees with diameters greater than four inches at diameter breast height (DBH, 4.5 feet from the ground).

As required by law, the Board of Land and Natural Resources (Board) must approve a Forest Management Plan before a single tree can be harvested on state-owned land. After the Division staff drafted a management plan in 1998, public information meetings were held to solicit public input to the plan. A series of three meetings were conducted with over 50 community members representing varying interests from the forestry industry, environmental and conservation groups, native Hawaiian organizations, hunters and other recreationists, and the general public. Major environmental and social issues and concerns voiced by the participants were as follows:

1. Possibility of watershed degradation
2. Past military dumping of chemical agent canisters
3. Replanting the site with nitrogen fixing plants or bamboo and rattan
4. Availability of job opportunities for local people
5. Availability of area for hunting, recreation and non-wood forest product gathering

Each of these concerns is addressed in this environmental assessment.

The majority consensus has been favorable and supportive of a commercial use of the timber resources. With this community input, the Waiakea Timber Management Area plan was presented to the Board and approved on September 11, 1998, as required by Chapter 183-16.5, Hawaii Revised Statutes, and as being consistent with the Resource subzone of the Conservation District.

III. DESCRIPTION OF THE AFFECTED ENVIRONMENT

A. PROJECT LOCATION

The Waiakea Timber Management Area (WTMA) is located on the slopes of Mauna Loa volcano, approximately five miles southwest of Hilo town and within the South Hilo and Puna Districts (Appendix A). It is situated along the Stainback Highway, extending from 400 to 3,200 feet in elevation. Parts of the State of Hawaii Tax Map Key (TMK) parcels 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22 are included in the WTMA. Portions of the Waiakea (WFR), Upper Waiakea (UWFR), and the Olaa (OFR) Forest Reserves comprise the 12,000-acre unit. The WTMA represents less than three percent of the forest reserve acreage managed by DOFAW on the island of Hawaii. Approximately 330 acres of former Puna Sugar lands (in TMK 2-4-8:22) are currently included at the east end of WTMA.

B. PHYSICAL SITE CHARACTERISTICS

Median annual rainfall in the WTMA varies with elevation, exceeding 200 inches annually at 400 feet elevation, and gradually decreasing to 150 inches at 3,200 feet elevation. Rainfall is distributed throughout the year, but winters generally are wetter than summers. Occasionally, drought conditions occur for several months at a time. Overcast conditions are very common, and humidity is high throughout the year. Mean annual temperature is approximately 79 degrees (F). The rainfall and temperature are favorable for supporting tree growth throughout the project area.

The topography mimics the surface of the underlying lava bedrock, averaging six-percent slope throughout the area (except in ravines where the slopes can exceed 45 percent). The pahoehoe and a'a lava bedrock ranges from approximately 150 to 9,000 years old.

Soils in the WTMA are thin, extremely stony (stones between 10 and 24 inches in diameter comprise at least 60 percent of the volume), and have formed over a'a or pahoehoe lava. The soils are made up of "muck," which is well-decomposed organic soil material. Generally, the soil reaction is strongly acidic. The soils are well drained, with rapid permeability, slight erosion potential, and slow to medium runoff. Where the soil overlies a'a lava, the substrata is also rapidly permeable. Although the pahoehoe lava is slowly permeable, water moves rapidly through cracks in the lava. In some low-lying areas, swampy conditions may occur.

The WTMA has extensive tree and ground cover making the area a functional watershed. The area contains no permanent streams, and the few intermittent streams

present eventually lead to ground infiltration. There are no known surface water sources used for domestic or agricultural purposes.

C. BIOLOGICAL RESOURCES

1. Flora

Introduced timber species and other non-native plant species are the dominant vegetation in the project area. Any native plants that are present also are common. No rare, threatened or endangered species have been identified within the WTMA.

a. Native plants

During initial land clearing operations, large native trees such as `ohi`a lehua (*Metrosideros polymorpha*), koa (*Acacia koa*), and loulou (*Pritchardia* spp.) were left undisturbed. Today, these plants are intermixed with non-native timber species. Current primary native understory species include hapu`u and uluhe (*Dicranopteris linearis*). Many other native plant species also are common, such as olomea (*Perrottetia sandwicensis*), kopiko (*Psychotria* spp.), moa (*Psilotum nudum*), pilo (*Coprosma* sp.), mamaki (*Pipturus albidus*), and manono (*Hedyotis* sp.) and others (Appendix C).

Approximately 480 acres of undisturbed native forest remain in the WTMA. These areas are classified as native `ohi`a and `ohi`a-hapu`u wet forest, or koa/`ohi`a wet forest. These vegetation types have scattered to closed canopies (up to 75 feet tall in places) and contain a variety of native and non-native tree and shrub species. Recent inventory data summarize the current acreage breakdown based on dominant overstory tree species (Appendix B).

b. Non-native plants

Common understory non-native plants are guava (*Psidium* spp.), palm grass (*Setaria palmifolia*), and *Melastoma* species (Appendix C).

The project area and the surrounding native forest are vulnerable to the establishment and spread of invasive non-native plant species such as Koster's curse (*Clidemia hirta*), trumpet tree (*Cecropia obtusifolia*), strawberry guava (*Psidium cattleianum*), king palm (*Archontophoenix alexandrae*), gunpowder tree (*Trema orientalis*), mulesfoot fern (*Angiopteris evicta*), and others (Appendix C).

c. Introduced timber species

Timber inventory data from 1997 indicate that the WTMA contains over 16 million cubic feet of timber on a gross merchantable basis. This represents enough wood

to build and panel approximately 6,400 houses. There are 4,030 acres of eucalyptus species, 3,500 acres of Australian red cedar, 2,060 acres of tropical ash, 1,485 acres of Queensland maple, and several hundred acres of various other introduced timber species (Appendix B).

Eucalyptus species. Most commercial species of *Eucalyptus* are well suited to the growing conditions found in the WTMA. Rapid growth rates, high yields, and straight form of these trees make them desirable for a wide variety of processing opportunities including dimensional lumber, veneer, plywood, poles, and chips. Although *Eucalyptus* has the potential to spread into adjacent areas under certain conditions, it has not done so in the 40 years since the establishment of the WTMA plantations. Current *Eucalyptus* wood resources within the WTMA range from newly planted seedlings, to stands which contain medium or "pole" sized (6 to 12 inch diameter) trees, to mature or "saw timber" sized (12-inch and larger diameter) trees. Most *Eucalyptus* stands are in the latter two categories, indicating a great potential to begin harvesting mature stands immediately, allowing pole stands to continue growing while simultaneously expanding the *Eucalyptus* acreage by planting additional seedling acreage.

Queensland maple. While initially planted on a smaller scale than the *Eucalyptus*, Queensland maple (*Flindersia brayleana*) has proven to be exceptionally well adapted to the growing conditions in the WTMA. This species produces a high quality, light colored wood which is useful for finish grade dimensional lumber, veneer, and plywood. This wood represents an important resource for high quality, value added operations such as furniture or cabinet making. For these reasons, Queensland maple is considered to be a key species for intensified timber management activities within the WTMA. As with *Eucalyptus*, a full range of stand ages and tree sizes are present, allowing for both immediate harvest opportunities, and new plantings.

Other species. Large areas of the WTMA were originally replanted with tropical ash (*Fraxinus uhdei*) and Australian red cedar (*Toona ciliata*). While Australian red cedar grows well only on the best quality sites, tropical ash has proven to be poorly adapted to local site conditions. After more than 35 years of growth, most stands of these species contain only scattered pole sized trees. These areas could play an important role in future timber management by being made available to community groups or small businesses interested in managing parcels for salvage operations. After the trees are removed from the poorly stocked stands, site conversion to *Eucalyptus*, Queensland maple, or other high-value species can be implemented. Other areas could be made available to community groups or small businesses interested in managing parcels for production of specialty timber or non-timber forest products.

2. Fauna

The primary management goal for native vertebrates and invertebrates is to preserve the viability of species within a greater landscape, not to maintain high population densities within the timber management area. The protection of endemic wildlife and their habitats is more likely to be successful in native forests than in non-native timber plantations. DOFAW currently manages a system of forest reserves, natural area reserves, and wildlife sanctuaries for protecting native biota.

a. Vertebrates

Native vertebrates. Forest birds are the dominant forms of native wildlife in the WTMA. Common endemic species inhabiting the forest are apapane (*Himatione sanguinea*), amakihi (*Hemignathus virens*), oma'o (*Myadestes obscurus*), elepaio (*Chasiempis sandwichensis*), iiwi (*Vestiaria coccinea*), and pueo (*Asio flammeus*). These birds are most frequently observed above 3,000 feet elevation, which is the upper extreme of the WTMA (Appendix D).

The endangered Hawaiian hawk, or i'o, (*Buteo solitarius*) only occurs on the Island of Hawaii. These birds of prey feed on rodents, insects, and small birds, including young game birds. Breeding pairs typically nest in large ohia trees, but a variety of other native and non-native tree species are used, including koa, kolea, lama, mango, macadamia, coconut, ironwood, and eucalyptus. A recent breeding survey conducted by the U.S. Fish and Wildlife Service documented 51 nests on the Island of Hawaii. Of these, 80 percent were in ohia trees, four percent in ironwood, four percent in eucalyptus, and two percent in each of the other species (J. Klavitter, personal communication, 1999).

Hawks occasionally are observed in the WTMA and adjacent forest reserves. Available data indicate that i'o densities are low in the non-native timber units and that no breeding takes place there. The nearest known nests (four) are located below the project area in the vicinity of Panaewa Zoo. The WTMA appears to be occupied primarily by juvenile hawks that have been ejected from prime nesting territories in adjacent native forests.

Other rare native bird species are found in native forests above the WTMA. These include the endangered o'u (*Psittirostra psittacea*), akiapola'au (*Hemignathus munroi*), and Hawaii akepa (*Loxops coccineus*). It is unlikely that any of these rare bird species permanently inhabit the WTMA, because introduced timber species fail to provide the necessary habitat requirements for these birds. Additionally, mosquitoes capable of transmitting avian malaria and other bird diseases occur in the WTMA.

The native bat, or ope`ape`a, (*Lasiurus cinereus semotus*) is Hawaii's only endemic land mammal. This rare mouse-like creature is a subspecies of the mainland hoary bat and is officially listed as endangered. Hawaiian hoary bats roost solitarily in the foliage of trees. They are most active at dusk when they forage on flying insects. Bats have been seen in the WTMA and its environs, but their distribution and density is unknown. Bat surveys were conducted in the WTMA by DOFAW in December 1998, January 1999, and February 1999. An ultrasound Mini-2 bat detector (Summit, Birmingham, England) was used to search for flying bats each evening. None were detected on any of those occasions. There are no records of bats breeding in the area. However, bats have been observed in Hilo town proper, especially around streetlights where there are abundant insects for food. It is probable that bats also roost near these food sources.

Native wildlife species area protected under Hawaii's Administrative Rules, Chapter 123, Indigenous Wildlife, Endangered and Threatened Wildlife and Introduced Wild Birds. The Federal Endangered Species Act of 1973 also applies to officially listed species.

Non-native vertebrates. Non-native bird species such as northern cardinal (*Cardinalis cardinalis*), Japanese white-eye (*Zosterops japonicus*), melodius laughing thrush (*Garrulax canorus*), house finch (*Carpodacus mexicanus*), house sparrow (*Passer domesticus*), and other bird species (Appendix D) utilize the area for feeding, roosting, and nesting.

The Division estimates that there are about 150 feral pigs in the project area. The number of feral pigs fluctuates depending on food and water availability, as well as on hunting pressure.

b. Invertebrates

Endemic invertebrates appear to be particularly sensitive to changes in the microclimate (e.g., forest clearing and invasion of alien plant and animal species). Many insects have evolved specialized habitat and require one or a very few native plant species to complete their life cycle. The earlier bulldozing of native plants in logging units probably contributed to the loss of associated arthropod communities. Recent invasions of yellow jacket wasps (*Vespula pennsylvanica*) have undoubtedly affected native insect populations. No detailed survey of the project area's insect fauna has been completed, but a number of arthropod species still exist. Some groups like lepidoptera are relatively abundant and exhibit great species diversity. Lava tubes, if they are present, probably contain obligate cave species. Mollusks have not been studied in the project area, but the endemic snail *Succinea* is relatively common.

D. CULTURAL AND SOCIAL RESOURCES

1. Public land use

Although established for commercial timber management, the WTMA provides several other important public uses. The plantations and surrounding native forests are used extensively for wild pig hunting. Among the management objectives for the area are to maintain a sustainable feral pig population and to increase hunters' success rates. DOFAW promulgates hunting rules to regulate seasons and bag limits. The WTMA includes sections of three Hunting Units: B, H, and K. Hunters are required to check in and out at established checking stations and to report game harvests on official field forms.

Kalij pheasant are the most plentiful game bird inhabiting the WTMA. Other game bird species are present, but usually are restricted to forest edges or along roadways and lava flows. Game bird populations are primarily managed by opening and closing hunting season and by setting bag limits.

Motorcycle riders use the well-developed road network within the area for outings. Other recreational activities include mountain biking, horseback riding, bird watching, botanical exploration and hiking. Permits have been issued to mountain bike clubs that sponsor riding events.

Within the WTMA, native forest stands will be accessible for traditional gathering of forest resources, research, hunting, and recreation. Commercial timber management activities will not be conducted in those areas containing 50 percent or more native forest cover. Non-timber products commonly are collected within the WTMA. They include

- mosses
- tree seedlings
- guava poles
- firewood
- fruits
- ferns
- maile
- hapu`u fronds
- ti leaves
- mushrooms
- flowers

Gathering of material from plant species that are not on Federal or State threatened and endangered species lists is permitted and regulated by DOFAW through standard forest permit procedures. Gathering of plant materials from threatened or endangered species may be allowed by native Hawaiians if individuals obtain a special collecting permit from DLNR. Harvesting permits are required for gathering firewood, maile, fern shoots, and greenery for floral arrangements. Permits for gathering plant material are obtained from the DOFAW-Hilo office at 19 E. Kawili Street, Monday through Friday (except State holidays) from 7:45 AM to 4:30 PM. The permits are free and available for noncommercial, home use only. Approximately 750 permits are issued for the Waiakea area annually.

2. Education and research

Forest plantations in the WTMA provide excellent opportunities for individuals, organizations, and institutions to study both native and introduced forest communities. From the 1960's to the 1970's, the State Department of Health conducted studies on the population dynamics of rodents in the Waiakea Forest Reserve. In the 1970's, the U.S. Fish and Wildlife Service conducted native forest bird surveys on the island of Hawaii and several of the survey transects extended through the WTMA. During the Vietnam war, the U.S. Army conducted several research projects in the WFR, UWFR, and OFR including chemical gases, defoliants, and phosphate explosive devices. The USDA Forest Service, Institute of Pacific Island Forestry, has been monitoring forestry research projects in the WTMA since the late 1950's to the present. Some of the research projects have included nutrient cycling, watershed quality of various native forest plant communities, wood properties of commercial native tree species and the occurrence of 'ohi'a decline. Forestry instructors at the University of Hawaii, Hilo campus, frequently use the WTMA for field laboratory exercises.

3. Historical and archaeological resources

There are no known historical or archaeological sites within the project area.

E. ECONOMIC RESOURCES

In 1991, the forest industry in Hawaii contributed \$29 million and 736 jobs to our economy. Its payroll exceeded \$21 million and the average salary was over \$14 per hour. Sustainable commercial forest management can bring economic stability and enhance the environment while retaining the rural character of the islands. The Island of Hawaii is clearly the best location for initial efforts at stimulating local forest industry. It has high unemployment, thousands of acres of vacant and/or under-utilized high quality forest land, and an existing commercial forest resource base that can support a range of value added forest processing options.

In 1994, the State played a leadership role to stimulate the forest industry by creating a Forest Investment Memorandum (FIM) that attracted interest from forest developers, private landowners, and financial institutions. This leadership was matched by the acquisition of Hamakua Sugar lands by Kamehameha Schools Bishop Estate (KSBE) and the County of Hawaii, and fueled by their interest and understanding of potential forest development. The economics of plantation forestry has now gained credibility in Hawaii as a result of a multi-million dollar *Eucalyptus* plantation project by Prudential Timber company on KSBE lands. There is increasing interest from other companies, as well as from local landowners, in the next phases of forest development throughout the State.

F. ACCESS ROADS

Stainback Highway (also identified as Kulani 19) is located off State Highway 11, about five miles southwest of Hilo. The single-lane paved road (no shoulder) provides east-to-west access to the project area, and it is maintained by Kulani Correctional Facility and the County of Hawaii. Kulani Correctional Facility (through the Department of Public Safety) presently is proposing major road improvement work on Stainback Highway. Also, about 13 miles from Hilo, North Kulani Road provides access from State Highway 11.

Approximately 130 miles of unimproved access roads grid the WTMA tree planting area into 40-acre blocks. These roads provide access to the public and to DOFAW for hunting, recreation, non-timber forest product gathering, forest protection, and timber management.

IV. PROPOSED ACTION

The Division of Forestry and Wildlife proposes to harvest timber and non-timber forest products from the Waiakea Timber Management Area, and to subsequently reforest the harvested areas.

The State's goal is to assist in the creation of a sustainable forest industry that enhances the productivity and health of Hawaii's forests, restores and protects the forest environment, creates value and jobs through local processing from each tree harvested, and strengthen forest communities. With the downsizing of the sugar industry, Hawaii has an opportunity to create commercial forests that are environmentally sustainable and economically profitable for the potential investor, small and large landowners, and the people of Hawaii.

The Division will require that all forest management activities comply with the measures listed in the State's *Best Management Practices for Maintaining Water Quality in Hawaii* (BMP, Appendix E) for activities such as pre-harvest planning, road improvement and maintenance, timber harvesting, site preparation and regeneration, fire management, and use of fuels and chemicals. Implementation of the BMP insures that environmental safeguards are utilized, such as effective soil erosion control practices, safe use and storage of chemicals, and visual buffers along major transportation corridors.

As of the preparation of this Final Environmental Assessment, the State Department of Public Safety (DPS) is preparing an Environmental Impact Statement for a new 2,300-bed medium security correctional facility within the western boundary of the WTMA near the 3,000 foot contour, adjacent to Stainback Highway. Should the project be implemented, approximately 320 acres will be taken out of the WTMA. DOFAW has submitted a request to DPS for the opportunity to salvage trees and other non-timber forest products from the project site. These forest resources will be made available to individuals, organizations, and processors of forest products for home use and commercial purposes.

A. TIMBER HARVESTING

All timber harvesting activities will be conducted according to a timber harvesting plan approved by DOFAW.

Each of the commercial introduced timber species or species groups grown and managed within the WTMA have unique management requirements. This is due to differences in physiology and growth potential and utilization considerations such as value and products.

1. Silvicultural Guidelines

Queensland maple: This timber species will be managed under the guidelines of a selection tree harvesting method to create and maintain an uneven age timber stand of at least three well defined age classes. Because Queensland maple is a shade tolerant species, thinning by single tree selection and/or group selection can be used to harvest trees, with natural regeneration to replace the harvested trees.

DOFAW considers Queensland maple to be the most valuable introduced timber species in this forest because of its high wood quality, desirable growth characteristics, and site adaptability. Six type classes of Queensland maple currently exist within the WTMA, coded FB00, FB11, FB22, FB33, FB44, and FB55 (Appendix B). Initially, intensive forest management practices will be applied to type class FB33 and FB44. These two type classes comprise 291 acres of medium and high-stocked timber, with a merchantable volume of 1,218,585 cubic feet (approximately 50 percent of the total wood volume), on only 20 percent of the area for all Queensland maple stands in the WTMA.

An annual goal of conducting commercial thinning operations on 100 acres of Queensland maple in FB33 and FB44 could provide as much as 55,000 cubic feet of wood to the island's markets each year for 15 years¹. Wood marketing and utilization both will need to be enhanced to accommodate this level of production. If local markets do not absorb such wood production, DOFAW will shift forest management activities to focus on timber stands that are young or composed primarily of smaller diameter trees. Such activities would include replanting, weeding and pre-commercial thinning. DOFAW will also consider making wood available for export should there be a demand for small diameter logs.

Eucalyptus species: The *Eucalyptus* stands will be managed as even-aged stands, utilizing a modified shelterwood/patch-cut method as the optimal harvest method, because *Eucalyptus* are intolerant of shade. Also, any trees left during a harvest are at a risk to blow down due to opening of the stand and exposure to winds. Replanting of eucalypts will be most successful in completely open areas, which will require mechanical site preparation. Residual overstory trees would impede such operations.

Sometimes, public perception of even-aged management is linked to large clear-cut areas and significant environmental impacts. To address these concerns, and to improve the aesthetics and visual impacts, harvesting guidelines for the *Eucalyptus* species are as follows:

¹ For common tree sizes in the WTMA, one cubic foot of wood is equivalent to four to six board feet (Cahill).

- a. Harvest units will not exceed 40 acres. Patch-cut systems will be the preferred harvesting method for *Eucalyptus* because these species require an open, well-prepared site to regenerate and grow vigorously. No adjacent 40-acre blocks will be harvested simultaneously.
- b. Specific conditions, if any, for leave or residual trees within the 40-acre harvesting blocks will be specified in the Timber Land License. Residual trees may be required for wildlife habitat, regeneration enhancement, and aesthetics.
- c. All harvested areas will be replanted with *Eucalyptus* species, Queensland maple, or other high value hardwood timber species.

The WTMA contains a total merchantable volume of 9,276,450 cubic feet of various *Eucalyptus* species. *E. grandis* and *E. saligna* constitute 88 percent of the total eucalyptus volume in the WTMA, with minor components of other species. To manage the 4,030 acres of *Eucalyptus* as a "fully regulated forest," up to 500 acres of WTMA current *Eucalyptus* stands could be harvested and replanted annually based on an 8-year rotation cycle. This would allow for an even flow of timber off the land. This prescription may be changed based on different desired rotations or different end product mixes.

Tropical ash and Australian red cedar: After more than 35 years growth, a majority of Australian red cedar and tropical ash trees are still pole sized. Due to this poor performance, there will be no additional plantings of either species. DOFAW will prioritize conversion of acreage containing Australian red cedar (3500 acres) and tropical ash (2060 acres) to *Eucalyptus* species, Queensland maple, and other prospective high-value species. Prior to replacement planting, salvage sales will be conducted to utilize any Australian red cedar or tropical ash wood resources that have commercial value.

2. Roads

There are about 130 miles of unimproved roads in the WTMA that can be utilized for hauling the timber products out of the forest. All roads that will be utilized for such purposes as well as the number and location for all main skid trails and landing sites must be approved by DOFAW. The contracted logger will need to plan and secure accesses that will have a minimum use and impact on the Stainback Highway for transporting the timber products to the manufacturing sites. The County of Hawaii Department of Public Works (Panaewa Zoo) as well as the State Department of Corrections (Kulani Correctional Facility) must be consulted for use of the Stainback Highway.

Since there is already a network of roads in place, no new permanent roads will be allowed. All access improvements will be restricted to clearing and regrading old roads that have become overgrown. The contracted logger will be required to maintain and restore any roads to their original condition.

Temporary skid trails and landings will be permitted. These temporary trails and landings will be scarified and replanted after harvesting is complete.

B. REPLANTING/REFORESTATION

The Waiakea Timber Management Area was established to support Hawaii's forest industry. Because non-native trees and shrubs dominate almost all of the WTMA, it represents a logical site to continue commercial timber operations to support Hawaii's forest industry, and to replant and reforest the area as soon as it is harvested.

1. Species selection

Selecting the appropriate species to plant in a given area is largely dependent on growth potential for a given site. Site productivity for tree growth in the WTMA can be broadly linked to lava flow type and age. Older flows are more productive sites than younger flows, and a'a sites are more productive than pahoehoe sites. The *Eucalyptus* appear to grow well in all areas of the WTMA except on very shallow pahoehoe lava flows. In addition, depressions in the landscape and drainage areas seem to provide the highest growth potential of all, due to higher accumulation of geologically recent ash deposits.

2. Site preparation

Site preparation is achieved by the removal of competing vegetation and exposure of surface soils to aid planting operations. Site preparation is often the most costly silvicultural operation. Manual clearing with saws and machetes can be implemented where brush and trees are relatively sparse and short. Manual clearing is useful for cutting planting lines in existing plantations for supplemental planting and where planting sites are small and scattered.

The primary form of site preparation recommended for the WTMA is mechanical crushing of existing vegetation. This is conducted with heavy crawler tractors, which run over shrub and weed species, and scatter tree debris. This method of site preparation has two primary merits. First, soil disturbance is minimized, which helps maintain soil productivity and nutrient cycling potential. Second, desirable stems of both native and non-native tree species can be left standing, contributing to future stand diversity and value.

Herbicides, such as Rodeo and RoundUp, are sometimes used for site preparation. Herbicides are used to kill grass along planting lines before planting, or to kill undesired remnant woody vegetation. When herbicides are applied, all Federal and State rules and

regulations will be followed to protect both the worker and the environment. Use of fire for site preparation will not be considered.

3. Timber stand improvement

Fertilizer application is essential for satisfactory seedling survival and growth. During and after planting, commercial fertilizer applications will be applied manually as needed. Weed control may be required in newly planted stands to reduce seedling mortality and competition. Spraying will be limited to manual applications in areas around seedlings and crop trees. Chemical quantities will be carefully prescribed at levels to control the specific target populations. Only approved chemicals will be used in the WTMA in strict accordance with the manufacturer's labels.

Young tree stands may require side branch pruning to maximize the potential value of crop trees. Pruning will be conducted manually on species that can produce high-value solid wood end products such as Queensland maple or African mahogany (*Khaya spp.*).

4. Long-term forest management practices

a. Threatened and endangered species

Historic plantation timber establishment and associated clearing of native forest in the WTMA impacted the native plants that once were found in the area. Rare native plant species historically found in the WTMA include ohe (*Joinvillea ascendens ssp. ascendes* – last observed in 1950), nau (*Gardenia remyi* – last observed in 1952), *Phyllostegia vestita* (last observed in 1957), and *Phyllostegia foribunda* (last observed in 1973). These plant species may exist in the adjacent native forest because there are known populations of some of these rare plants within the Puu Makaala Natural Reserve Area.

Haha (*Cyanea tritomantha* – last observed in 1988) was the most recent endangered plant discovery in the WTMA and is considered to be part of a larger population of this species located within the Puu Makaala Natural Reserve. Another endangered species of haha (*Cyanea platyphylla*) has been out planted in a fenced enclosure within the Waiakea Arboretum. Although there is no record of wild individuals occurring within the WTMA, the historical range of this species includes the Waiakea Forest Reserve (Hawaii Natural Heritage Program, 1989). Endangered plant information in this environmental assessment is derived from The Nature Conservancy of Hawaii's Rare Plant Database and should not be considered comprehensive.

b. Insects and disease monitoring

Phytophthora cinnamomi (root rot disease) can cause limited damage to some tree seedlings planted on pahoehoe lava flows that have poor water drainage. The tree species most affected are Spanish cedar (*Cedrela odorata*), *Casuarina* spp., and various mahogany species. Whenever this disease problem occurs, other tree species subsequently are selected for planting such as Australian red cedar, Queensland maple, or eucalypts. At times, the black twig borer (*Zylosandrus compactus*) can be a problem at lower elevations within the WTMA, especially for seedlings of koa, Queensland maple, African mahogany, Spanish cedar, and Australian red cedar. These insects do not kill tree seedlings, but hinder their growth and development.

Trees within the WTMA will be monitored by DOFAW employees for evidence of insect damage or disease. If problems arise, qualified entomologists or plant pathologists will be consulted to identify the problem and develop a solution or minimize the damage.

c. Fire prevention and control

The WTMA is located in a high rainfall zone where wildfire occurs only during extreme drought conditions. Though rare, the potential occurrence of drought does require active fire control planning. In February 1926, an escaped trash fire burned 125 acres in WFR, and in March 1926, a land-clearing fire escaped and burned 20 acres of forest. In late March 1926, a fire started from a fisherman's camp on the coast burned 4,000 acres, 700 of which were in the Panaewa Forest Reserve. Smaller fires occurred more recently in 1970-1972, and in 1998.

Typically, fire risk increases in forested areas with increased human activity. However, intensification of timber management activities within the WTMA is expected to have negligible impact on fire risk. This area normally is very wet and does not burn readily. Maintenance of the road network within the WTMA for timber management activities will improve access and facilitate rapid containment of fire. During dry periods, DOFAW will post fire prevention signs, distribute brochures, and employ Public Service Announcements to increase public awareness of fire risk. In extreme conditions, DOFAW will consider public access restrictions and minimize timber management activities to mitigate increased risk.

C. NATIVE FOREST MANAGEMENT

There are approximately 480 acres of native forest within the WTMA. The primary goal in these areas will be forest protection and management of threatened and endangered plants. The native forest stands will be accessible for traditional gathering of

forest resources, research, hunting, and recreation. Commercial timber management activities will not be conducted in those areas containing 50 percent or more native forest cover.

DOFAW intends to manage commercial timber harvesting activities in a manner that minimizes disturbance to native forest adjacent to the timber management area. The goal is to prevent the spread of non-native invasive plant species and to preserve native forest ecosystems for education, research, recreation, and most importantly – for the enjoyment and benefit of future generations. DOFAW will establish protective buffer zones, approximately 150 feet in width, within the planted hardwood timber forest if the harvest area is adjacent to a high quality native forest. High quality native forest is defined as those plant communities that have a minimal component (of less than 10 percent in any layer) of non-native plants and exhibit minimal disturbance. Skid trails and/or timber haul roads will not be permitted within these buffer zones. Cable logging will be employed if any timber is removed from protective buffer zones.

V. ENVIRONMENTAL IMPACTS OF PROPOSED ACTION; PLANNED MITIGATION MEASURES

A. IMPACTS ON PHYSICAL RESOURCES

Timber harvesting operations, by their very nature, create a temporary disturbance in the forest. If conducted in a manner sensitive to the surrounding environment, the impact can be minimized in scope and time.

1. Soil

Management objectives for the long-term productivity and sustainability of the WTMA forest resources necessitate the protection of soil resources on site. The State's BMP will be followed to minimize soil movement, erosion, and compaction during tree thinning and harvesting; road improvement and maintenance; and site preparation, so it is unlikely that forest management activities will have a significant effect on soil resources. The soils in the WTMA are well drained with rapid permeability, slight erosion potential, and slow to medium runoff (USDA, 1973). Average slope is six percent throughout the WTMA (although much higher in ravines). Where the soil overlies a'a lava, the substrata is also rapidly permeable. Although the pahoehoe lava is slowly permeable, water moves rapidly through cracks in the lava.

Timber harvesting operations will require the construction of temporary skid trails and landings. Timber harvesting has the potential to cause soil disturbance when trees are felled and logs are skidded to landings, decked, and later loaded onto trucks or chipped. Soil resources will be protected by proper engineering in the design and location of roads, skid trails, and landings, and by not operating during periods of excessively wet soil conditions. Access roads will be single-lane gravel roads and grades will not exceed 10 percent.

Chemicals, including vehicle and equipment fuel and oil substances, may be stored in specified areas in the WTMA, according to Timber License requirements. All chemical spills will be removed immediately according to the measures that are specified in the State's BMP.

2. Water quality

As discussed in the BMP, the major sources of water quality degradation from forest management activities are sediment, nutrients, pesticides, and debris. Because BMP guidelines will be strictly adhered to, it is expected that the proposed project will

have little or no significant negative impact on water quality. The project area has no running streams except during periods of heavy rainfall.

To minimize nonpoint source pollution from sediments, the required practices include avoiding any disruption of natural drainages, preventing excessive soil displacement, providing drainage in case of slope instability, and providing culverts, dips, water bars, and cross drainages on roads and skid trails to minimize erosion.

To minimize water quality degradation from nutrients and pesticides, required practices include efficient and safe pesticide and fertilizer use. Strict compliance will be adhered to regarding the selection, use and storage of chemicals for all forest management activities as specified in the State's BMP. The Division will report all violations to the State's Department of Labor and Industrial Relations, Occupational Safety and Health regulating agency of any improper use of chemicals in the project area. Careful chemical selection and application as outlined in the BMP will be required. Additionally, any chemicals found in the WTMA from previous uses (e.g., chemical/defoliant trials) will be reported to the proper regulating agency, and will be handled according to standard procedures.

B. IMPACTS ON BIOLOGICAL RESOURCES

1. Flora

The proposed project is not expected to have any significant long-term negative impacts on native plant species within the WTMA. All intensive forestry operations will be conducted on areas that originally were converted to non-native timber stands; no new native forest areas will be disturbed. Non-native trees and shrubs dominate almost all of the WTMA. Almost all remaining native species are common, and are not rare, threatened, or endangered.

Non-native plants may be damaged or destroyed during certain forest management operations such as thinning, timber harvesting, site preparation for replanting, and road maintenance. For instance, non-native trees will be cut and removed from the site during thinning and harvesting, and competitive weedy vegetation will be controlled mechanically and/or chemically during site preparation. Of the non-timber species, most will grow back naturally. Timber tree seedlings will be planted as soon as the timber harvesting has been completed in each harvesting unit except in areas of selection tree harvesting.

There are no known threatened and endangered plant species presently growing in the project area. Botanical surveys will be conducted throughout the areas that will be immediately impacted by timber harvesting activities to insure that no rare or T&E plant species are accidentally destroyed. If a rare or T&E plant species is encountered within

introduced timber plantations, a buffer zone of 50 feet of undisturbed vegetation will be fenced around the individual or population; an additional area of one acre of undisturbed vegetation will be left for the protection of the individual or population. Known locations of rare or T&E plant species will be visited to collect seed or cuttings for propagation as needed. Such activity will lead to out planting in areas that are actively managed for rare plant species. Potential out planting sites will include areas of native forest that may be adjacent to established introduced timber species throughout the WTMA. A map and associated database for rare and T&E plant species within the WTMA will be maintained by DOFAW.

Introduced timber species found in the WTMA potentially could spread into the adjacent native forest, although this has not occurred to date. The potential for their spread would be increased if a major catastrophe such as fire or hurricane should occur and prepare suitable habitats for them to become established. DOFAW will monitor any spread of non-native flora that occurs and provide control, usually at the early stages of individual plant establishment.

2. Fauna

Forest management activities, especially timber harvesting, thinning, and site preparation for replanting, may have a direct impact on the invertebrate and vertebrate fauna in the project area. Forest disturbance may temporarily reduce the use of the area by some wildlife species, but will increase it for others. Arthropod (insects and spiders) and animal populations will stabilize as the disturbed areas are replanted with tree seedlings and native plants become reestablished in the understory. DOFAW will conduct surveys for threatened and endangered birds and bats prior to the commencement of harvest activities.

Native bird populations are not expected to be significantly impacted by timber harvesting operations. Very few native forest birds nest in non-native timber trees. Nesting birds would be most vulnerable to tree felling from February through June. This is the period when they are most likely to have eggs and young. The endangered Hawaiian hawk, or i`o, utilizes the WTMA for foraging, but it is unlikely that nesting birds will be found there. Hawks commonly hunt in forests, but they also forage in agricultural and residential areas. Even though human activity appears to have little effect on foraging birds, disturbance at nest sites is known to cause nesting failure and abandonment of young (Griffin, 1985). Hawks typically exhibit aggressive behavior towards humans and other birds that enter their breeding territories. If breeding birds or nests are found in the WTMA, harvesting at that site will be suspended until all young fledged from the nest. Harvesting of non-native timber species should not produce any long-term negative impacts on native forest birds, including the i`o.

There have been no known observations of roosting or breeding Hawaiian hoary bats in the WTMA. However, Hawaiian bats are known to forage in and above forest

stands including *Eucalyptus* plantations. The age and condition of the trees within the WTMA must be considered. Most trees in the eucalyptus planting are 14 years of age and in their second rotation, meaning that this is the second scheduled harvesting for this timber species within the WTMA. The Queensland maple planting will be managed by single tree selection harvesting, meaning that the larger, dominant trees will not be harvested probably for another 15 to 20 years. The first priority of harvesting will be the smaller, poorly formed trees.

Every precaution will be taken to avoid any impacts to the Hawaiian hoary bat from harvesting or other silvicultural activities within the WTMA. For example, not all trees in an area will be harvested. Within a 40-acre harvesting unit, for instance, a number of trees will be left for wildlife and aesthetics. During harvesting, if a visual sighting determines that bats are probably breeding in the area, that particular 40-acre unit will not be cut. Visual surveys, together with sonar equipment testing at night, should increase the probability of detecting bats that may be breeding in the area.

If bats are present in the general area, they may be attracted to forest clearings created by timber harvesting activities. The type of tree harvesting proposed should not have any negative impact on foraging bats, but may disrupt roosting behavior. If any roosting site is discovered, harvesting operations will be suspended at that location until roosting sites can be identified and protected.

Also, the logging contractor and workers will be trained and educated about the Hawaiian hoary bat. If they see a bat fall to the ground, they must cease operations and call DOFAW immediately. The DOFAW Wildlife Biologists will provide appropriate services, including possibly moving and rearing the bat, and/or turning it over to an appropriate endangered species propagation program (such as the Peregrine Fund).

When and if bats are proven to breed in the WTMA, harvesting activities will cease during their breeding season (June and July). DOFAW will continue with visual and sonic detection during all seasons, especially in new prospective harvest areas.

Native arthropod abundance and species diversity is surprisingly high in the WTMA. Adjacent native forests undoubtedly support similar species in even greater numbers. Timber harvesting will have a short-term negative impact on native invertebrate species. This impact is expected to be temporary because populations will stabilize as harvested units are replanted. The long-term effect on insect abundance and diversity will be minimal, as similar species occupy protected habitats in the nearby Olaa, Waiakea, and Upper Waiakea forest reserves and in the Puu Makaala Natural Area Reserve.

Most timber management blocks within the WTMA offer good wildlife habitat, especially for feral pigs. Timber harvesting activities will encourage production of young herbaceous vegetation and create edges between vegetation types. Both of these habitat

conditions favor the production of Kalij pheasants, wild pigs, wild turkeys, and other game species. The positive effects of timber harvesting on animal abundance were demonstrated in the Laupahoehoe section of the Hilo Forest Reserve in the 1970's. Harvesting of koa and 'ohi'a along Blair Road significantly increased the number of feral pigs and wild turkeys in the area for several years.

DOFAW plans to maintain a sustainable feral pig population within the WTMA. Feral pig habitat is of considerable importance to a number of Hawaii residents, many of whom have utilized the Waiakea area for hunting for generations. Because the WTMA is not a pristine forested area, DOFAW must insure that the concerns and rights of the hunting groups and other recreationists are also addressed. If it is determined, however, that increased feral pig populations will adversely affect any newly found T&E species, the area would be fenced and protected. Should the size of the feral pig populations increase to a point of causing unacceptable damage or changes to the plant communities within the WTMA or in adjacent areas, DOFAW will increase the "take" limits to reduce the impacts to native forest species.

In the other extreme, improvements to existing access roads for forest management and timber harvesting activities may increase the hunting pressure on feral pigs to the degree that it would lead to decreased pig populations. To address this problem, should it occur, access roads might have to be controlled and/or closed after they have served their intended purposes.

C. IMPACTS ON CULTURAL AND SOCIAL RESOURCES

1. Public land use

Opportunities for public enjoyment and outdoor recreation activities, such as hunting, biking, hiking, and sightseeing, will continue. Gathering plant material from the project area for personal, cultural, religious, and traditional uses will still be encouraged.

The proposed project will limit some recreational use within the WTMA, especially at the current harvesting site. Activity may be restricted in certain areas where game management practices are initiated to increase the population of game animals. But, the proposed project will increase the total recreational use for the WTMA because more accesses will be built and/or maintained by the timber harvesters and by the Division of Forestry and Wildlife.

Transporting forest products to the processing plants will increase the use of Stainback Highway and North Kulani Road if these roads are used. The installation of ample road warning signs will inform other users of the highway and roads that potential hazards exist.

The forest will become a place of business for one or more forest industry companies that will be harvesting timber for commercial purposes. Their presence in the forest will restrict some public uses in the areas where timber harvesting activities are being conducted. These restrictions will include limiting the use of access roads that will be used for transporting the timber products to the processing sites. The restrictions will be temporary, and will include only areas where safety and efficiency of the forestry operations are at issue.

2. Education and research

There is great potential for field studies within the WTMA, especially in regard to introduced timber species in Hawaii. Permanent growth plots will be established by DOFAW in all principal timber types that will be thinned or harvested. Tree growth data will be obtained and reviewed annually to guide future timber management decisions and practices for the management of commercial species in this forest.

3. Historic and archaeological resources

Within the project area, there are no known historic or archaeological sites. But should timber harvesting or any other forest management activity uncover evidence of historic and/or archaeological sites, all further work in the area will be halted immediately, and the findings will be reported promptly to the State's Division of Historic Preservation for evaluation.

D. IMPACTS ON ECONOMIC RESOURCES

An aggressive yet attainable integrated forest industry initiative of 60,000 acres of forest plantations on the Island of Hawaii could support sustainable long-term direct employment of around 450 employees. This does not take into account indirect benefits such an industry would have on the local economy. The forest growing and harvesting program would employ over 200 people, with peaks of over 300 in the early establishment years. The processing sector would provide additional long-term employment of 235 people. Using a multiplier factor of 2.2 for each direct job, creation of 1,000 jobs is a realistic possibility. A large number of skilled workers will be required to staff these plants, including engineers, computer operators, marketing personnel, and accountants.

Although the economics of forestry as a business have been validated by the private sector, the State can provide a strategic role by guiding public timber assets into local processing facilities that will optimize high quality jobs for the local community. Decisions regarding the Waiakea Timber Management will influence how the forest industry develops and will help define the role of public assets in overall commercial forestry development throughout the State.

The WTMA has an estimated economic stumpage value of several million dollars. The actual stumpage value depends on the wood products that will be made from the timber resources. The value-added economic gain to the local economy will be many times that of the actual stumpage value. This timber resource should be utilized to manufacture locally desired wood products and be managed for sustained yield to provide employment and to increase the economic base of the State. Annual wood production from the harvest of *Eucalyptus* in the WTMA will contribute to supporting a local wood manufacturing company that obtains its wood requirements from a variety of sources.

VI. ALTERNATIVES TO THE PROPOSED ACTION

Several management alternatives have been considered. These include the following:

A. NO ACTION ALTERNATIVE

The No-Action Alternative would entail a continuation of the current management activities, without any commercial harvesting.

The positive impacts include no disruption to the public use of the WTMA, and a higher aesthetic quality of the environment for those who oppose any commercial timber operations.

The negative impacts of this alternative are decadent forests, increased fuel load with higher probability of forest fire, loss of economic potential for the community and the state, and an inability to provide material to attract veneer mill investments or similar operations.

B. EVEN-AGED MANAGEMENT THROUGHOUT THE WTMA

A second alternative would entail even-aged management by clearcutting all the timber trees over a short period of time. The larger trees would be utilized as timber, and the smaller trees for chips and pulp.

The positive impacts include an immediate financial gain, increased potential for short-term employment, and increased ability to replant.

The negative impacts of this alternative include severe disruption of public use, increased potential for soil erosion and water quality degradation, severe loss of habitat, loss of sustainability and long-term productivity, and severe loss of visual quality.

C. PROPOSED ACTION

The proposed alternative is to harvest timber and non-timber forest products from the Waiakea Timber Management Area, and to subsequently reforest the harvested areas with commercial timber species. For more than 35 years, this project area has been managed for commercial timber production and for other forest uses such as research, education, recreation, watershed, and wildlife. Timber harvesting is the next logical step.

Positive impacts of this alternative include enhancement of the productivity and health of Hawaii's forests, restoration and protection of the forest environment, creation of jobs and value through local processing, continued beneficial public use of the area, and improvement of the local and state economy.

The negative impacts include temporary disruption of public use of the land, temporary loss of plant and animal habitat, temporary increase in road traffic, and temporary loss of visual quality in harvested areas.

VIII. DETERMINATION

The Division of Forestry and Wildlife has declared a **Finding of No Significant Impact (FONSI)** for this project. Every phase of the proposed action has been considered, as well as the primary and secondary consequences, and the short and long-term effects. Based on the following 13 criteria, the proposed project will not have a significant impact.

1. **The proposed project does not involve an irrevocable commitment to loss or destruction of any natural or cultural resource.**

Timber harvesting operations create a temporary disturbance in the forest. Because operations will be implemented in a manner sensitive to the surrounding environment, the impact will be minimized in scope and time.

The State's *Best Management Practices for Maintaining Water Quality in Hawaii* will be adhered to minimize soil movement, erosion, and compaction during tree thinning and harvesting; road construction and maintenance; and site preparation and replanting. Soil resources will be protected by proper engineering in the design and location of roads, skid trails, and landings, and by not operating during periods of excessively wet soil conditions.

The proposed project will have little or no significant negative impact on water quality. To minimize nonpoint source pollution from sediments, the required practices include avoiding any disruption of natural drainages, preventing excessive soil displacement, providing drainage in case of slope instability, and providing culverts, dips, water bars, and cross drainages to minimize erosion. To minimize water quality degradation from nutrients and pesticides, practices include efficient and safe pesticide and fertilizer use. Careful chemical selection and application as outlined in the BMP will be required.

The proposed project is not expected to have any significant long-term negative impacts on native plant species within the WTMA. Although both native and non-native plants may be damaged and/or destroyed during thinning, timber harvesting, site preparation for replanting, and road construction and maintenance, most will grow back naturally. Timber tree seedlings will be planted as soon as the timber harvesting has been completed in each harvesting unit except in areas of selection tree harvesting

Forest disturbance will temporarily reduce the use of the area by animal species. Insect and animal populations will stabilize as the disturbed areas are replanted with tree seedlings or are reestablished with natural plant species.

Within the project area, there are no known historic or archaeological sites. But should timber harvesting or any other forest management activity uncover evidence of historic and/or archaeological sites, all further work in the area will be halted immediately, and the findings will be reported promptly to the State's Division of Historic Preservation for evaluation.

2. The proposed project does not curtail the range of beneficial uses of the environment.

Opportunities for public enjoyment and outdoor recreation activities, such as hunting, biking, hiking, and sightseeing, will continue. Gathering plant material from the project area for personal, cultural, religious, and traditional uses will still be encouraged.

Timber harvesting activities will encourage production of young herbaceous vegetation and create edges between vegetation types. Both of these habitat conditions favor the production of game species such as wild turkeys, Kalij pheasants, wild pigs, and others.

There will be some restrictions on some public uses in the areas where timber harvesting activities are being conducted. These restrictions will include limiting the use of access roads that will be used for transporting the timber products to the processing sites. The restrictions will be temporary, and will include only areas where safety and efficiency of the forestry operations are at issue.

There will be increased opportunity for field studies within the WTMA, especially in regard to introduced timber species in Hawaii. Permanent growth plots will be established by DOFAW in all principal timber types that will be thinned or harvested.

3. The proposed project does 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.

Chapter 344 of the Hawaii Revised Statutes states

It shall be the policy of the State, through its programs, authorities, and resources to:

- (1) Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which*

humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii.

The management criteria of the proposed project are based on sound forest stewardship and sustainable, long-term productivity. The project serves to enhance the environmental quality of the area, and to provide social and economic opportunities for the surrounding human communities.

The project's impacts are primarily positive for the State and for DOFAW's Land and Natural Resource 172 "Forest Products Development" program. The Division's mission statement is "to grow high quality forest products in sustained yield systems and practices to create job opportunities in rural areas and to broaden Hawaii's economic base." This project will provide employment opportunities, the timber resources will be managed for sustained yield, and the State's economic base will be enhanced.

4. The proposed project does not substantially affect the economic or social welfare of the community or state.

The economic and social welfare of the community and state will actually be improved with the implementation of the proposed project. This forest has an estimated economic stumpage value of several million dollars. The actual stumpage value depends on the wood products that will be made from the timber resources. The value-added economic gain to the local economy will be many times that of the actual stumpage value. This timber resource will be utilized to manufacture locally desired wood products and be managed for sustained yield to provide employment and to increase the economic base of the State. Annual wood production from the harvest of *Eucalyptus* in the WTMA will contribute to supporting a local wood manufacturing company that obtains its wood requirements from a variety of sources.

5. The proposed project does not substantially affect public health.

To minimize water quality degradation from nutrients and pesticides, required practices include efficient and safe pesticide and fertilizer use. Strict compliance will be adhered to regarding the selection, use and storage of chemicals for all forest management activities as specified in the State's BMP. The Division will report all violations to the State's Department of Labor and Industrial Relations, Occupational Safety and Health regulating agency of any improper use of chemicals in the project area.

All safety and health laws and regulations regarding workers and the public will be strictly enforced.

6. **The proposed project does not involve substantial secondary impacts (such as population changes or effects on public facilities).**

The primary secondary impacts concern the increased use of access roads in the area, but these impacts are temporary and insignificant.

7. **The proposed project does not involve a substantial degradation of environmental quality.**

Adherence to the State's BMP and to the management objective of sustainable, long-term productivity will insure that there will not be a significant degradation of the physical environment. Timber harvesting will decrease the current density of biological resources, but this impact will be temporary, and will actually lead to a healthier forest community.

8. **The proposed project does not have considerable cumulative adverse effects.**

The cumulative effects are positive, rather than adverse. (See Criteria #1.) A primary short term benefit of this project is the immediate creation of jobs for the people that will be hired by the forest industry companies that will be harvesting and processing timber into valuable wood products. This benefit will extend into the long-range because the timber resources will be managed for sustained yield. Other long-range benefits will be the establishment of a larger forest product industry that will encourage private landowners to grow and market their timber resources locally. This response from private landowners will further increase the value of the State's local forest product industry. Commercial timber management can be a beneficial land use alternative, as forests increase the land's value for watershed, wildlife, forest recreation, aesthetics, and storage of carbon.

9. **The proposed project does not substantially affect a rare, threatened, or endangered species, or its habitat.**

There are no known threatened and endangered plant species presently growing in the project area. Botanical surveys will be conducted throughout areas that will be immediately impacted by timber harvesting activities to insure that no rare or T&E plant species are accidentally destroyed. If a rare or T&E plant species is encountered within introduced timber plantations, a buffer zone of 50 feet of undisturbed vegetation will be fenced around the individual or population; an additional area of one acre of undisturbed vegetation will be left for the protection of the individual or population. Known locations of rare or T&E plant species will be visited to collect seed or cuttings for propagation as

needed. Such activity will lead to out planting in areas that are actively managed for rare plant species.

The impacts of timber harvesting on native bat and bird populations are expected to be minimal. Surveys for threatened and endangered bats and birds will be made by qualified and competent professionals in DOFAW prior to the commencement of harvest activities to augment the current available information on these species. If any rare animal roosting trees or active nests are encountered, a no-harvest zone (250 feet in radius) will be established around each site.

10. The proposed project does not detrimentally affect air or water quality or ambient noise levels.

The proposed project will have little or no significant negative impact on water quality. To minimize nonpoint source pollution from sediments, the required practices include avoiding any disruption of natural drainages, preventing excessive soil displacement, providing drainage in case of slope instability, and providing culverts, dips, water bars, and cross drainages to minimize erosion. To minimize water quality degradation from nutrients and pesticides, practices include efficient and safe pesticide and fertilizer use. Careful chemical selection and application as outlined in the BMP will be required.

11. The proposed project does not affect nor is likely to suffer damage by being located in an environmentally sensitive area such as a floodplain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.

The Waiakea Timber Management Area is not located in or near any of the above-mentioned environmentally sensitive areas.

12. The proposed project does not affect scenic vistas and viewplanes identified in county or state plans or studies.

The WTMA is not identified as a scenic vista or viewplane. However, visual impacts to the area will be mitigated by limiting the size of the timber harvesting blocks. (See the harvesting information above.)

13. The proposed project does not require substantial energy consumption.

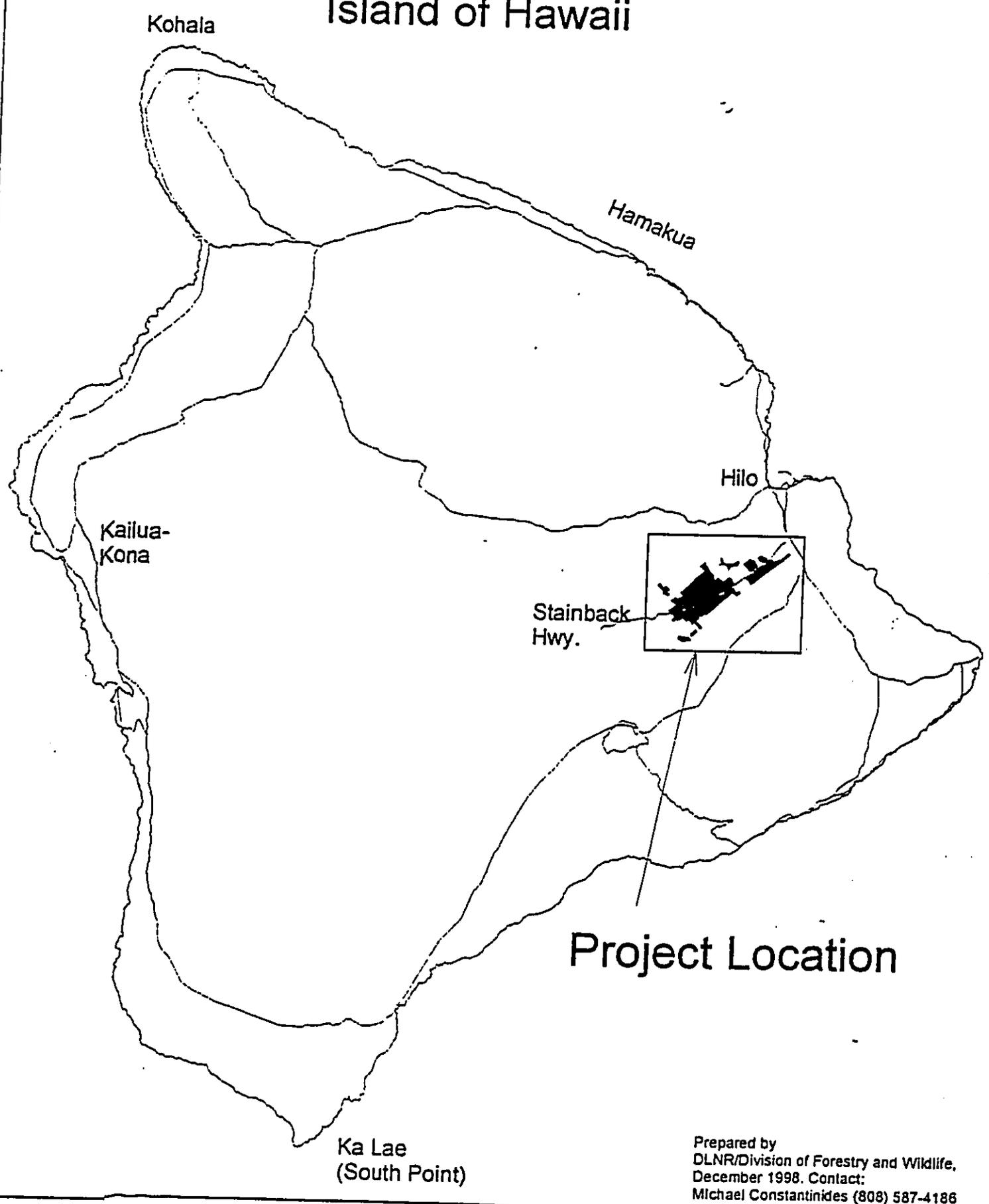
Petroleum fuels will be used during most of the forest management activities, but this energy consumption is not expected to be substantial (especially when the benefits and uses of the wood and timber products are considered).

LITERATURE CITED

- Cahill, T.M., 1984. *Log scale conversion factors*. pp. 58-65. In *User's Guide for Cubic Measurement*. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, OR.
- Griffin, C.R., 1985. *Biology of the Hawaiian Hawk, Buteo solitarius*. Ph.D. Dissertation. University of Missouri-Columbia, Columbia, MO.
- Hawaii Natural Heritage Program, *Rare Plant Database*, 1989. The Nature Conservancy of Hawaii, 1116 Smith Street, Suite 201, Honolulu, HI.
- Richmond, G.B., 1963. *Species trials at the Waiakea Arboretum, Hilo, Hawaii*. USDA Forest Service Research Paper PSW-4. Pacific Northwest Forest and Range Experiment Station, Berkeley, CA.
- State of Hawaii, 1998. *Forest Management Plan for the Waiakea Timber Management Area*. Department of Land and Natural Resources, Division of Forestry and Wildlife, Hilo, HI.
- USDA Soil Conservation Service, 1973. *Soil survey of Island of Hawaii, State of Hawaii*. U.S. Government Printing Office, Washington, D.C.

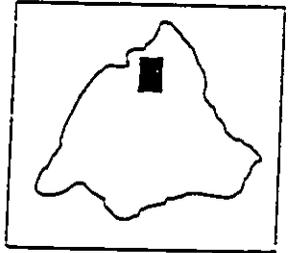
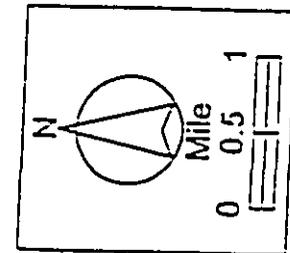
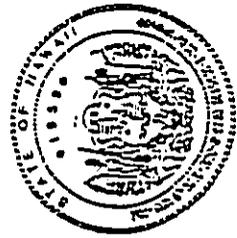
APPENDIX A: SITE AND LOCATION MAPS

Waiakea Timber Management Area Island of Hawaii



Prepared by
DLNR/Division of Forestry and Wildlife,
December 1998. Contact:
Michael Constantinides (808) 587-4186

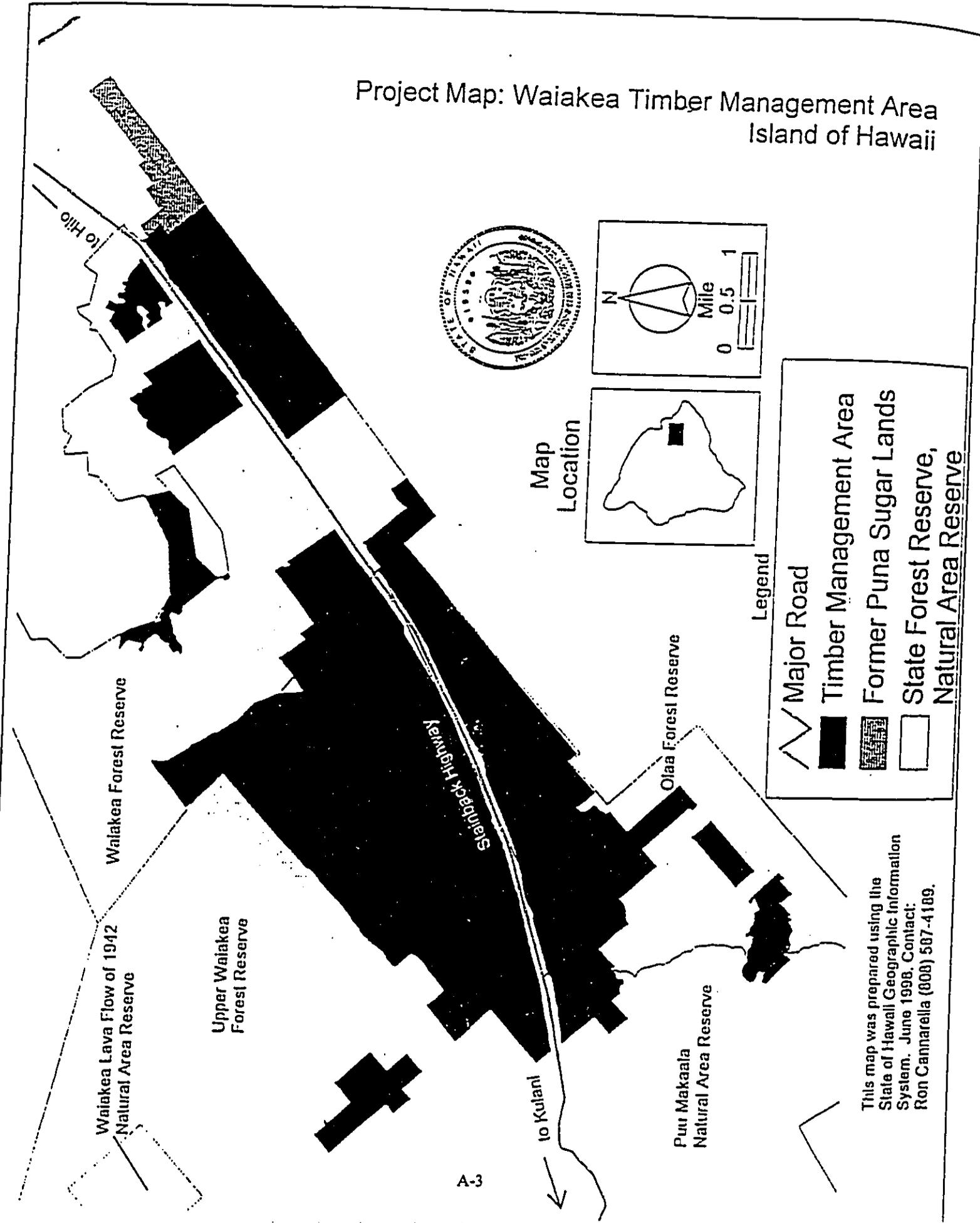
Project Map: Waiakea Timber Management Area Island of Hawaii



Map Location

Legend

- Major Road
- Timber Management Area
- Former Puna Sugar Lands
- State Forest Reserve, Natural Area Reserve

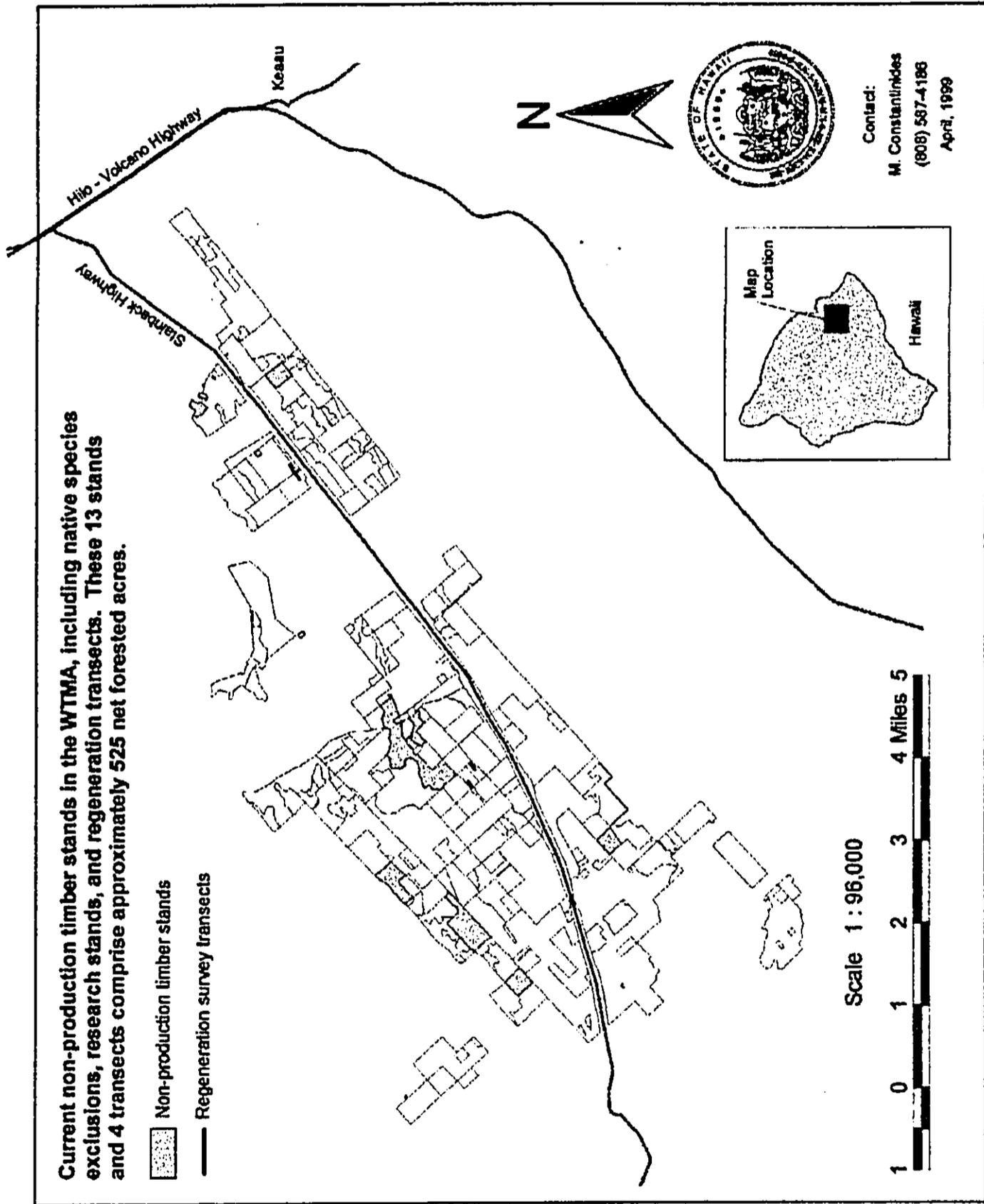


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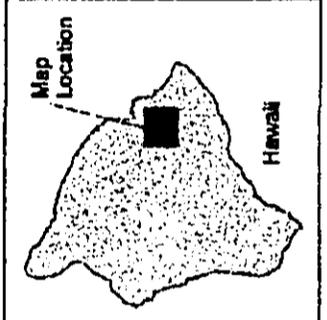
This map was prepared using the State of Hawaii Geographic Information System. June 1998. Contact: Ron Cannarella (808) 587-4189.

Current non-production timber stands in the WTMA, including native species excursions, research stands, and regeneration transects. These 13 stands and 4 transects comprise approximately 525 net forested acres.

- Non-production timber stands
- Regeneration survey transects



Contact:
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April, 1999



**AREAS TO BE EXCLUDED FROM COMMERCIAL FORESTRY ACTIVITY IN
THE WAIAKEA TIMBER MANAGEMENT AREA AS OF APRIL, 1999.**

UNDISTURBED NATIVE FOREST (status E):

<u>Stand Number</u>	<u>Net Acres</u>	<u>Primary Species</u>
10060	34.9	<i>Metrosideros polymorpha</i>
10470	183.0	<i>Acacia koa</i>
10481	29.0	<i>Acacia koa</i>
10640	59.6	<i>Acacia koa</i>
10760	99.4	<i>Metrosideros polymorpha</i>
10891	37.2	<i>Metrosideros polymorpha</i>
11330	33.1	<i>Metrosideros polymorpha</i>

Sub total: 476.2

RESEARCH PLANTINGS (status X):

<u>Stand Number</u>	<u>Net Acres</u>	<u>Primary Species</u>
10181	17.0	Experimental mixed hardwoods
10183	4.0	Experimental mixed hardwoods
10185	0.6	Experimental mixed hardwoods
10231	3.3	<i>Flindersia brayleyana</i>
10291	2.9	<i>Agathis robusta</i>
10911	0.6	<i>Liriodendron tulipifera</i>

Sub total: 28.4

REGENERATION SURVEY TRANSECTS (with buffer):

<u>Location</u>	<u>Approximate net acres</u>	<u>Primary Species</u>
Stand 10230	5.0	<i>Flindersia brayleyana</i>
Stand 10230	5.0	<i>Flindersia brayleyana</i>
Stand 10591	5.0	<i>Eucalyptus grandis</i>
Stand 10592	5.0	<i>Eucalyptus grandis</i>

Sub total: 20.0

STAINBACK HIGHWAY CORRIDOR:

The existing buffer between Stainback highway and non-native timber stands of the WTMA shall remain an undisturbed corridor.

APPENDIX B: WTMA TIMBER INVENTORY

Table B-1. Volume summary for timber resources in the WTMA. Values in parentheses represent nearest whole percentages of area and volume totals.

Species	Acres	Total Merchantable Volume (ft ³)	Average Merchantable Volume (ft ³ per acre)
Nepal alder	24 (0)	110,855 (1)	4,619
Eucalyptus robusta	227 (2)	1,007,433 (6)	4,438
E. saligna & E. grandis	3,749 (31)	8,180,306 (50)	2,182
Queensland maple	1,485 (12)	2,557,756 (16)	1,722
E. deglupta & E. pilularis	54 (0)	88,711 (1)	1,643
Experimental hardwoods	28 (0)	38,427 (0)	1,372
Koa	272 (2)	327,086 (2)	1,203
Ohia	205 (2)	167,113 (1)	815
Australian red cedar	3,500 (29)	2,682,282 (16)	766
Tropical ash	2,060 (16)	1,128,586 (7)	548
Sugi	102 (1)	30,798 (0)	302
Other	337 (3)	0 (0)	0
Total	12,043	16,319,353	

Table B-2. Descriptive statistics for timber types in the WTMA.

Species & Type Description	Acres	Age in Years	Trees per Acre	DBH Range	Median DBH	--Mean (ft ³ ac ⁻¹ --		Total merchantable volume (ft ³) by log minimum diameter class			Row Sub-Totals
						Gross	Merch	4-8"	8-12"	> 12"	
Queensland Maple											
FB00 Recent plantings / sapling stands	242	1-15	160-220	1-6	2	742	481	91,682	14,418	10,306	116,407
FB11 Low volume pole and saw timber	715	28-35	30	8-18	12	1,095	901	282,010	236,022	125,904	643,936
FB22 Low to moderate volume pole and saw timber	114	28-31	50-65	8-27	15	2,782	2,442	95,683	96,576	85,164	277,424
FB33 Moderate volume pole and saw timber	171	32	100	8-27	14	3,808	3,447	170,624	238,173	181,978	590,775
FB44 High volume pole and saw timber	120	32	120-140	8-28	14	5,649	5,214	203,486	265,708	158,616	627,810
FB55 Same as FB33 with 8-33% volume as Toona	123	29	55-110	8-26	11-14	2,716	2,460	86,411	112,601	102,392	301,404
Sub-Total FB:	1,485							929,896	963,499	664,361	2,557,756
Eucalyptus saligna and grandis											
ES00 Recent plantings / sapling stands	113	5-8	100-280	1-12	5	478	206	13,613	3,145	5,898	22,655
ES11 Cut over, or low volume pole and saw timber	730	12-30	10-50	8-28	10-18	1,141	913	307,493	197,181	161,797	666,470
ES22 Low to moderate volume pole and saw timber	1447	11-31	40-60	8-24	11-13	2,119	1,653	1,313,800	853,728	224,350	2,391,877
ES33 Moderate volume pole and saw timber	1057	29	65-85	8-23	14	3,498	3,105	1,289,546	1,270,558	729,895	3,289,999
ES44 High volume pole and saw timber	185	14	190	8-19	12	6,243	5,699	443,557	473,387	136,282	1,053,226
ES55 Moderate volume saw timber	218	28	45-80	8-32	12-17	3,710	3,476	153,420	238,481	364,177	756,078
Sub-Total ES:	3,749							3,521,429	3,036,479	1,622,397	8,180,306
Eucalyptus robusta											
ER22 Low to moderate volume pole and saw timber	44	30	15	14-31	22	2,663	2,564	15,781	27,897	68,374	112,051
ER33 Moderate volume pole and saw timber	87	31-53	35-70	8-42	13-20	3,536	3,305	45,406	63,642	179,507	288,556
ER55 Moderate volume saw timber	57	53	70	8-40	15	4,814	4,475	49,946	59,546	146,017	255,509
ER66 High volume saw timber	39	59	155	8-38	15	9,541	9,078	65,106	81,882	204,329	351,317
Sub-Total ER:	227							176,240	232,967	598,226	1,007,433
Eucalyptus deglupta and pilularis											
ED11 Cut over, or low volume pole and saw timber	20	29	5	8-9	8	354	184	1,507	755	1,489	3,752
ED22 Low to moderate volume pole and saw timber	34	29	65	8-17	12	2,825	2,499	23,020	29,717	32,221	84,959
Sub-Total ED:	54							24,527	30,473	33,711	88,711
Australian Red Cedar (Toona)											
TC11 Low volume pole and saw timber	3,178	30-35	25-55	8-14	9	873	595	1,088,854	487,061	314,593	1,890,508
TC22 Low to moderate volume pole and saw timber	69	30	135	8-15	10	1,986	1,698	73,634	43,879	0	117,513
TC33 Moderate volume pole and saw timber	253	30-35	95	8-20	12	3,023	2,667	307,814	255,219	109,229	674,262
Sub-Total TC:	3,500							1,472,301	786,159	423,822	2,682,282

Table B-2, cont.

Species & Type Description	Acres	Age in Years	Trees per Acre	DBH Range	Median DBH	Mean (ft ³ ac ⁻¹)		Total merchantable volume (ft ³)			Row Sub-Totals
						Gross	Merch	4-8"	8-12"	> 12"	
Other species											
FU11 Low volume Tropical Ash with 5-10% as Toona	2,060	34	45	8-18	9	902	548	855,304	250,770	22,512	1,128,586
AN33 Moderate volume Nepal Alder pole and saw timber	24	30	140	8-27	13	4,956	4,677	30,245	41,110	39,500	110,855
CJ00 Recent Sugi plantings / sapling stands	102	7-10	200-220	1-10	3	618	303	17,333	4,039	9,426	30,798
AK11 Low volume Koa pole and saw timber	272	NA	Native species			1,296	1,204	63,272	70,620	193,194	327,086
MP22 Low volume Ohia pole and saw timber	205	NA	Native species			978	817	58,435	45,139	63,538	167,113
XH33 Moderate volume experimental hardwoods	28	38	Experimental species			1,512	1,387	14,403	12,646	11,178	38,427
Sub-Total other species:	2,689							1,039,192	424,324	339,348	1,802,864

11,704

Total forested acreage:

Merchantable volume summary:
Cubic foot totals by log diameter and timber type class.

Type Class	Log minimum diameter			Total
	4-8"	8-12"	> 12"	
00	122,629	21,602	25,630	169,860
11	2,598,440	1,242,408	819,490	4,660,338
22	1,580,353	1,096,936	473,647	3,150,937
33	1,860,237	1,881,348	1,251,287	4,992,872
44	647,043	739,095	294,897	1,681,036
55	289,777	410,628	612,586	1,312,992
66	65,106	81,882	204,329	351,317
Total	7,163,586	5,473,901	3,681,865	16,319,352

Table B-3. Cruise precision analyses for the WTMA timber inventory. Volume data are presented in gross cubic feet.

Type	Acres	Sample Plots	Mean ----ft ³ ac ⁻¹ ----	SE	% SE	----80 % CI----	
						Low ----ft ³ ac ⁻¹ ----	High ----ft ³ ac ⁻¹ ----
FB00	242	7	742	294	40	319	1,164
FB11	715	13	1,095	154	14	886	1,304
FB22	114	20	2,782	194	7	2,525	3,040
FB33	171	26	3,808	284	7	3,434	4,182
FB44	120	24	5,649	326	6	5,219	6,080
FB55	123	26	2,716	178	7	2,482	2,951
ES00	113	2	478	19	4	420	535
ES11	730	17	1,141	128	11	970	1,313
ES22	1,447	41	2,119	105	5	1,982	2,255
ES33	1,057	26	3,498	281	8	3,128	3,868
ES44	185	4	6,243	681	11	5,129	7,358
ES55	218	6	3,710	383	10	3,145	4,275
ER22	44	1	2,663	NA	NA	NA	NA
ER33	87	8	3,536	687	19	2,564	4,507
ER55	57	7	4,814	352	7	4,307	5,321
ER66	39	6	9,541	508	5	8,791	10,290
ED11	20	3	354	89	25	185	522
ED22	34	3	2,825	1,370	48	241	5,410
TC11	3,178	71	873	50	6	808	938
TC22	69	1	1,986	NA	NA	NA	NA
TC33	253	6	3,023	447	15	2,363	3,683
FU11	2,060	47	902	37	4	853	950
AN33	24	3	4,956	287	6	4,415	5,497
CJ00	102	3	618	238	39	169	1,067
AK11	272	6	1,296	259	20	914	1,678
MP22	205	4	978	252	26	564	1,391
XH33	28	1	1,512	NA	NA	NA	NA
XX00	17	0	NA	NA	NA	NA	NA
Roads	320	0	NA	NA	NA	NA	NA
Total	12,042	382					

SE = standard error; % SE = standard error / mean volume per acre * 100

FB = Flindersia brayleyana; ES = Eucalyptus saligna & E. grandis; ER = E. robusta
ED = E. deglupta; TC = Toona ciliata; FU = Fraxinus uhdei; AN = Alnus nepalensis
CJ = Cryptomeria japonica; AK = Acacia koa; MP = Metrosideros polymorpha
XH = experimental hardwoods; XX = open or cleared area; NA = not applicable

Table B-4. Component merchantable volume for timber types in the WTMA.

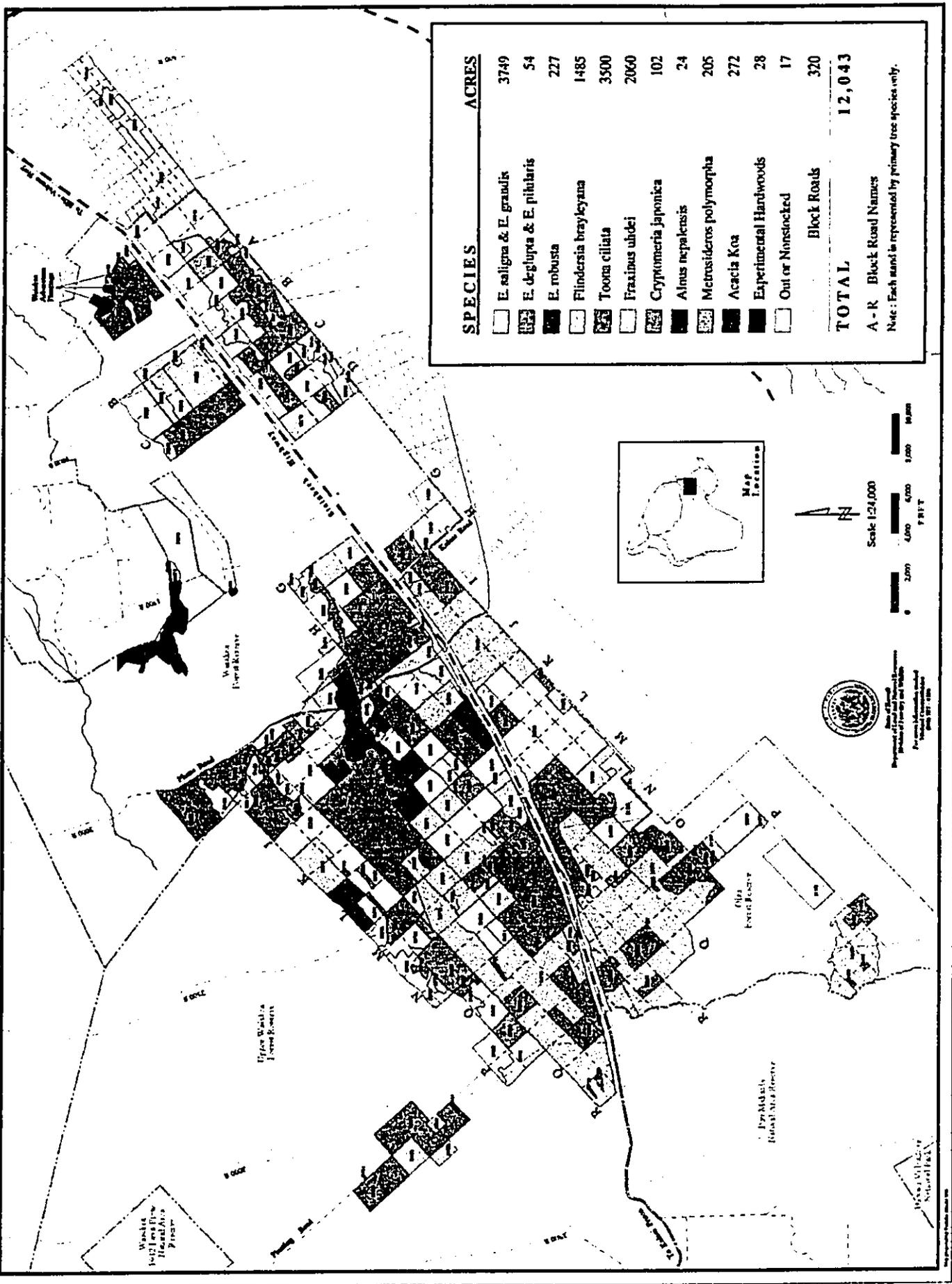
Type	Acres	--mean ft ³ ac ⁻¹ --		Component merchantable volume per acre													
		Gross	Merch	FB	TC	MP	ES	ER	ED	AK	FU	TO	EM	CJ	AN	MQ	OTH
FB00	242	742	481	65	359	56				17	12						
FB11	715	1,095	901	82	592	100				63	59					26	11
FB22	114	2,782	2,442	88	1,922	225				10	178						4
FB33	171	3,808	3,447	91	3,056	21				8	124						
FB44	120	5,649	5,214	92	5,058	63											2
FB55	123	2,716	2,460	91	1,756	229				46							
ES00	113	478	206	43	34	118	54								2		
ES11	730	1,141	913	80	35	81	729			68							
ES22	1,447	2,119	1,653	78	24	18	1,538	22	2	1	11	38					
ES33	1,057	3,498	3,105	89	146	20	2,810				40	80					7
ES44	185	6,243	5,699	91			5,629					71					
ES55	218	3,710	3,476	94	36	92	3,349										
ER22	44	2,663	2,564	96	1,155			1,410									
ER33	87	3,536	3,305	93			666	1,537	1,015								
ER55	57	4,814	4,475	93			118	862	3,041		53					28	5
ER66	39	9,541	9,078	95				369	8,709		31	74				349	
ED11	20	354	184	52			124										
ED22	34	2,825	2,499	88			469			53							
TC11	3,178	873	595	68	300	228	5		1,885	144							7
TC22	69	1,986	1,698	86	1,698					45	10						
TC33	253	3,023	2,667	88	2,105	10											7
FU11	2,060	902	548	61	29	28				552							
AN33	24	4,956	4,677	94						487							
CJ00	102	618	303	49		61				193							3
AK11	272	1,296	1,204	93		150								4,424			
MP22	205	978	817	84	28	725							24				
XH33	28	1,512	1,387	92		811				452							
XX00	17	NA	NA	NA		263											5
Roads	320	NA	NA	NA													1,124
Total	12,042																

FB = Flindersia brayleyana; ES = Eucalyptus saligna & E. grandis; ER = E. robusta; ED = E. deglupta; TC = Toona ciliata
 FU = Fraxinus uhdei; AN = Alnus nepalensis; CJ = Cryptomeria japonica; AK = Acacia koa; MP = Metrosideros polymorpha
 TO = Trema orientalis; EM = E. microcorys; MQ = Melaleuca quinquenervia
 XH = experimental hardwoods; XX = open or cleared area; NA = not applicable

WAIAKEA TIMBER MANAGEMENT MAP

Map 1 : PRIMARY TREE SPECIES

Third Edition 2/98
Based on 1997 Timber Inventory



**APPENDIX C: COMMON COMPONENTS OF FORESTS IN
THE WAIAKEA TIMBER MANAGEMENT AREA**

APPENDIX C

COMMON COMPONENTS OF THE FORESTS IN THE WAIAKEA AREA

Native species

- loulou palm (*Pritchardia beccariana*)
- `ohi`a (*Metrosideros polymorpha*)
- olapa (*Cheirodendron trigynum*)
- alani (*Melicope sp.*)
- kawa`u (*Ilex anomala*)
- ho`i`o (*Athyrium sandwichianum*)
- ama`u (*Sadleria spp.*)
- ala ala wai nui (*Peperomia sp.*)
- hame (*Antidesma platyphyllum*)
- koa (*Acacia koa*)
- manono (*Hedyotis spp.*)
- ohelo (*Vaccinium spp.*)
- papala kepau (*Pisonia brunoniana*)
- kopiko (*Psychotria sp.*)
- hapu`u (*Cibotium sp.*)
- kolea (*Myrsine sp.*)
- pilo (*Coprosma sp.*)
- kanawao (*Broussaisia arguta*)
- *Thelypteris sandwichensis*
- uluhe (*Dicranopteria linearis*)
- mamaki (*Pipturus albidus*)
- `i`e`i`e (*Freycinetia arborea*)
- maile (*Alyxia olivaeformis*)
- moa (*Psilotum nudem*)
- olomea (*Perrottetia sandwichensis*)
- *Phyllostegia spp.*

Invasive non-native species

- trumpet tree (*Cecropia obtusifolia*)
- gunpowder tree (*Trema orientalis*)
- strawberry guava (*Psidium cattleianum*)
- banana poka (*Passiflora mollissima*)
- king palm (*Archontophoenix*)
- maile pilau (*Paederia foetida*)
- Maui pamakani (*Ageratina adenophora*)
- sourbush (*Pluchea symphitonia*)
- sweet granadilla (*Passiflora ligularis*)
- *Melochia umbellata*
- *Melastoma candidum*
- palm grass (*Setaria palmifolia*)
- dog tail (*Buddleia asiatica*)
- Koster`a curse (*Clidemia hirta*)
- mulesfoot fern (*Angiopteris evicta*)
- passion fruit (*Passiflora edulis*)
- thimbleberry (*Rubus rosifolius*)

APPENDIX D

SUMMARY OF GAME AND NON-GAME WILDLIFE SPECIES PRESENT IN THE WTMA

GAME SPECIES

Mammal

Feral pig (*Sus scrofa*)

Birds

Kalij pheasant (*Lophura leucomelana*)
Wild turkey (*Meleagris gallopavo*)
Spotted dove (*Streptopelia chinensis*)
Zebra dove (*Geopelia striata*)
Japanese quail (*Coturnix japonica*)

NON-GAME SPECIES

Native mammal

Bat (*Lasiurus cinereus semotus*)

Native birds

Amakihi (*Hemignathus virens*)
Apapane (*Himatione sanguinea*)
Elepaio (*Chasiempis sandwichensis*)
Iiwi (*Vestiaria coccinea*)
Io (*Buteo solitarius*)
Omao (*Mayadestes obscurus*)
Pueo (*Asio flammeus*)

Introduced mammals

Feral dog (*Canis familiaris*)
Feral cat (*Felis catus*)
Mongoose (*Herpestes auropunctatus*)
Rat (*Rattus* spp.)

Introduced birds

Barn owl (*Tyto alba*)
Common mynah (*Acridotheres tristis*)
House finch (*Carpodacus mexicanus*)
House sparrow (*Passer domesticus*)
Japanese white eye (*Zosterops japonicus*)
Melodius laughing thrush (*Garrulax canorus*)
Northern cardinal (*Cardinalis cardinalis*)
Red-billed Leiothrix (*Leiothrix lutea*)

**APPENDIX E: BEST MANAGEMENT PRACTICES FOR
MAINTAINING WATER QUALITY IN HAWAII**

**BEST MANAGEMENT PRACTICES
FOR
MAINTAINING WATER QUALITY
IN HAWAII**



**State of Hawaii
Department of Land and Natural Resources
Division of Forestry and Wildlife
June 1998**

FOREWORD	3
INTRODUCTION	5
THE FOREST/WATER RELATIONSHIP	6
Timber Harvesting	6
Road Construction and Drainage Techniques	6
Pollutants from Silvicultural Activities	7
1) Sediment	7
2) Nutrients	7
3) Pesticides	7
4) Debris	7
BEST MANAGEMENT PRACTICES	8
1.0 Forest Roads	8
Standards and Use	8
Planning, Design, and Location	8
Construction	9
Maintenance	11
Harvesting - Temporary Access Roads and Landings	11
Pre-Harvest Planning	12
2.0 Timber Harvesting	13
Standards and use	13
Felling and Bucking	13
Skidding	13
Mechanical Site Preparation	14
Disposal of Debris and Litter	14
Silvicultural Chemical Management	14
Description and Purpose	14
Planning Considerations	15
Pesticide Selection	15
1) Solubility	15
2) Absorption	15
3) Breakdown Rate	15
Procedures for Chemical Use	16
A) Transportation	16
B) Storage	16
C) Mixing/Loading	17
D) Application	17
E) Cleanup and Disposal	18
Other chemicals	18
4.0 Streamside Management Zone (SMZ)	19
Recommendations	20
5.0 Fencing	22
6.0 Wildfire Damage Control and Reclamation/Prescribed Burn	22
6.1 Fire Line Construction and Maintenance	23
6.2 Prescribed Burn	24
7.0 Reforestation	24

FOREWORD

Best Management Practices (BMPs) are effective, practical, structural or nonstructural methods which prevent or reduce the movement of sediment, nutrients, pesticides and other pollutants from the land to surface or ground water, or which otherwise protect water quality from potential adverse effects of silvicultural activities. These practices are developed to achieve a balance between water quality protection and the production of wood crops within natural and economic limitations.

A thorough understanding of BMPs and the flexibility in their application are of vital importance in selecting BMPs which offer site specific control of potential nonpoint source pollution. With each situation encountered at various sites, there may be more than one correct BMP for reducing or controlling potential nonpoint source pollution. Care must also be taken to select BMPs that are practical and economical while maintaining both water quality and the productivity of forest land.

The Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500 (and as amended by Sec. 319, 1986), require the management of nonpoint sources of water pollution from sources including forest-related activities. BMPs have been developed to guide forest landowners, other land managers and timber harvesters toward voluntary compliance with this act. Maintenance of water quality to provide "fishable" and "swimmable" waters is central to this law's objectives. The Environmental Protection Agency (EPA) recognizes the use of BMPs as an acceptable method of reducing nonpoint source pollution.

Nonpoint source is diffuse pollution that comes from almost everywhere; it even occurs naturally to a certain extent. The amount of pollutants from any particular spot is small and insignificant, but when combined from over the landscape, can create water quality problems. Although it is unrealistic to expect that all nonpoint source pollution can be eliminated, BMPs can be used to minimize the impact of forestry practices on water quality. These practices must be reasonable, achievable and cost effective. The adoption and use of BMPs will provide the mechanism for attaining the following water quality goals:

- to maintain the integrity of stream courses;
- to reduce the volume of surface runoff originating from an area of forest management disturbance and running directly into surface water;
- to minimize the movement of pollutants i.e. pesticides, nutrients, petroleum products, etc. and sediment to surface and ground water;
- to stabilize exposed mineral soil areas through natural or artificial revegetation means.

The intent of this guide is to promote better stewardship of the forest resources. This guide delineates environmentally responsible land management methods which, when applied properly, minimizes adverse impacts on the forest ecosystem and maximizes landowner objectives. Unusual situations may arise or pollution control measures other than those recommended here may be found. In these cases, common sense is most often the best guide.

Information presented in this guide is not to be used as the basis for setting water quality standards or as the basis of required use of watershed protection practices. Compliance with any watershed protection practices would be on a voluntary basis backed up with a public water quality education and awareness program. Changing of water quality standards or the required use of protection practices should not be attempted without careful study of the beneficial effects gained from modifying existing silvicultural practices now in use.

INTRODUCTION

The Division of Forestry and Wildlife (DOFAW) is mandated by HRS, Chapter 183 to "...devise ways and means of protecting, extending, increasing, and utilizing the forests and forest reserves, more particularly for protecting and developing the springs, streams, and sources of water supply to increase and make that water supply available for use..."

The number one resource that is generated by the forest is water. Since the establishment of the Department of Agriculture and Forestry in 1900, the concern for the protection of forest lands for the purpose of water has been a high priority. Fencing to keep out wild cattle and other feral animals and reforestation efforts to re-establish watersheds have been the key to the continuance of the production of high quality water.

In 1961, Hawaii created, by law, the nation's first statewide zoning districts, and today approximately 95% of the Hawaii's four million acres are zoned for agricultural or conservation uses. The Conservation district, which is under the jurisdiction of the Department of Land and Natural Resources (DLNR), encompasses almost one-half of the State, of which one million acres is state-owned. The majority of Conservation lands are covered by forests, but also contain grasslands, coastlines, cliffs, offshore islets, and wetlands. Vegetative communities include lowland and montane rainforests and unique examples of tropical biodiversity, much of it endangered.

The Division of Forestry and Wildlife recognizes the need for responsible stewardship of the natural resources, which include soil and water. The success of DFW's to protect water quality within Hawaii depends on mutual cooperation and trust among landowners, industry, environmentalists, wood producers, regulatory agencies, governmental officials, and the general public. All have an interest in good land management as it relates to water quality.

THE FOREST/WATER RELATIONSHIP

The forest and water resources are mutually dependent upon one another. Forests depend on water, namely rain, surface water, and groundwater for their growth and reproduction. Major long-term changes in the water supply can cause permanent changes in the content, quality and vitality of forest lands.

On the other hand, surface and groundwater quantity and quality are largely influenced by the surface on which rain falls and through which it percolates. The tremendous filtering capacity of forest lands provide effective and high quality groundwater recharge.

Hawaii's streams and aquifers all benefit from the presence of forests. In addition to these water quality benefits, forests provide needed wood and fiber products, wildlife habitat, aquatic resources and habitat, recreation values and aesthetic benefits. It is in managing forests for these benefits that damage to the water resource can result. Following is a brief discussion of the most commonly used forest management practices and the impacts they can have on the quality of the water resource.

Timber Harvesting

The removal of trees from a site has little impact on water quality, as long as the trees do not provide vital shade to streams and as long as the slope of the land is not excessive. The natural warmth of many streams can be exaggerated by removing shading vegetation from their banks. Increased water temperature promotes lower dissolved oxygen levels, placing stress on fish and other aquatic organisms.

Removing timber per se does not directly cause significant water quality changes, since ground cover is not excessively disturbed during proper logging operations. On steep slopes, however, careless timber removal can increase the likelihood of runoff and soil loss. This may lead to water quality degradation as well as a loss of site productivity. Steep areas should therefore be logged carefully using proper harvesting techniques for the sake of both water quality protection and site protection.

Road Construction and Drainage Techniques

All facets and phases of a sound forest management program rely heavily on accessibility to the forest. Consequently, temporary and permanent access roads are necessary components of all management programs. They are also one of the most costly investments made in a forest.

Temporary access roads are constructed to facilitate harvesting operations, site preparation and planting and often abandoned after the new stand is established. When abandoned, these temporary roads are normally allowed to revegetate naturally or are planted with trees.

Pollutants from Silvicultural Activities

The major types of water pollutants that can be generated from forest management disturbances to the forest ecosystem include sediment, nutrients, pesticides, and debris.

1) Sediment

Sediment is the most common pollutant resulting from silvicultural activities. Sediment principally results from erosion of soil, but may also include organic matter. Excessive sediment upsets balanced ecology within streams by smothering bottom dwelling organisms in the water, interfering with photosynthesis by reducing light penetration, serving as carriers of nutrients and pesticides, inhibiting fish reproduction and altering stream flow.

2) Nutrients

Nutrients, primarily phosphorous and nitrogen fertilizers, are sometimes applied to the forest to stimulate tree growth. Soluble nutrients may reach surface or ground water through runoff, seepage, and percolation. Insoluble forms may be absorbed on soil particles and reach water by direct wash-off of debris and recently applied fertilizer. Excessive nutrients lead to an imbalance in natural life cycles of water bodies.

3) Pesticides

Pesticides, if applied during silvicultural activities, may be soluble or insoluble. Pesticides in surface or ground water may result in toxicity problems, affecting water quality and food sources for aquatic life.

4) Debris

Tree limbs, tree tops, and other waste materials are the principal organic pollutants from silviculture. They reach streams through direct pushing or felling into water drainages, and washout during storms. Organic materials may place an oxygen demand on the receiving water body during the decomposition process. In addition, associated problems may include odor, color, taste and nutrients. Inorganic material such as oil cans and pop bottles are also considered nonpoint source debris.

BEST MANAGEMENT PRACTICES

3.0 Forest Roads

Standards and Use

Forest roads are managed to provide adequate access to lands for timber management, fire protection, wildlife habitat improvement and a variety of dispersed and developed recreational activities. Generally, these are low volume roads that must carry heavy loads for short periods of time. The potential for adverse impacts from forest roads exists in areas where steep slopes, erodible soils, or where forest roads are located near water. Forest roads cause more erosion than any other forestry activity. Most of this erosion can be prevented by locating, constructing, and maintaining roads to minimize soil movement and pollution of streams. The need for higher standard roads can be alleviated through better road-use management. Design roads to the minimum standard necessary to accommodate anticipated use and equipment.

Planning, Design, and Location

A well planned access system is a sound method of reducing erosion and sedimentation in areas requiring frequent or temporary access. Proper location and construction of roads will provide for safety, longer operating periods, lower maintenance and operating costs, and minimal impacts on water quality. The value of the resource served and site characteristics will influence the choice of road construction standards and maintenance activities. The following practices are recommended:

- (1) Use a design to minimize damage to soil and water quality.
- (2) Roads should be designed no wider than necessary to accommodate the immediate anticipated use.
- (3) Design cut and fill slopes to minimize mass soil movement.
- (4) Provide culverts, dips, water bars, and cross drainages to minimize road bed erosion.
- (5) Design bridge and culvert installations using stream flow data, with a margin of safety proportional to the importance of the road and the protected resources.
- (6) Provide drainage where surface and groundwater cause slope instability.
- (7) Avoid diverting water from natural drainage ways. Dips, water bars, and cross drainage culverts should be placed above stream crossings so that water can be filtered through vegetative buffers before entering streams.

- (8) Locate roads to fit the topography and minimize alterations to the natural features.
- (9) Avoid marshes and wetlands.
- (10) Minimize the number of stream crossings.
- (11) Cross streams at right angles to the stream channel.
- (12) A road may not be located in a Streamside Management Zone (SMZ) except where access is needed to a water crossing, or where there is no feasible alternative. A road in any SMZ must be designed and located to minimize adverse effects on fish habitat and water quality.

Construction

Once the road's location and design is staked out, road construction begins. Timber is out, logs and vegetation are removed and piled along the lower side of the right-of-way.

Most forest roads are built by excavating a road surface. Road design and layout on-the-ground show machine operators the proper cut slopes and indicate cut slope steepness. The bulldozer starts at the top of the cut slope, excavating and sidesteering material until the desired road grade and width is obtained. Material from cuts is often pushed in front of the blade to areas where fill is needed. Road fill is used to cover culverts and build up flat areas. Since fill must support traffic, it needs to be spread and compacted in layers to develop strength. The following practices are recommended:

- (1) Construct roads when moisture and soil conditions are not likely to result in excessive erosion or soil movement.
- (2) The boundaries of all SMZs shall be defined on the ground prior to the beginning of any earth-moving activity.
- (3) Construct a road sufficient to carry the anticipated traffic load with reasonable safety and with minimum environmental impact.
- (4) When using existing roads, reconstruct only to the extent necessary to provide adequate drainage and safety.
- (5) Avoid construction during wet periods, when possible, to minimize unnecessary soil disturbance and compaction.
- (6) Road grades should be kept at less than 10%, except where terrain requires short, steep grades.

- (7) Minimize the number of stream crossings. Stream crossing construction should minimize disturbance of the area in which the crossing is being constructed.
- (8) As slope increases, additional diversion ditches should be constructed to reduce the damages caused by soil erosion; ditches, adequate culverts, cross drains, etc., should be installed concurrent with construction.
- (9) To control erosion, cut and fill slopes should conform to a design appropriate for the particular soil type and topography.
- (10) Stumps, logs, and slash should be disposed of outside of the road prism; in no cases should they be covered with fill material and incorporated into road beds.
- (11) Stabilize the side banks of a road during construction to aid in the control of erosion and road deterioration; this may require mesh or other stabilizing material in addition to planting and/or seeding and other structural measures.
- (12) Water bars should be located to take advantage of existing wing ditches and cross drainage. Water bars should be constructed at an angle of 30 to 45 degrees to the road. Water bars should be periodically inspected and damage or breaches should be promptly corrected. Install water bars at recommended intervals to provide the drainage. Water bar spacing recommendations are as follows:

Grade of Road	Distance Between Water Bars
2%	250 ft.
5%	135 ft.
10%	80 ft.
15%	60 ft.
20%	45 ft.
25%	40 ft.
30%	35 ft.
40%	30 ft.

Water bars may need to be spaced closer together depending on soil type and rainfall.

- (13) Bridges and overflow culverts should be constructed to minimize changes in natural stream beds during high water.
- (14) Culverts on perennial streams should be installed low enough to allow passage of aquatic life during low water.

Maintenance

Maintenance of active and inactive roads shall be sufficient to maintain a stable surface, keep the drainage system operating, and protect the quality of streams. The following are recommended:

- (1) Maintenance should include cleaning dips and crossdrains, repairing ditches, marking culverts inlets to aid in location, and clearing debris from culverts.
- (2) Keep culverts, flumes, and ditches functional before and during the rainy season to diminish danger of clogging and the possibility of washouts. This can be done by clearing away any sediment or vegetation that could cause a problem. Provide for practical and scheduled preventative maintenance programs for high risk sites that will address the problems associated with high intensity rainfall events.
- (3) Conduct road surface maintenance as necessary to minimize erosion of the surface and subgrade.
- (4) During operations, keep the road surface crowned or outloped, and keep the downhill side of the road free from berms except those intentionally constructed for protection of fill.
- (5) Avoid using roads during wet periods if such use would likely damage the road drainage features.
- (6) Water bars should be inspected after major rain storms and damage or breaches should be promptly corrected.

Harvesting - Temporary Access Roads and Landings

- (1) The location of temporary access roads (logging roads) should be planned before operations begin.
- (2) Road construction should be kept to a minimum.
- (3) Landings should be located to minimize the adverse impact of skidding on the natural drainage pattern.
- (4) Logging roads and landings should be located on firm ground.
- (5) Landings should be kept as small an area as possible.
- (6) When operations are completed, provisions should be made to divert water run-off from the landings and roads.

2.0 Pre-Harvest Planning

Pre-harvest planning is the collection of information about the area to be harvested and the synthesis of that information into an effective environmental plan. This plan will consider the silvicultural prescription for the species and site, the best estimate of the time and method of harvest and any post-harvest site preparation and reforestation activities.

At this stage, it is assumed that all federal, state, and local government regulations regarding harvesting have been met.

An effective pre-harvest plan will take into consideration all aspects of the timber harvest which may lead to water quality degradation and plan for the implementation of BMPs which will minimize or avoid the adverse effects of the operation. The objective of pre-harvest planning from the perspective of non-point source pollution is to determine which BMPs are necessary to protect water quality and how those BMPs will be implemented. The following is recommended:

(1) A pre-harvest plan should include the following information:

A. Physical and administrative description

1. Property boundaries & administrative boundaries (zoning, etc.)
2. Topography
3. Location of streams and drainages
4. Location of SMZs and buffer strips
5. Forest types
6. Soil types
7. Areas of ecological and/or archaeological concerns

B. Management Activities

1. Design and construction techniques for all new roads, skid trails, and landings or modification of existing roads, skid trails and landings.
2. Felling and bucking techniques
3. Yarding systems and layout
4. Planned stream crossings
5. Disposal of waste materials (machine lubricants)
6. Post-harvest site preparation
7. Reforestation activities

(2) The use of topographic maps, road maps, aerial photos, forest type maps, and soil surveys in combination with field reconnaissance is essential to determine site conditions and plan operations.

(3) Field reconnaissance with a trained forester or one who is knowledgeable about the specific area is highly recommended.

(4) Preliminary planning should consider the maintenance of existing drainage patterns and the location of environmentally sensitive areas such as streams, wet areas, and high erosion hazard areas.

(5) The design of roads, skid trails, and landings shall be integrated to minimize their impact.

(6) The grade of logging roads and skid trails should be less than 10% when possible, with 3-5% being the norm. Long, straight, unbroken grades are to be avoided. Adequate surface drainage shall be provided.

(7) Time the harvesting activity for the season or moisture conditions when the least impact occurs.

(8) A final pre-harvest site review shall be conducted by management so that road alignments and other considerations can be visually checked prior to road construction. The reconnaissance plan shall be modified as necessary to make desirable adjustments based on the final site review.

2.1 Timber Harvesting

Standards and use

Timber harvesting is an integral part of most forest management programs. Harvesting operations cause a temporary disturbance in the forest as well as diminish water quality. However, it can be conducted in a manner where the impact to water quality is minimized and the re-establishment of vegetative cover is realized. Guidelines to help reduce the potential for nonpoint source pollution from harvesting trees are as follows:

Felling and Bucking

- (1) Careful felling can minimize the impact of subsequent phases of the logging operation.
- (2) Trees should not be felled into streams, except where no safe alternative exists. In the latter case, such trees should be removed promptly.

Skidding

- (1) Skidding should be done so as to avoid disrupting natural drainage and to prevent excessive soil displacement.

- (2) Stream channels or road ditches should not be used as skid trails.
- (3) Skid trails on steep slopes should have occasional water bars.
- (4) Servicing of equipment involving fuel, lubricants, or coolants should be performed in places where these materials cannot enter streams. Spent oil should be collected for proper disposal, never poured on the ground.
- (5) Upon completion of logging, erosion-prone areas should be mulched or seeded.

Mechanical Site Preparation

- (1) Avoid excessive soil compaction.
- (2) Minimize erosion and the movement of sediment into waters.
- (3) Prevent accumulation of debris in ponds, streams, or rivers.
- (4) Windrows, diskings, bedding, and planting with "furnow" type mechanical planters should follow contours.
- (5) Avoid complete diskings of steep slopes with extremely erodible soil.
- (6) Plant trees on contour.

Disposal of Debris and Litter

- (1) Logging debris in streams should be removed immediately.
- (2) Debris from landings should not be pushed into drains, streams or Streamside Management Zones (SMZs)
- (3) All trash associated with the logging operation should be promptly removed (not buried) and hauled to a legal disposal site.

3.0 Silvicultural Chemical Management

Description and Purpose

Pesticides are used on forest lands to facilitate meeting forest management objectives. The purpose of a pesticide application is to rid an area of undesirable vegetation or control insects or diseases to promote the establishment, survival, growth or maintenance of a desired species or condition.

Planning Considerations

Planning is an essential first step in reducing pest problems. A plan is needed by which the application of pesticides is utilized in an efficient manner that produces no adverse impacts on the environment. The maintenance of water quality is an important consideration in all aspects of pesticide operation planning.

Pesticide Selection

When the decision is made to use pesticides, choose products suitable for use on the target species and registered for the intended uses. Use only pesticides registered by the Environmental Protection Agency. Prior to using any pesticide, carefully read and follow all label directions.

When selecting pesticide options, more than effectiveness and cost should be evaluated. Consideration should be given to site factors, application conditions and techniques and products that can influence impacts to water quality.

Three main characteristics can greatly affect a pesticide potential to contaminate surface or ground water. They are solubility, absorption and breakdown rate.

1) Solubility

Solubility is the ability of a pesticide to dissolve in water. The greater the solubility, the greater the chance that the chemical will leach to ground water.

2) Absorption

Absorption is the inherent ability of a pesticide to bind with soil. Some pesticides stick very tightly to soil while others are easily dislodged. A greater absorption means a pesticide will remain longer in the soil and thus be less likely to leach down into the ground water before it has degraded. Absorption increases as soil organic matter increases.

3) Breakdown Rate

Breakdown rate or half-life is the time a pesticide takes to degrade or breakdown into other chemical forms. Pesticides that do not break down quickly can be hazardous if they move to ground water or surface water.

In a given situation, pesticides with the highest water solubilities, greatest persistence, lowest affinities for absorption to organic matter and other soil components, and highest application rates have the greatest potential for movement in surface water or to ground water. An alternative means of minimizing the potential movement of a pesticide is to select a non-broadcast application

technique for the same pesticide that reduces the amount of the chemical applied directly to the soil.

Procedures for Chemical Use

Proper pesticide management practices make efficient use of chemical while preventing contamination of surface water or ground water. Residues of pesticides used in forestry can affect water quality at several phases of the chemical use cycle. These phases are: 1) transportation, 2) storage, 3) mixing and loading, 4) application, and 5) cleanup and disposal. To minimize potential impacts on water quality, use of the following practices is encouraged.

A) Transportation

- (1) Inspect all containers prior to loading and ensure all caps, plugs and bungs are tightened.
- (2) Handle containers carefully when loading them onto vehicles.
- (3) Secure containers properly to prevent shifting during transport.
- (4) Check containers periodically enroute.
- (5) Limit access to containers during transport to prevent tampering.
- (6) Educate and inform the driver of the proper transportation precautions.
- (7) Never transport pesticides unless arrangements have been made to receive and store them properly.

B) Storage

- (1) Chemicals should be managed and stored in accordance with all applicable federal, state, or local regulations. These would include:
 - (a) The EPA container registration label, as printed on the label;
 - (b) Label instruction for use as provided by the manufacturer;
 - (c) Requirements of the use, application, and registration of pesticides;
 - (d) Requirements relating to the licensing of applicators.
- (2) All containers should be labeled in accordance with applicable federal, state and local regulations.

- (3) Store pesticides in their original containers with labels intact.
- (4) Do not store pesticides for extended periods in buildings that can not contain a complete spill from the largest container being stored.
- (5) Check containers prior to storage and periodically during storage to ensure that they are properly sealed.
- (6) Locate pesticide storage facilities at sites that minimize the possibility of impacts of water quality in case accidents or fires occur.
- (7) Use storage buildings that have floors constructed of concrete or other impermeable materials so that spills are easy to clean up.
- (8) Ensure that storage facilities can be secured under lock and key.
- (9) Post storage areas with a list of chemicals and quantities stored and notify the fire department about storage.

C) Mixing/Loading

- (1) Review the label before opening the container to ensure familiarity with current use directions.
- (2) Exercise care and caution during mixing and loading.
- (3) Replace pour caps and close bags or other containers immediately after use.
- (4) Mix chemicals and clean equipment only where possible spills would not enter streams, lakes or ponds.
- (5) Chemicals should not be applied where stream pollution is likely to occur through aerial drift.
- (6) Use a spray device capable of immediate shutoff.

D) Application

- (1) Refer to label directions before making a pesticide application.
- (2) Check all application equipment carefully, particularly for leaking hoses and connections and plugged or worn nozzles. Calibrate spray equipment periodically to achieve uniform distribution and rate.

- (3) Apply pesticides under favorable weather conditions. Never apply a pesticide when there is a likelihood of significant drift.
 - (4) Always use pesticides in accordance with label instruction, and adhere to all Federal and State policies and regulations governing pesticide use.
- E) Cleanup and Disposal**
- (1) Before disposal, containers should be rinsed as described in equipment cleanup.
 - (2) Cleanup should be in a location where chemicals will not enter any stream, pond, or where stream pollution might occur.
 - (3) Rinse empty pesticide containers and mixing apparatus as many times as needed. This flushing should be applied in spray form to the treated area, NOT into the ground near streams.
 - (4) Dispose of pesticide wastes and containers according to federal and state laws. Some pesticide wastes are specifically identified as hazardous wastes by law and must be handled and disposed of in accordance with hazardous waste regulations. For more information about proper management of waste pesticides, contact the Department of Health, Environmental Health Administration.

Other chemicals

Improper storage and handling of oil products and fuel can be a water quality hazard. Improper disposal of oil or fuel can contaminate ground water and seep into streams. The following are recommended:

- (1) Locate facilities away from streams and be prepared to clean up spills.
- (2) Know and comply with regulations governing the storage, handling, application (including licensing of applicators), and disposal of hazardous substances.
- (3) Do not transport, handle, store, load, apply or dispose of any hazardous substance or fertilizer in such a manner as to pollute water supplies or cause damage or injury to land, including humans, desirable plants and animals.
- (4) Do not store, mix, or rinse hazardous substances or fertilizers within the streamside management zone or where they might enter streams or waterways.
- (5) Develop a contingency plan for hazardous substance spills, including cleanup procedures.

- (6) Report all spills to the Department of Health, Environmental Health Administration.

4.0 Streamside Management Zone (SMZ)

The Special Management Zone (SMZ) is a specific area associated with a stream, lake, wetland or other waterbody that is designated and maintained during silviculture operations. The purpose of the SMZ is to protect water quality by reducing or eliminating forestry related outputs, i.e. sediment, nutrients, logging debris, chemicals, and water temperature fluctuations that can adversely affect aquatic communities. SMZs provide shade, streambank stability and erosion control, as well as detritus and woody debris which benefit the aquatic ecosystem in general. In addition, the SMZ is designed to maintain certain forest attributes that will provide specific wildlife habitat values. Snags, den and cavity trees as well as mast producing trees, left in the SMZ, are necessary to meet habitat requirements for certain wildlife.

The SMZ has specific criteria, that defines operational restrictions and special management objectives. In addition, the SMZ has a specific width which is based on the size and type of waterbody involved.

A Streamside Management Zone (SMZ) is an area covered with vegetation or ground cover on both sides of perennial, intermittent streams and other bodies of open water, where extra precaution is used in carrying out forest management practices. The SMZ also provides shade and functions as a buffer when fertilizers, pesticides, etc. are applied to adjacent lands. For practical purposes, an SMZ must be wide enough to protect water quality and stream characteristics. Precaution is needed in carrying out forest management practices in order to protect bank edges and water quality. Determining the necessary width involves in part a judgement factor based on reliable local experience.

SMZs should be used where: 1) water quality is impaired and adjacent land use contributes to that degradation, 2) good water quality exists and protection against potential future impairment is desired, 3) streambank erosion is a concern, 4) wildlife habitat enhancement is desired, and/or 5) silviculture practices are to be implemented, and 6) the lower edge of cropland, grassland, or forest land is adjacent to permanent or intermittent streams, or border streams, rivers, ponds or intermittent or permanently flooded, open-water wetlands.

SMZ benefits include the following:

- (1) Shade - Trees within the SMZs provide shade to maintain cool water temperatures which aid in the spawning of fish. Without trees and overhanging shrubs, stream temperatures would increase during the summer. Some fish species and aquatic organisms would then be unable to live in the streams. In the summer, water from shaded streams eventually flows into larger bodies of water and helps maintain its fish and aquatic life by keeping these waters cool all the way downstream.

- (2) Food - Leaves and insects drop into streams from overhanging trees and shrubs. In fact, 90% of the food in the forested streams comes from bordering vegetation.
- (3) Protection of Streambanks - Many streambanks are stabilized by streambank trees. They anchor banks and prevent erosion during periods of high water. Removing trees and shrubs and substituting shallow rooted grasses can lead to streambank collapse and stream sediment. Bank overhang is created by stream flows undercutting the stream bank and tree roots. Fish can rest, hide from predators, and feed in these protected areas.
- (4) Flooding - Healthy SMZs stabilize floodplains. During times of high water, SMZs reduce the velocity of floodwaters. Their dense vegetation and deep humus slow down racing waters. Forest floodplains suffer less damage when SMZs are protected during harvesting activities.
- (5) Recreation - The recreational activities that we enjoy in and around streams are many. This includes swimming, fishing, camping, hunting, and backpacking to name a few.
- (6) Timber Production - For those who grow and harvest trees, the fact is that trees often grow best in SMZs. Trees respond to those deep, fertile, and moist soils. Logging activities should not be eliminated within SMZs but modified to insure that stream channels and banks are protected from disturbance. SMZs are not timber harvest "keep out" zones, but there are locations where timber harvesting activities must be modified to protect the many benefits mentioned above.

Recommendations

SMZs should be maintained along all perennial streams or where forest disturbances occur and surface runoff will carry sediment loads. SMZs should be maintained around streams, ponds, perennial flowing natural springs, and all springs and reservoirs serving as domestic water supplies. The following best management practices are recommended:

- (1) The width of SMZs should be determined depending on the following conditions: slope of land adjacent to stream, soil erodibility, precipitation, knowledge of particular area, sensitivity of stream, etc. These factors can be obtained from soil maps, on-the-ground evaluation and measurements, weather data, etc.
- (2) SMZs should be designed on a case-by-case basis. Most important is that SMZs be consistent with stream characteristics and wide enough to protect water quality.

Soil Type	Percent Slope	SMZ Width (each side)
Slightly erodible	0-5	35'
Slightly erodible	5-20	35-50'
Slightly erodible	20+	50-160'
Erodible	0-5	35-50'
Erodible	5-20	80' minimum
Erodible	20+	160' minimum

Table 1. Recommended Widths for Streamside Management Zone

[NOTE: Please contact your local Natural Resources Conservation Service office to determine the erodibility factor of the soil before determining the proper width of the SMZ.]

- (3) On relatively flat terrain (0-5%) on slightly erodible soils, the width of an SMZ should be at least 35 feet wide on each side of a stream.
- (4) On relative flat terrain (0-5%) on erodible soils, the SMZ width should range between 35 to 50 feet on each side of a stream.
- (5) On slightly erodible soils with slopes ranging between 5 and 20 percent, the SMZ width should range between 35 to 50 feet wide on each side of a stream.
- (6) On erodible soils with slopes ranging between 5 and 20 percent, the SMZ width should range between 50 to 160 feet on each side of a stream.
- (7) On slightly erodible soils with slopes exceeding 20 percent, the SMZ width should be at least 80 feet on each side of a stream.
- (8) On erodible soils with slopes exceeding 20 percent, the SMZ width should be a minimum of 160 feet on each side of a stream.
- (9) Partial harvesting is acceptable. A minimum of 50% of the original crown cover or 50 square feet of basal area per acre, evenly distributed, should be retained in the SMZ. This may be adjusted to meet on-site conditions.
- (10) Clearcutting is always prohibited within the SMZ.

- (11) Designate SMZs to provide stream shading, soil stabilization, sediment and water filtering effects, and wildlife habitat.
- (12) Strive to protect the forest floor and understory vegetation from unnecessary damage. Do not remove (harvest) trees from banks, beds or slopes if it will destabilize the soil. Trees on the south and west banks provide the most critical shading of water.
- (13) Access roads should cross perennial or intermittent streams at or near a right angle.
- (14) Drainage structures such as ditches, cross drain culverts, water bars, rolling dips, and broad-based dips should be used on all roads prior to their entrance into an SMZ to intercept and properly discharge runoff waters.
- (15) SMZs may be desirable on intermittent streams for large drainage areas where wildlife is a major landowner concern or for other reasons.

5.0 Fencing

- (1) Fencing out livestock, pigs, and other animals in certain areas will help to prevent water quality degradation of streams, protect threatened and endangered plants, reduce soil compaction and maintain soil productivity. Fencing is applicable where desired forest reproduction, soil hydrologic values, existing vegetation, aesthetic values, and recreation are prevented or damaged by these animals.
- (2) Pastures should be fenced separately from woodlands. Consider maintenance as well as ease of construction when planning a fence location. By taking advantage of natural barriers such as cliffs, the cost of animal exclusion can be reduced. Also consider use of fences to protect vegetation that provides wildlife food and cover.
- (3) Fences should be permanent stock fences built in accordance with good construction principles and workmanship.

6.0 Wildfire Damage Control and Reclamation/Prescribed Burn

The prevention, control, and extinguishment of all wildfires on grass, brush, and watershed lands and the implementation of a prescribed fire program is a desirable goal. Where wildfires do occur, the first and foremost concern is to control the fire and limit the damage. Fire suppression activities can add to the problem of water quality protection.

The loss of vegetative cover, destruction of soil-holding feature of root masses, the exposure of bare mineral soil, is a combination that makes the area burned a highly erodible one. The effects of suppression efforts and equipment operations necessary to control and stop the fire can magnify the erosion problem.

The following are best management practices for wildfire control and reclamation:

- (1) The first and foremost concern in wildfire control is to prevent harm or damage to people and property. Fire line best management practices should incorporate minimum impact strategies, which meet land and resource management objectives;
- (2) Areas with bare mineral soils should be revegetated and areas where vegetative cover has been killed or severely degraded should be regenerated with plant species appropriate for the soil conditions;
- (3) First priority for revegetation/reforestation should be given to banks of surface water bodies so that the SMZ is reestablished;
- (4) Fire lines should be stabilized and, if necessary, revegetated. Erodible areas altered by suppression equipment activities should be repaired and revegetated as necessary;
- (5) Access road surfaces should be repaired and stabilized as necessary.
- (6) Whenever possible, avoid using fire suppression chemicals over watercourses and prevent their runoff into watercourses. Do not clean application equipment in watercourses or locations that drain into watercourses.
- (7) Provide advance planning and training for firefighters that considers water quality impacts when fighting wildfires. This can include increasing awareness so direct application of fire suppression chemicals to water bodies is avoided and fire lines are appropriately placed.
- (8) Include rehabilitative practices as part of suppression and post-suppression tactics and strategies to mitigate non-point source pollution.

6.1 Fire Line Construction and Maintenance

Fire line construction and maintenance is an essential part of forest and other land management activities. It deals with site preparation burning, prescribed burning, and wildfire defense and control. A number of control practices can be implemented during fire line construction to prevent unnecessary erosion. Periodic inspection and proper maintenance can prevent potential erosion on established firelines. The following are best management practices for fire line construction and maintenance:

- (1) Fire lines should be constructed on the perimeter of the burn area and along the boundary of the Streamside Management Zone. The purpose of protecting the Streamside Management Zone from fire is to safeguard the filtering effects of the litter and organic matter.

- (2) Fire lines should follow the guidelines established for logging trails and skid trails with respect to waterbars and wing ditches, and should be only as wide and as deep needed to permit safe prescribed burns or fire suppression needs;
- (3) Fire lines which would cross a drainage should be turned parallel to the stream or have a wing ditch or other structure allowing runoff in the line to be dispersed rather than channeled directly into the stream.
- (4) All fire lines should be assessed after the fire is controlled for appropriate stabilization, and if necessary, proper rehabilitation should be done while equipment and people are in place.

6.2 Prescribed Burn

- (1) Intense prescribed fire for site preparation shall be conducted only if it achieves desired results with minimum impacts to water quality.
- (2) Burning on steep slopes or highly erodible soils should be conducted when they are absolutely necessary and should follow carefully planned prescriptions.
- (3) Carefully plan burning to adhere to time of year, weather, topography, and fuel conditions that will help achieve the desired results and minimize impacts on water quality. With proper planning, prescribed fires should not cause excessive sedimentation due to the combined effect of removal of canopy species and the loss of soil-binding ability of the subcanopy and herbaceous vegetation roots, in streamside vegetation, small ephemeral drainages, or on very steep slopes.
- (4) Site preparation burning creates the potential for soil movement. Burning in the SMZ reduces the filtering capacity of the litter. All efforts should be made to plan burns to minimize impacts on the SMZ.
- (5) All bladed fire lines, for prescribed fire and wildfire activities, should be built so as to minimize erosion. If necessary, the fire lines should be stabilized with water bars and/or other appropriate techniques to control excessive sedimentation or erosion of the fire line. Include any erosion control practices in the construction of fire lines.

7.0 Reforestation

Reforestation refers to those operations undertaken to establish a new forest. Site preparation, for the purpose of forest regeneration, is a basic silvicultural tool where for competing vegetation and

reduction of logging debris are necessary. Common site preparation techniques include, manual, mechanical, fire, and herbicides.

Regeneration includes hand and machine planting and direct seeding. Since hand planting and direct seeding pose no water quality problems, BMPs are not necessary. Some mineral soil exposure does occur with machine planting and BMPs are offered.

- 1) Sites should receive the minimum preparation necessary to successfully control competing vegetation and establish a desirable timber stand. In general, the more intensive the treatment, the more concern for water quality.
- 2) When working on slopes, mechanical operations such as ripping, shearing, etc., should follow contours.
- 3) Hand planting, direct seeding or natural regeneration should be used on protected areas adjacent to streams or on slopes too steep to machine plant.

APPENDICES

- 1. Definition of Terms**
- 2. Road Construction Applications**
- 3. Streamside Management Zone**
- 4. Available Assistance**
- 5. Suggested Readings**

definition of terms

DEFINITION of TERMS:

Best Management Practices -- effective, practical, structural or nonstructural methods which prevent or reduce the movement of sediment, nutrients, pesticides and other pollutants from the land to surface or ground water, or which otherwise protect water quality from potential adverse effects of silvicultural activities. These practices are developed to achieve a balance between water quality protection and the production of wood crops within natural and economic limitations.

Buckling -- to saw felled trees into predetermined lengths.

Clearcutting -- the removal of all standing trees within a designated area.

Cross drain -- a cross ditch used to move water from one side of the road to the other side to prevent accumulation of runoff without the need of a culvert or bridge.

Culvert -- a conduit through which surface water can flow under roads.

Diversion ditch - a ditch built across the top of a slope to divert surface water from that slope.

Felling -- the process of severing trees from stumps.

Firebreaks -- naturally occurring or man-made barriers preventing the spread of fire.

Fireline construction -- the construction of a barrier used to prevent the spread of fire.

Intermittent streams -- streams that provide water flow continuously during some seasons of the year but little or no flow during the remainder of the year.

Landing -- an area in the field where logs are collected.

Non-point source -- a source of water pollution which are induced by natural processes, including precipitation, seepage, percolation, and runoff; and not traceable to any discrete or identifiable source.

Perennial streams -- streams which provides water flow at all times except during extreme drought.

Pesticides -- any herbicide, insecticide, or rodenticide, but does not include non-toxic repellents or other chemicals.

Pre-commercial thinning - the removal of selected trees within an established forest destined for commercial use.

Prescribed burning -- the controlled application of fire as a management tool in forest management.

Reforestation -- the successful reestablishment of tree species following harvest.

Silvicultural practices -- all forest management practices, including the establishment, composition, constitution, and growth of forests.

Site preparation -- the removal of unwanted vegetation and other material prior to reforestation.

Skid trails -- routes over which logs are moved to a landing or road.

Streamside Management Zone -- an area on each side of the banks and above the head of intermittent streams, perennial streams, and other drains or bodies of water where extra precaution in carrying out best management practices is needed to protect bank edges and water quality.

Waterbar -- a cross drainage diversion ditch and/or hump in a trail or road for the purpose of diverting surface water runoff into roadside vegetation, duff, ditch, or dispersion area to minimize the volume and velocity which can cause soil movement and erosion.

Wetlands -- geographic areas that are inundated or saturated by surface or groundwater at a frequency or duration sufficient to support (and under normal circumstances do support) a prevalence of vegetation typically adapted for life in saturated soil conditions.

Wing ditch -- a water turnout or diversion ditch constructed to move and disperse water away from the road and side ditches into adjacent undisturbed areas so that the volume and velocity of water is reduced on slopes.

Yarding -- the method of log transport from the harvest area to the storage area.

BROAD BASED DIPS

Definition:

A dip and reverse slope in a truck road surface with an outslope in the dip for natural cross drainage.

Purposes:

To provide cross drainage on insloped truck roads to prevent build-up of excessive surface runoff and subsequent erosion.

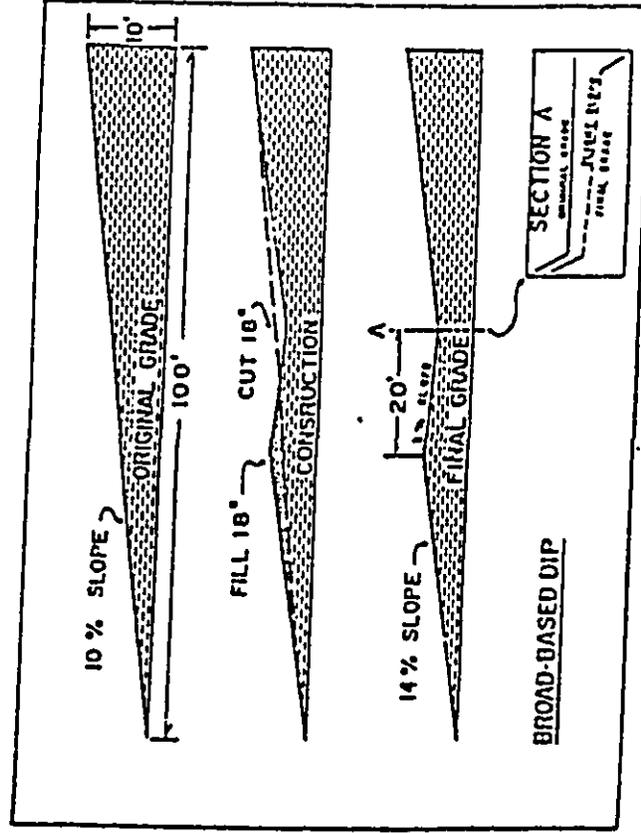
Conditions Where Practice Applies:

Use on truck roads and heavily used skid trails having a gradient of 10% or less. May be substituted for other cross drainage structures where no intermittent or permanent streams are present.

Guidelines:

- Proper construction requires an experienced bulldozer operator.
- Installed after the basic roadbed has been constructed and before major hauling use.

road construction applications



- On grades steeper than 8%, surface dips with stone (approx. 3" diameter) or gravel.
- Use dips on approaches to steep declines in heavily used skid trails.
- Discharge area should be protected with stone, grass sod, heavy litter cover or slash and logs to reduce the velocity and filter the water.

WATER BARS

Definitions:

An earthen or reinforced berm constructed across a truck road or skid trail.

Purpose:

To intercept and divert water from side ditches and truck road or skid trail surfaces, therefore minimizing erosion by decreasing the slope length of surface water flow.

Conditions Where Practice Applies:

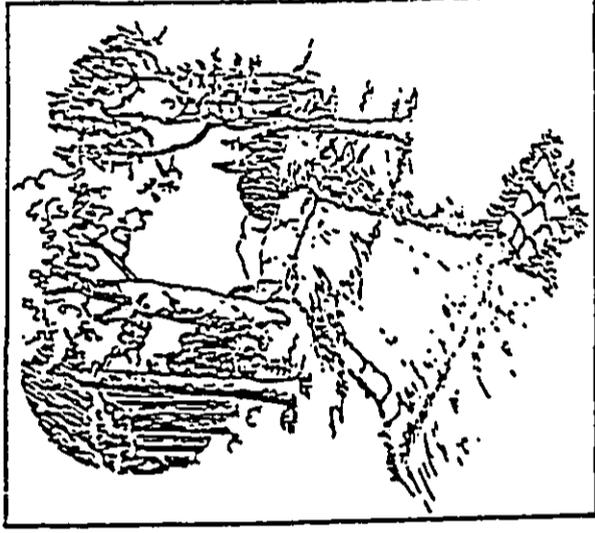
Utilized on any sloping truck road or skid trail where surface water runoff may cause erosion.

Guidelines:

- Start placement of water bars at the farthest skid trail and work back to the log landing and then to the truck road.
- Install water bars with a skidder blade, dozer blade, or by hand.
- Install water bars at the top of any sloping road or trail and at proper spacing along steep sections.

SPACING FOR BROAD BASED DIPS

Road Grade (percent)	Spacing Between Dips (feet)
2	300
4	200
6	165
8	150
10	140
12	130

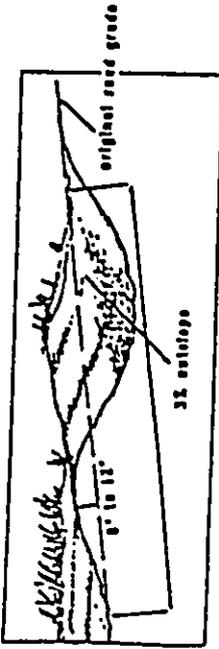


- Water bars may be shallow or deep depending on the need.
- Soil should be left along the lower side of the water bar.
- Should be constructed at a 30° - 35° angle downslope from a line perpendicular to the direction of the truck road or skid trail.
- Should drain at a 3% outslope onto undisturbed litter or vegetation.
- The uphill end of the water bar should extend beyond the side ditch line of the road or trail to fully intercept any water flow.
- The downhill end of the water bar should be fully open and extended far enough beyond the edge of the road or trail to disperse runoff water onto undisturbed forest floor.
- Place rocks, slash, or logs to disperse water coming from a water bar.
- If the road or trail is to be kept open after the harvesting operation, the following guidelines should be used in order to preserve effective water bars.

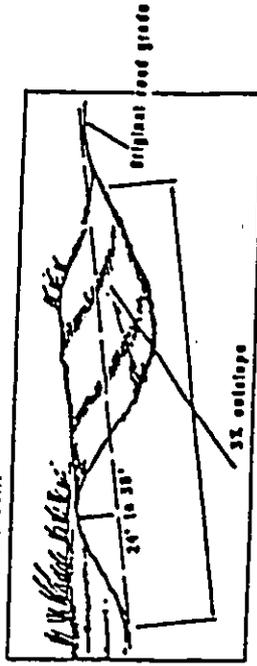
- Reinforce the water bars
- Keep travel to a minimum
- Use only in dry weather
- Make frequent inspections
- Maintain as needed

SPACING FOR WATER BARS	
Road/trail Grade (percent)	Spacing Between Water Bars (feet)
2	250
5	135
10	80
15	60
20	45
30	35

SHALLOW WATER BAR



DEEP WATER BAR



WATER BARS

Definitions:

An earthen or reinforced berm constructed across a truck road or skid trail.

Purpose:

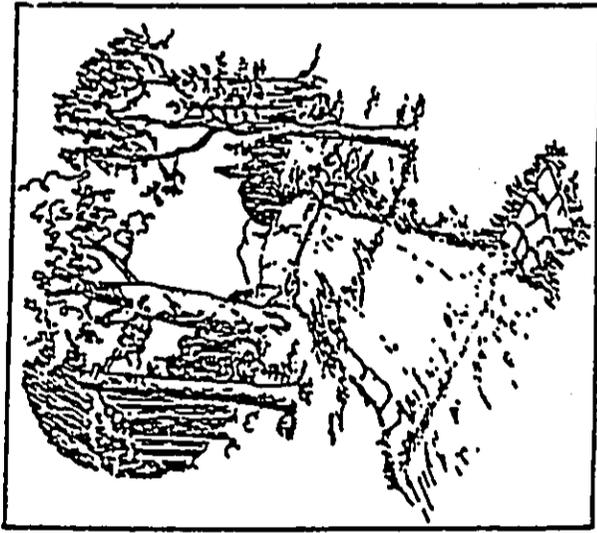
To intercept and divert water from side ditches and truck road or skid trail surfaces, therefore minimizing erosion by decreasing the slope length of surface water flow.

Conditions Where Practice Applies:

Utilized on any sloping truck road or skid trail where surface water runoff may cause erosion.

Guidelines:

- Start placement of water bars at the farthest skid trail and work back to the log landing and then to the truck road.
- Install water bars with a skidder blade, dozer blade, or by hand.
- Install water bars at the top of any sloping road or trail and at proper spacing along steep sections.



(9)

- When constructing roads on sidehill locations, ditch uphill side of the roadway to intercept surface runoff.

- Allow inlet end of culvert to extend into side ditch so that it intercepts water flowing in the ditch. Construct a berm across the side ditch to assist in diverting water into the culvert.

- Allow outlet end of culvert to extend beyond any fill and empty onto an apron of rock, gravel or logs.

- Space culverts according to road grade:

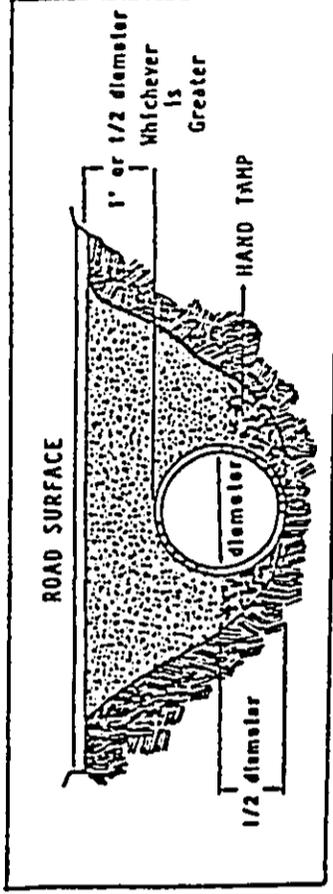
On gentle slopes (1-2%)	300 feet
On moderate slopes (3-10%)	150 feet
On steep slopes (10%+)	100 feet or less

- Culverts should be installed at a 30-35 degree angle downgrade.

- Culverts should be sloped at least 5 inches for every 10 feet of length to permit self-cleaning.

- When harvesting operation has been completed, the road should be stabilized by installing water bars and removing all pipe culverts from truck roads which will not be maintained.

- Culverts, when not maintained, are very likely to become blocked with rocks, ice or other debris. Runoff water can become rerouted over and around the culvert and may wash out sections of road into brooks, streams, ponds or wetlands. It is important to clean culverts regularly. Check after every storm.



- Culvert size selection should be based on the size of the drainage area of a forested watershed and should be able to handle the largest flows.

- Estimating drainage area by taking measurements on a USGS topographic map, using contour lines to define the drainage limits. The Soil Conservation Service can assist you with determination of drainage area.

(11a)

OPEN TOP CULVERTS

Definition:

A wooden culvert placed across truck haul roads to convey surface runoff and side ditch flows across to downslope side.

Purpose:

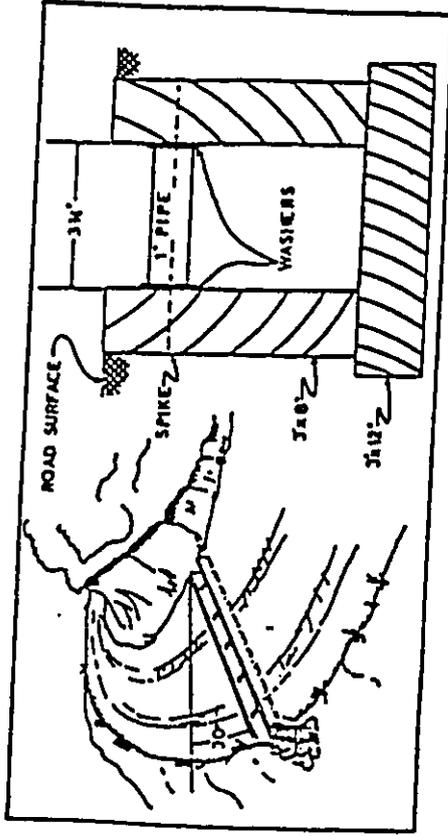
To collect and direct road surface storm runoff and upslope side ditch flows across road without eroding drainage system or road surfaces.

Conditions Where Practice Applies:

This is a temporary drainage structure for on-going harvesting operations. Property built and maintained, it can be used for cross drainage on roads of smaller operations as a substitute for a pipe culvert. This practice should not be used for handling intermittent or live streams or skid trail cross drainage.

Guidelines:

- Can be constructed of cull logs or from sawn lumber. If made of durable wood or treated material, these culverts will give many years of service.



- To be installed flush with the road surface and skewed at an angle not less than 30 degrees downgrade.
- Allow the inlet end to extend into the cut slope or side ditch so that it intercepts water.
- Allow outlet end to extend beyond any fill and empty onto an apron of rock, gravel or logs.
- Open top culverts must be cleaned regularly to remove sediments, gravel, and logging debris to allow normal function of structure at all times.

<u>SPACING FOR OPEN TOP CULVERTS</u>	
Road Grade (percent)	Spacing Between Culverts (feet)
2	300
4	200
6	165
8	150
10	140
12	130

INSLOPING

Definition:

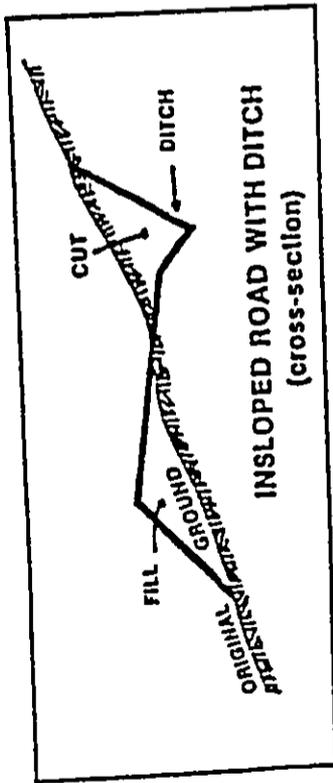
A section of road is sloped slightly (1-3%) toward the cut bank.

Purpose:

Effective way of limiting erosion because water is removed from the road surface quickly and diverted directly to the inside ditch which will carry the water into a culvert.

Condition Where Practice Applies:

Used when the soils are easily saturated or highly erodible. This will limit the amount of ditch water which will flow on to unstable fills.



(13)

OUTSLOPING

Definition:

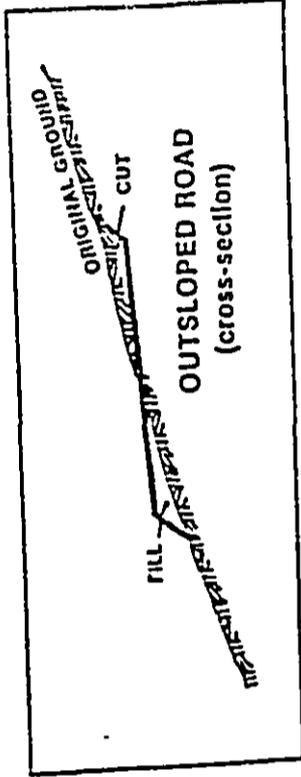
A section of road is sloped slightly (1-3%) from the cut bank to the outside edge of the road bed.

Purpose:

Effective way of limiting erosion because water is removed from the road surface quickly and diverted on to the forest floor.

Condition Where Practice Applies:

Used when the area is entirely rock, or when water can be diverted on to undisturbed forest floor.



(14)

CROWNING

Definition:

A section of road is sloped slightly (2-4%) from the center line of the road to the outside edges of the roadbed.

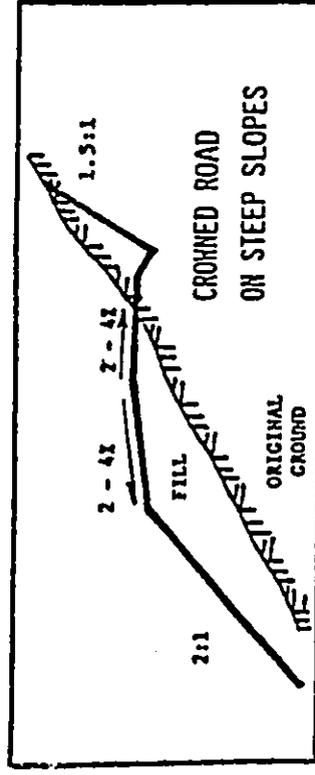
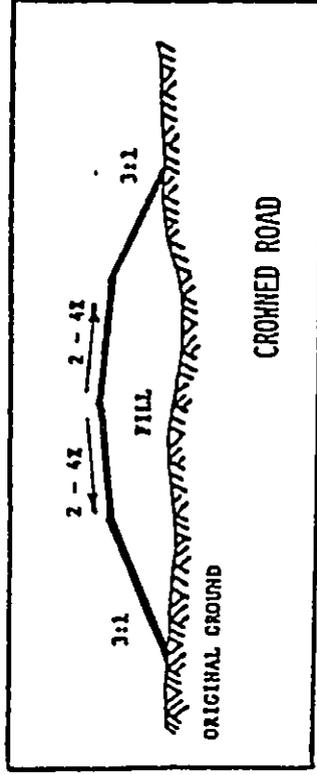
Purpose:

Effective way of limiting erosion because water is removed from the road surface quickly and diverted directly onto the forest floor or into a ditch which will carry the water into a culvert.

Conditions Where Practice Applies:

Used when soils are easily saturated or highly erodible when adjacent areas are relatively level with roadbed or on steep side hills.

streamside management zone



STREAMSIDE MANAGEMENT ZONE

Streamside Management Zones (SMZs) should be maintained along all perennial streams or where forest disturbances occur and surface runoff will carry sediment loads. SMZs should be maintained around streams, ponds, perennial flowing natural springs, and all springs and reservoirs serving as domestic water supplies.

The width of SMZs should be varied, depending on the following conditions: slope of land adjacent to stream, soil erodibility, precipitation, knowledge of particular area, sensitivity of stream, etc. These factors can be obtained from soil maps, on-the-ground evaluation and measurements, weather data, etc.

SMZs should be designed on a case-by-case basis. Most important is that SMZs be consistent with stream characteristics and wide enough to protect water quality.

The following is offered as a guideline:

Soil Type	Percent Slope	SMZ Width (each side)
Slightly erodible	0-5	35'
Slightly erodible	5-20	35-50'
Slightly erodible	20+	50-160'
Erodible	0-5	35-50'
Erodible	5-20	80' minimum
Erodible	20+	160' minimum

[NOTE: Please contact your local Natural Resources Conservation Service office to determine the erodibility factor of the soil before determining the proper width of the SMZ.]

available assistance

Available Assistance

Department of Land & Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, HI 96813

Telephone: (808) 587-0166 Facsimile: (808) 587-0160

Hawaii Branch

P.O. Box 4849
Hilo, HI 96720-0849
Telephone: (808) 974-4221
Facsimile: (808) 974-4226

Oahu Branch

2135 Makiki Heights Drive
Honolulu, HI 96822
Telephone: (808) 973-9778
Facsimile: (808) 973-9781

Maul Branch

54 High Street
Wailuku, HI 96793
Telephone: (808) 984-8100
Facsimile: (808) 984-8111

Kaui Branch

3060 Eiwa Street, Rm. 306
Lihue, HI 96766-1875
Telephone: (808) 274-3433
Facsimile: (808) 274-3438

Natural Resources Conservation Service
Prince Kuhio Federal Bldg., Rm 4-118
Honolulu, HI 96850
Telephone: (808) 541-2600

Hawaii District Offices

Hilo Office
154 Waiuanu Avenue
Hilo, HI 96720
Telephone: (808) 933-6955

Kaunakakai Office
P.O. Box 636
Kaunakakai, HI 96750
Telephone: (808) 322-2484

Kamuela Office
P.O. Box 1089
Kamuela, HI 96743
Telephone: (808) 885-6602

Natural Resources Conservation Service, cont'd.

Maul District Offices

Wailuku Office
70 S. High Street
Wailuku, HI 96793
Telephone: (808) 244-3729

Molokai Office
P.O. Box 376
Kaunakakai, HI 96748
Telephone: (808) 567-6868

Kaui District Office

Lihue Office
4334 Rice Street, Rm. 104
Lihue, HI 96766
Telephone: (808) 245-6513

Consulting Foresters

Contact the Division of Forestry and Wildlife at (808) 587-0166 for the most current list.

NOTES

Suggested Readings

1. "Logging Roads and Skid Trails, A Guide for Soil Protection and Timber Access," Indiana Department of Natural Resources - Division of Forestry, 21 pp.
2. Dellberg, Robert A., "Road Building for Small Private Roads," Mendocino County Resource Conservation District, Ukiah, CA., July 1992, 73 pp.
3. Walbridge, T.A. Jr., "The Direct Location of Forest Roads," Virginia Polytechnic and State University, Blacksburg, VA., 1990, 70 pp.
4. Walbridge, T.A. Jr., "The Paper Location of Forest Roads," Virginia Polytechnic and State University, Blacksburg, VA., 1990, 75 pp.
5. Walbridge, T.A. Jr., "Field Tables for the Direct Location of Forest Roads," Virginia Polytechnic and State University, Blacksburg, VA., 1991, 15 pp.
6. Wenger, Karl F., "Forestry Handbook, Second Edition," Society of American Foresters, 1984, 1,335 pp.
7. "Erosion and Sediment Control Guide for Hawaii," Soil Conservation Service, 1981, 178 pp.

suggested readings

**APPENDIX F: MARKET RESEARCH ON COMMODITY
WOOD PRODUCTS**

Market Research on Commodity Wood Products from 8 Non-Native, Hawaiian Grown Timber Species

prepared for
Hawaii Forest Industry Association
funded by
Hawaii Forestry & Communities Initiative

Executive Summary

Introduction

This report reviews eight exotic species grown in plantations in Hawaii and includes their physical and mechanical properties, the processing characteristics of their wood; and the potential quantities available as sawlogs and pulpwood from the Hamakua and Waiakea State owned plantations.

The report presents information and analyses relevant to assessing the technically feasible and market competitive development opportunities for wood and wood products industries in Hawaii using the eight species.

Species Descriptions

Individual species descriptions are provided in the report. Table 1 summarises these descriptions for the more important wood characteristics. For definitions of the terms used, the reader is referred to Section 1 of the main report.

Resource Availability

The only reliable resource information for the eight species came from inventory data of the Division of Forestry and Wildlife for the Waiakea and Hamakua State owned plantations. The anticipated annual quantities of sawlogs and pulpwood (including lumber sawmill residues) and lumber output are shown in Tables 2 and 3, based on the assumption that the plantations would be harvested over 15 years. In addition to the eight named species which are the subject of the report, there are other unidentified species in the Hamakua plantation which are of sawlog size and which could increase the combined Waiakea/Hamakua resource by about 18%.

Market Alternatives

Based on their timber properties at least three market alternatives for each species were defined. These are summarised in Table 4.

Demand for Wood Products in Hawaii (excluding pulp and paper)

Domestic Market

The study attempted, through interviews and surveys, to obtain data on demand for forest products in Hawaii but the results were insufficient to support rigorous analysis. There are, therefore, no measures of production, imports exports and consumption.

The annual per capita consumption of wood and wood panels combined in the USA as a whole is about 0.63 m³ (267 bf) and in Australia about 0.3 m³ (127 bf). Data provided from limited sources suggested that for Hawaii it is only 0.14 m³ (59 bf) for 1997/98. However, it seems likely, based on lifestyle comparisons with Australia and mainland USA, that total per capita consumption of wood products would be higher than this figure.

Export Demand

Three major demographic factors; population growth, urbanisation and improved living standards influence the growth in demand for forest products.

Asia will provide most of the majority of the 1.5 billion additional people in the world during the next 15 years. Currently, 60% of the Asian population is under 25; this age class represents the key emerging market for new homes, fittings and furniture.

Urban people use more industrial wood products than rural people and Asian cities are currently gaining around 50 million inhabitants per year.

Until 1997, living standards in most Asian countries were developing more rapidly than the rest of the world and it seems likely this trend will return. The supply/demand balance, cost competitiveness and availability of alternative high quality hardwoods suggest the emerging markets in Asia may provide a better opportunity for Hawaiian products than the mature markets in North America.

Annual demand for hardwood in the Asia Pacific region is around 55 million cubic metres and this is expected to grow to around 70 million cubic metres by 2010. The majority has been supplied from tropical countries where harvests are expected to decline and create opportunities for new suppliers. The main use of hardwood is for furniture (50%); housing, panelling and flooring make up a

further 30%. There has been a strong trend away from exports of logs to sawn timber and semi-processed products.

Future export markets for wood products in Asia will be driven by demand (increasingly for semi-processed products) in the Japanese, Korean, Chinese and Taiwanese markets.

Prices

Table 5 gives wholesale prices in Hawaii for a selection of sawn and dried hardwoods and sugi. The wholesale price in Hawaii is 40 to 50% below the retail price and 25 to 35% off the quoted trade price. This indicates that the wholesale price will be about \$955/m³ (\$2,250/Mbf) for the eucalypt species and Queensland maple and \$1,380/m³ (\$3,250/Mbf) for sugi and toon. Silver oak can achieve a price premium. Higher prices for the plantation species will be achieved with further value-adding such as dressing, moulding or production of components.

Cost Competitiveness

The relative cost competitiveness of Hawaiian manufactured sawn hardwood and plywood is analysed assuming delivery to Japan. Given the immature nature of the industry in Hawaii the costs provided are not a good indication of what could be expected from a new large scale industry. The landed log cost in Australia is USD. 40 - 50 and in Hawaii is USD 70 - 80. However, it will take time, investment and increasing harvest volumes before the Hawaiian industry can expect to achieve competitive cost structures. The Hawaiian unit cost of producing and distributing sawn hardwood would be the highest of the four countries analysed, i.e. Australia, Indonesia, Malaysia and Hawaii at current rates of exchange and its cost competitiveness is, therefore, least favourable. However, this disadvantage could be overcome by exploiting niche markets.

In the case of plywood, however, Hawaii would be in a more favourable position and could compete provided the annual log input to the mill is around 150,000 m³ (5.3 million ft³) which on present known volumes would be difficult. Without a much more detailed knowledge of the total resource, the possibility of delivering sufficient logs to one mill cannot be assessed. Veneer production for export could be competitive at a lower level of input.

Marketing Plan

The major issues which were raised during the study have been summarised in the context of the actions required to deal with the issues and the likely outcomes of these actions. These issues constitute the main actions required in a plan for developing and marketing plan for the Hawaii forest industry.

Table 1: Summary of the Species Descriptions

Common name	Botanical name	Density	Seasoning characteristics	Radial and tangential shrinkage	AR'	Natural durability	Strength group	Characteristic defects	Termite resistance	Lycetus susceptibility
Rose gum	<i>E. grandis</i> *	Medium	Easy to moderately difficult to season	Radial Tangential	3.4% 5.2%	Moderate	S4 SD4	Very prone to attack by marine borers	Not resistant Heartwood resistant to treatment with preservative	Resistant
Swamp mahogany	<i>E. robusta</i>	High	Rather difficult to season	Radial Tangential	7% 9%	Moderately durable to durable	S4 SD4 to SD5	Dimensionally unstable Brittleheart	Moderately resistant Heartwood untreatable	Susceptible
Saligna	<i>E. saligna</i>	High	Seasons easily but must be reconditioned after collapse	Radial Tangential	3.7% 5.4%	Moderate	S3 SD3	Dimensionally unstable Prone to attack by marine borers	Not resistant Heartwood resistant to treatment with preservative	Susceptible
Queensland maple	<i>Findleria brayleyana</i>	Medium	Moderately difficult to season because of interlocked grain	Radial Tangential	3% 6.5%	Moderately durable to durable	S6 SD6		Attacked by dry wood termites Heartwood resistant to treatment	Resistant
Tropical ash	<i>Fraxinus uhdei</i>	Medium	Seasons easily	Radial Tangential	2.1 to 4% 4.1 to 7%	Perishable	S5	Susceptible to blue stain	Not resistant Heartwood moderately resistant to treatment	Susceptible
Silver oak	<i>Gravilea robusta</i>	Medium	Seasons slowly	Radial Tangential	2% 5%	Moderately durable to perishable	S6 SD5	Liable to marine borer and pinhole borer attack	Not resistant Heartwood moderately resistant to treatment	Susceptible
Toon	<i>Toona ciliata</i>	Medium to low	Seasons easily	Radial Tangential	1.5% 3%	Hawaiian wood is perishable	S7		Probably not resistant in Hawaii The wood is resistant to treatment	Susceptible
Sugi	<i>Cryptomeria japonica</i>	Low	Care needed to avoid checks and splits	Radial Tangential	2% 4%	Moderately durable to durable	S7 SD8	Frequent knots	Not resistant Wood can be treated	Not attacked

Table 2: Annual sawn timber estimates in m³ and Mbf for Waiakea and Hamakua State owned plantations

	Annual sawlog volume		Annual lumber output	
	m ³	'000s ft ³	m ³	Mbf
Waiakea	23,300	820	9,300	3,950
Hamakua	44,300	1,560	17,700	7,500
Combined	67,600	2,380	27,000	11,450

Table 3: Annual pulpwood estimates in metric tonnes and US tons for Waiakea and Hamakua State owned plantations

	Annual roundwood pulpwood		Annual pulpwood residues		Total annual pulpwood	
	tonnes	US tons	tonnes	US tons	tonnes	US tons
Waiakea	10,900	12,100	9,300	10,300	20,200	22,400
Hamakua	9,800	10,800	17,700	19,500	27,500	30,300
Combined	20,700	22,900	27,000	29,800	47,700	52,700

Table 4: Appropriate Products for each Species

Common name	Botanical name	Appropriate products
Rose gum	<i>E. grandis</i>	Flooring, plywood, structural sawnwood and treated poles
Swamp mahogany	<i>E. robusta</i>	Flooring, structural plywood (including LVL, face veneers)
Saligna	<i>E. saligna</i>	As for rose gum. Older material may be suitable for face veneers
Queensland maple	<i>Flindersia brayleyana</i>	Decorative veneer, panelling, mouldings, furniture and joinery
Tropical ash	<i>Fraxinus uhdei</i>	Furniture, flooring, mouldings and structural plywood
Silver oak	<i>Grevillea robusta</i>	Furniture, joinery, mouldings and decorative veneer
Toon	<i>Toona ciliata</i>	Furniture, panelling, mouldings and decorative veneer
Sugi	<i>Cryptomeria japonica</i>	Panelling, poles, fencing and light construction

Table 5: Wholesale Prices in Hawaii for Sawn and Dried Hardwoods and Sugi

Product	PRICE	
	\$/m ³	\$/Mbf
Clear oak (DAR)	2,800	6,600
Mahogany (DAR)	1,600	3,780
<i>E. grandis</i> , <i>E. robusta</i> , <i>E. saligna</i> and Queensland maple	955	2,250
Silver oak	1,800	4,250
Toon and sugi	1,380	3,250

NOTE: Sugi is a softwood

Action Summary

ACTIONS	OUTCOMES
<ul style="list-style-type: none"> State wide inventory of standing timber on all islands containing commercial stands. All potentially important commercial species should be identified and inventoried, e.g. <i>Eucalyptus microcorys</i> on the Hamakua coast. Quality, as well as quantity, should be assessed. 	<ul style="list-style-type: none"> Area and volumes of commercial timber. Inventory of species worthy of further development Investors can determine if there is enough wood within economic hauling distance of a proposed processing plant. Investors can determine the size of processing plants according to the resource available. Investors can decide the most appropriate type of processing plant and product for the resource available.
<ul style="list-style-type: none"> Investigate the potential for expanding the resource base and assessing how likely it is that such an expansion will occur. 	<ul style="list-style-type: none"> Potential to expand the industry and gain increased economic development for the state. Allows long term predictions of development to be made.
<ul style="list-style-type: none"> Government assistance in the development of commercial forestry and forest industries in Hawaii includes support for species and provenance trials and infrastructure for industry 	<ul style="list-style-type: none"> Improved productivity from plantations. Provision of additional infrastructure to improve competitiveness.
<ul style="list-style-type: none"> Assess the durability of each of the species for various hazard levels and modes of attack and determine appropriate preservative treatments. 	<ul style="list-style-type: none"> Guarantee of durability under specified hazard levels. Most efficient use of the resource - consumer confidence in local products.
<ul style="list-style-type: none"> Establish internationally acceptable grading rules for both appearance and structural grades of lumber. The advice and assistance of National Hardwood Lumber Association should be sought. 	<ul style="list-style-type: none"> Production of commonly accepted commercial grades in a consistent manner. Cost efficient conversion of logs to a range of graded sawn products.
<ul style="list-style-type: none"> Define appropriate drying schedules and techniques under Hawaiian conditions. 	<ul style="list-style-type: none"> Production of well seasoned sawn timber to meet market requirements - consumer confidence in local products.
<ul style="list-style-type: none"> Statewide forest products market survey. 	<ul style="list-style-type: none"> Improved understanding of the local market and requirements. Opportunities for local grown and processed products. Informed forestry and forest industry development.
<ul style="list-style-type: none"> Investigation of export markets for Hawaiian forest products including cost competitiveness studies. Review option of joining American Hardwood Export Council. 	<ul style="list-style-type: none"> Controlled, informed and profitable penetration of export markets. Indication of likely margins for producers and selling agents. Leverage from AHEC's extensive and highly successful marketing efforts yielding cost effective marketing.
<ul style="list-style-type: none"> Publication of quarterly production, import, export and consumption statistics for forest products in Hawaii. 	<ul style="list-style-type: none"> Informed industry and government.
<ul style="list-style-type: none"> Promotion of the industry through: Brochures, technical literature, newsletters, samples, participation in trade shows, web sites. 	<ul style="list-style-type: none"> Industry recognition and expansion. Raises industry profile with potential growers, investors, processors, government and product buyers.
<ul style="list-style-type: none"> Targeted marketing which has identified customers and assessed their needs and then provides that market with a supply to meet these needs. 	

**APPENDIX G: PUBLIC COMMENTS REGARDING THE
DRAFT ENVIRONMENTAL ASSESSMENT**



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Ecoregion
 300 Ala Moana Boulevard, Room 3122
 Box 50088
 Honolulu, Hawaii 96850

MAY - 6 1999

In Reply Refer To: MR

Jon G. Giffin
 Hawaii District Branch Manager
 Division of Forestry and Wildlife
 P.O. Box 4849
 Hilo, HI 96720-9849

OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL

of pages 3

To Jon Giffin / Howard Horiuchi	From Mike Richardson
Dept. Agency DOFAW	Phone # 808-511-1699 x126
Fax # 808-974-4226	Fax # 808-511-3470
GENERAL SERVICES ADMINISTRATION	

Re: Draft Environmental Assessment for Commercial Harvesting of Forest Products and Subsequent Reforestation of the Waiakca Timber Management Area, Hawaii Island, Hawaii

Dear Mr. ^{Jon}Giffin:

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Environmental Assessment (EA) for Commercial Harvesting of Forest Products and Subsequent Reforestation of the Waiakca Timber Management Area on the island of Hawaii. The project sponsor is the Hawaii Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW). The proposed project involves the harvesting of timber and some nontimber forest products from the Waiakca Timber Management Area (WTMA) and the subsequent reforestation of harvested areas. The Service offers the following comments for your consideration.

The Draft EA states approximately 480 acres of undisturbed, native forest remain within the WTMA. Discussions with DOFAW staff have clarified that this 480-acre area will be off-limits to commercial timber cutting and in the remaining WTMA acreage, commercial timber cutting will take place only in areas where 60% or less native forest cover occurs. In areas where commercial cutting will be allowed, only nonnative trees will be intentionally cut. It was further clarified that the 60% figure is based on a current Hawaii County ordinance giving preferential tax treatment to private landowners who maintain at least 60% native forest on their land, of which a minimum of 20% is native overstory. The Service believes any area in the WTMA initially cleared and now containing at least 50% native forest has shown itself to possess the environmental factors needed to support native forest. Therefore, we recommend the DOFAW consider using 50% instead of 60% as the determining figure.

**DEA for Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Hawaii Island, Hawaii**

As the Draft EA acknowledges, the area surrounding the WTMA contains native plant species, of which some are federally listed as endangered. Our records indicate in recent years, the upper portion of WTMA has been inadequately surveyed for endangered plants. One endangered plant, *Cyrtandra giffardii*, and two plant species of concern, *Cyanea triomantha* and *Phyllostegia floribunda*, have been reported in the upper region of the WTMA as recently as the mid-1970's. Furthermore, nesting sites for native birds, including the federally endangered Hawaiian hawk (*Buteo solitarius*), are present in the area surrounding the WTMA. The area also contains relatively intact assemblages of native arthropods. For example, an individual *Megalagrion nesiotes*, a damselfly species proposed for Federal listing, was recently discovered in the Pu'u Maka'ala Natural Area Reserve. Finally, lava tubes, which often contain unique ecosystems that include rare, native arthropods are known to be present within the WTMA.

The Service agrees with the Draft EA in that project-related impacts to these resources can best be avoided or minimized if their locations are identified just prior to the actual time at which the proposed harvesting would occur. Accordingly, we recommend the preparation of a map clearly identifying the 480 acres of native forest which will not be subject to harvest. Other trust resources within the WTMA should be mapped and identified for special attention during the project. For example, we recommend surveys of existing lava tubes at the site be conducted prior to harvesting in order to document their conditions and locations so project-related impacts to cave systems can be minimized. We recommend flora located in the above-ground 'footprint' of all caves discovered in the WTMA area be left intact to protect root systems which provide a food source to cave fauna.

According to the Draft EA, a likely effect of timber harvesting within WTMA will be the improvement of feral pig habitat, and this is considered a beneficial outcome by the DOFAW. The Draft EA states the DOFAW plans to maintain a sustainable feral pig population at the site to increase hunting success rates in the area. However, a full discussion of how this will be done without adversely impacting important native species is absent. Because it is widely known feral pigs are detrimental to native forest ecosystems, the Service recommends that adverse project-related impacts from increased feral pig populations on native plants, birds, and arthropods within and surrounding the WTMA be more thoroughly assessed and measures proposed for reducing anticipated impacts be identified.

In summary, the Service believes impacts to plant and animal resources anticipated to result from the proposed project need some further assessment. The primary deficiencies in the Draft EA include inadequate maps showing the exact sites of proposed harvesting and other timber management activities, an incomplete identification of significant plant and animal resources existing in the proposed project area, and lack of a full discussion on anticipated, project-related

**DEA for Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Hawaii Island, Hawaii**

impacts to plant and animal resources from continued feral pig management, including a description of proposed measures to reduce those impacts to predominantly native environments. We recommend that the suggested maps and additional information be included in the Final EA.

The Service appreciates the opportunity to comment on the Draft EA. If you have any questions regarding these comments, please contact Fish and Wildlife Biologist Mike Richardson by telephone at (808) 541-3441 or by facsimile transmission at (808) 541-3470.

Sincerely,



Robert P. Smith
Pacific Islands Manager

cc: CZMP, Honolulu
DOFAW, Honolulu



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
P.O. BOX 4849
HILO, HAWAII 96720
(808) 974-4221
FAX (808) 974-4226

June 29, 1999

Robert P. Smith
Pacific Islands Manager
Fish and Wildlife Service
US Department of the Interior
PO Box 50088
Honolulu, HI 96850

Dear Robert:

Subject: Draft Environmental Assessment
Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Island of Hawaii
TMKs: 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22

Thank you for your letter, received on May 6, 1999, during the public comment phase for the subject project. We offer the following responses in the respective order of your comments:

1. DOFAW agrees with the statement "...any area in the WTMA initially cleared and now containing at least 50% native forest has shown itself to possess the environmental factors needed to support native forest." Therefore, Commercial timber management activities will not be conducted in those areas containing 50 percent or more native forest cover.
2. While there are no known T&E in the WTMA, every precaution will be taken to avoid any impacts to T&E in the surrounding areas. For instance, *Cyrtandra giffardii* have been located in the buffer area along the Stainback Highway. Pages 22 and 23 of the Draft EA detail the process for surveying the WTMA, and for the protection of any T&E species that are found.

Your recommendation to prepare a map that clearly identifies that 480 acres of native forest that will not be subject to commercial harvest is well taken, and such a map is provided in the Final EA. Maps of other resources, such as lava tubes, are not readily available. At each harvesting site, a cursory survey will be conducted. If any lava tubes are located, they will be documented. If the Service is aware of any surveys or maps of lava tubes, we would appreciate the information.

We question if proposed harvesting activities will cause serious damage or destruction to lava tubes habitats. Approximately 35 to 40 years ago, the entire WTMA was cleared with D9 tractors. The mechanical equipment which is being considered for harvesting timber within the WTMA is much smaller than the D9 bulldozers that were used for land clearing purposes.

3. DOFAW plans to maintain a sustainable feral pig population within the WTMA. As you know,

Mr. Robert P. Smith
Page 2

feral pig habitat is of considerable importance to a number of Hawaii residents, many of who have utilized the WTMA area for hunting for generations. Because the WTMA is not a pristine native forest area, DOFAW must insure that the concerns and rights of the hunting groups and other recreationists are also addressed. If it is determined, however, that increased pig populations will adversely affect any newly found T&E species, the area would be fenced and protected as stated in the Draft EA. Should the feral pig populations be increased to a point of causing unacceptable damage or changes to the plant communities within the WTMA or in adjacent areas, DOFAW will increase the harvest limits to reduce the impacts to native forest species.

4. All areas within the WTMA that were cleared and planted with non-native species are subject to commercial harvest at some time. The exact sites to be harvested will be negotiated in the Timber Land License.

Your letter, along with this response, will be reproduced in the forthcoming Final Environmental Assessment. We appreciate your interest and participation in this phase of the project.

Very truly yours,

JON G. GIFFIN
Hawaii District Manager

RECEIVED

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ECO. LIFE
WAIK. DIST

COOPERATIVE EXTENSION SERVICE

University of Hawai'i at Mānoa - College of Tropical Agriculture and Human Resources
United States Department of Agriculture Cooperating

April 28, 1999

Jon G. Giffen
Forestry and Wildlife Manager
DOFAW
19 East Kawili St.
Hilo, HI 96720

Dear Jon,

I am writing a few comments on the draft management plan for the Waiakea Timber Management Area. I hear you have had four bidders on the timber sale, so it looks like things are going well so far.

I like your idea that the WTMA will "provide a model for Hawaii's developing forest industry." (p. 5). I think DOFAW's strength as a land management agency is that you all can take risks that might be uneconomic for private owners. I am thinking of species trials or management strategies such as fertilization, thinning and pruning. While I understand that the goal of the WTMA is to provide an economic model, you would be able to provide important knowledge to landowners by taking risks and perhaps making mistakes so that they could avoid them.

I noted in Michael's survey that there are some older pole sized stands of eucalyptus. You note that you plan to allow pole sized stands to continue growing (p. 9), but some of these stands may be stunted permanently and would be better replaced with another species or perhaps replanted with different site management, eg. deep ripping.

You note that you will be using a modified shelterwood cut method for the eucalyptus. Do you plan on some natural regeneration from seed, or are you planning to fully plant the areas? I am concerned about damage to the seedlings when the overstory is logged, and I think that the eucalyptus seedlings would do better in full sun than in partial shade. Are mature eucalyptus trees used at all as wildlife habitat?

Do you have a list of other prospective species to replace the toon and ash (p. 17)? Richmond noted that in the arboretum general condition and appearance of *Tristania* only was fair, *Khaya* and *Swietenia* were fair to very poor, and *Cedrela* was poor (Species trials at the Waiakea Arboretum, Hilo, Hawaii, George B. Richmond, US Forest Service Research Paper PSW-4, 1963.). Are there better sites within the forest where you are considering these species?

Hawai'i County - 875 Komohana Street - Hilo, Hawai'i 96720 - Cable Address: UNIHAW
Telephone: (808) 959-9155 - Facsimile: (808) 959-3101
An Equal Opportunity/Affirmative Action Institution

I think it is a good idea to set up permanent growth plots for the major timber types (p. 25). I have been in contact with a forester in Australia who is doing research on Queensland maple. If I get some useful results from him I'll certainly pass them on.

Good luck with assessing the harvest proposals and please keep me in touch with how things go.

Sincerely,



J. B. Friday
Tropical Forestry Extension



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE

P.O. BOX 4849
HILO, HAWAII 96720
(808) 974-4221
FAX (808) 974-4226

June 29, 1999

Dr. J. B. Friday
Tropical Forestry Extension
875 Komohana Street
Hilo, HI 96720

Dear J. B.:

Subject: Draft Environmental Assessment
Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Island of Hawaii
TMKs: 1-88-12:3, 2-4-8:1,10 and 22

Thank you for your letter of April 28, 1999, received during the public comment phase for the subject. We offer the following responses in the respective order of your concerns for the proposed project:

1. The Division of Forestry and Wildlife (DOFAW) will continue to conduct limited species trial planting projects within the Waiakea Timber Management Area (WTMA) and will conduct forest management timber stand improvement practices for fertilization, thinning and pruning. The information that we obtain from our experience in the WTMA will be shared with the public to include field trips to the areas of interest if necessary.
2. We agree with your comment that there are areas within the WTMA that were planted with eucalyptus species that are producing lower annual volume increases than we desire but the volume growth rate does exceed the National acceptable rate for an area which is considered as acceptable for producing timber. As you suggested deep ripping of the "pahoehoe" lava may enhance tree growth but the cost of deep ripping is costly. We made several inquiries as to the estimated cost of deep ripping an acre of "pahoehoe" lava for tree planting. The average

Dr. J.B. Friday
Page 2

estimated cost was \$4,000 per acre. At that cost, it is doubtful that any commercial forestry project can afford to deep rip an area for tree planting purposes.

3. DOFAW does not depend on natural regeneration for establishing a new eucalyptus timber stands. We have learn that it is paramount that an area be replanted as soon as it has been harvested. DOFAW wishes to leave one dominate tree per acre, but this is still subject to negotiation with the licensee and obtaining an approval from the Board of Land and Natural Resources, for aesthetic and wildlife. Birds and insects will benefit from the trees that will not be harvested. These residual trees may be harvested during the second rotation. Leaving one dominate tree per acre will not significantly retard the growth of the new planted tree seedlings in the area. The public will not tolerate clear cutting in WTMA.
4. The major timber species within the WTMA will be composed of eucalyptus, Queensland maple and tropical ash. Most of the toon planting will be converted to eucalyptus species. Some of the higher quality sites that are currently planted with eucalyptus will be converted to Queensland maple. Although the tropical ash has not done as well as expected, there is a sizeable volume of ash within the WTMA. DOFAW is currently assisting a local manufacture in developing a local market for tropical ash. Therefore, a final decision as to the management of the tropical ash within the WTMA has not be determined. The planting of other high quality hardwood tree species will be done on trial planting bases.
5. It is important to establish permanent growth plots within the WTMA to obtain growth data for the various tree species so that management can apply the proper forest management strategies to attain the desired goals for the WTMA. DOFAW appreciates receiving forestry information from anyone that will enhance the management of its forested lands.

Your letter, along with this response, will be reproduced in the forthcoming Final Environmental Assessment. We appreciate your interest and participation in this phase of the project.

Sincerely,

Jon G. Giffin
Hawaii District Manager

PHONE (808) 594-1888

FAX (808) 594-1865



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

May 3, 1999

Mr. Jon G. Giffin
Hawaii District Branch Manager
Division of Forestry and Wildlife
Department of Land and Natural Resources
P.O. Box 4849
Hilo, HI 96720

EIS 291

Re: Draft Environmental Assessment for Commercial Harvesting of Forest Products and Subsequent Reforestation of the Waiukea Timber Management Area
TMK (3) 1-S-012:003, 2-4-008:001, 2-4-008:010, and 2-4-008:022

Dear Mr. Giffin:

Thank you for the opportunity to comment on the draft environmental assessment for "Commercial Harvesting of Forest Products and Subsequent Reforestation of the Waiukea Timber Management Area." The Office of Hawaiian Affairs (OHA) has a few concerns about the proposed project.

Because forestry can have large-scale environmental impacts such as soil erosion and non-point source pollution, OHA would like DOFAW to take an *ahupua'a*-based management approach to the project. We hope that any timber harvesting will be done in accordance with the concept of *malama 'aina*, as with any other industry relying on the exploitation of natural resources. We are encouraged by some of the language in the draft EA, which appears to reflect some of these ideas.

However, the draft EA lacks detail on the projected development of the timber industry, including economic benefits and costs. In discussing the potential for increased employment, the document should also address whether Hawaii currently has the necessary downstream processing infrastructure or if it will have to be developed concurrently with the timber harvesting. It should also consider possible contingency plans for receiving and shipping raw materials, should processing capacity in Hawaii be stricken by an over- or under-supply that create disruptive processing bottlenecks. The



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES*
DIVISION OF FORESTRY AND WILDLIFE

P.O. BOX 4849
HILO, HAWAII 96720
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FAX (808) 974-4226

June 29, 1999

Colin Kippen
Deputy Administrator
State of Hawaii
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813

Dear Mr. Kippen:

Subject: Draft Environmental Assessment
Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Island of Hawaii
TMKs: 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22

Thank you for your letter of May 3, 1999, received during the public comment phase for the subject project. We offer the following responses in the respective order of your comments:

1. DOFAW's policy is to conduct timber harvesting on a sustained yield basis, which parallels the concept of *malama 'aina*.
2. We have provided information regarding economic resources on pages 13 and 25-26 of the Draft EA. We agree that the Draft EA does not provide extensive detail on the projected development of the timber industry. It is not within the scope of a draft environmental assessment to do so. A marketing study was conducted by Jaakko Poyry Consulting in February 1999 for the Hawaii Forestry Industry Association. An executive summary of the study has been added as an appendix to the Final EA.

There have been studies concerning the development of local processing facilities. The development of these facilities will be determined by the Request for Proposals and the Timber Land License negotiation process.

3. Several public meetings have been held regarding the development of WTMA Management Plan and the Draft EA. The local Native Hawaiian community was represented at those meetings. Several newspaper articles have been printed regarding the WTMA, and the Draft EA is available at three county libraries (Hilo, Keaau, Mt. View), and a notice has been published in the Office of Environmental Quality Control *Environmental Review*.

We feel that there have been ample opportunities for public review and comment, and that Native Hawaiians and others have indeed taken advantage of these opportunities. Furthermore, Native Hawaiians have the opportunity to give additional oral or written testimony to the Board of

Mr. Colin Kippen
Page 2

and Natural Resources when it conducts its meeting to review the WTMA project proposal (Timber Land License) for approval.

4. DOFAW admits that there is confusion regarding the portions of TMKs that will be available for timber harvest. This has been clarified in the Final EA.
5. DOFAW has actively sought input concerning the use and management of the WTMA from all sectors of the public, including Native Hawaiians and special interest groups. We would like to reiterate that Native Hawaiian gathering rights will be protected and honored within the WTMA.

Your letter, along with this response, will be reproduced in the forthcoming Final Environmental Assessment. We appreciate your interest and participation in this phase of the project.

Very truly yours,

JON G. GIFFIN
Hawaii District Manager

cc: Sebastian Aloit, Land and Natural Resources Division Officer

enc.: Market Research on Commodity Wood Products from a Non-Native, Hawaiian Grown Timber Species

Stephen K. Yamashiro
Mayor



Virginia Goldstein
Director

Russell Kokubun
Deputy Director

County of Hawaii

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

May 3, 1999

Mr. Jon G. Griffin
State of Hawaii
Department of Land and Natural Resources
Division of Forestry and Wildlife
Hawaii District Branch Manager
P. O. Box 4849
Hilo, Hawaii 96720

Dear Mr. Griffin:

SUBJECT: Review of General Plan Draft Economic Assessment

We have received and reviewed the document Draft Environmental Assessment, Commercial Harvesting of Forest Products and Subsequent Reforestation, Waiakea Timber Management Area, Island of Hawaii. The following inconsistencies have been noted:

- 1) According to our records the parcels in question have the following designations:

	LAND USE DESIGNATION	
TMK Number	STATE	COUNTY
1-8-12-3	CONSERVATION	No zoning designation applied
2-4-08-22	CONSERVATION	No zoning designation applied
2-4-08-1	mainly CONSERVATION; the exception is a remanent of Parcel 1 located along the makai boundary of Parcel 22 zoned AGRICULTURE	No zoning designation applied

Mr. Jon G. Griffin
State of Hawaii
Department of Land and Natural Resources
Page 2
May 3, 1999

2-4-08-10

AGRICULTURE

mainly A-3a with a small
portion along the mauka
border remaining not zoned
by the County.

It is also noted on Maps A-3 and B-7 that a portion of the Puu Makaala Natural Area Reserve, a portion of TMK 2-4-08-19, is included in the shaded area of the Waiakea Timber Management Area. As per a conversation with Howard Horiuchi, Forest Supervisor, this area is not included in the proposed harvesting area.

- 2) APPENDIX E: BEST MANAGEMENT PRACTICES FOR MAINTAINING WATER QUALITY IN HAWAII is missing from our copy of the Draft Environmental Assessment.
- 3) A potential conflict in goals is noted in section V. ENVIRONMENTAL IMPACTS OF PROPOSED ACTION, B. IMPACTS ON BIOLOGICAL RESOURCES, 2. Fauna, page 24, and in section VIII DETERMINATION, 2. The proposed project does not curtail the range of beneficial uses of the environment, page 30, wherein it is stated that historical timber harvesting resulted in an increase in the number of feral pigs, however, it is then postulated that the improvements to the existing access roads may lead to increased hunting pressure on the pigs at which time the access roads may have to be closed after harvesting. This it seems would conflict with the stated goal of encouraging opportunities for public enjoyment and recreation activities.

We have no further comments or objections on the information and the findings presented in the document submitted to us for review. Any inquiries can be directed to Chris Corley of our Hilo office at 808-961-8288.

Sincerely,


for VIRGINIA GOLDSTEIN
Planning Director

CC:gp
E:\wpwin60\chris\ldfw01.cc

c: OEQC

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APR 20 11 04 AM '99
STEPHEN K. YAMAGUCHI
MAYOR
COUNTY OF HAWAII



Virginia Goldstein
Director

Russell Kokubun
Deputy Director

County of Hawaii

PLANNING DEPARTMENT

25 Aupuni Street, Room 109 • Hilo, Hawaii 96720-4252
(808) 961-8238 • Fax (808) 961-8742

April 26, 1999

Mr. Jon G. Giffin, Hawaii District Manager
Division of Forestry & Wildlife
Department of Land and Natural Resources
P. O. Box 4849
Hilo, HI 96720

Dear Mr. Giffin:

Waiakea Timber Management Area
Commercial Harvesting of Forest Products - Draft EA
TMK: (3) 2-4-008-001, 10, & 22, etc.

We have reviewed the draft Environmental Assessment for the Commercial Harvesting of Forest Products and Subsequent Reforestation of the Waiakea Timber Management Area, Island of Hawaii.

The EA states that all of the proposed sites are within the Conservation District, however, our records show that TMK:2-4-008:010 is in the Agricultural District and is zoned Agricultural (A-3a) by the County. The harvesting of timber is a permitted use in the A-3a Zone. We have no other comments or objections to this proposal.

Thank you for the opportunity to comment. If we can be of any further assistance, please feel free to contact us.

Sincerely,

A handwritten signature in black ink, appearing to read "V. Goldstein".

VIRGINIA GOLDSTEIN
Planning Director

RKN:gp

E:\wp60\rodney\99-2\LG\Giffin.Ltr



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
P.O. BOX 4849
HILO, HAWAII 96720
(808) 974-4221
FAX (808) 974-4228

June 29, 1999

Ms. Virginia Goldstein
Planning Director
25 Aupuni Street
Room 109
Hilo, HI 96720

Dear Ms. Goldstein:

Subject: Draft Environmental Assessment
Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Island of Hawaii
TMKs: 1-8-12:3 and 2-4-8:1,10 and 22

Thank you for your letters of April 26, 1999 and May 3, 1999, received during the public comment phase for the subject. We offer the following responses in the respective order of your concerns for the proposed project:

1. The Land Use Designation for the State land parcels that are involved in the proposed project will be corrected per your comments and reflected in the Final Environmental Assessment.
2. All of the exotic tree planting areas within the Puu Makaala Natural Area Reserve are not included within the proposed WTMA project.
3. We intentionally omitted the attachment of the Department of Land and Natural Resources's "Best Management Practices guidelines for timber harvesting activities. A copy is enclosed for information and use.
4. The conflicting statement within the Draft Environmental Assessment will be corrected to say that the proposed project will limit some recreational use within the WTMA; especially, at the current harvesting site and may be restricted in certain areas where game

Ms. Virginia Goldstein
Page 2

management practices are initiated to increase the population of game animals. But, the proposed project will increase the total recreational use for the WTMA because more accesses will be built and/or maintained by the timber harvesters and by the Division of Forestry and Wildlife.

Your letters, along with this response, will be reproduced in the forthcoming Final Environmental Assessment. We appreciate your interest and participation in this phase of the project.

Sincerely,

Jon G. Giffin
Hawaii District Manager

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII



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

DEPUTIES
JANET E. KAWILO

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES --

HISTORIC PRESERVATION DIVISION
Kakuhikawa Building, Room 555
601 Kamohala Boulevard
Kapolei, Hawaii 96707

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

April 7, 1999

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FOREST
HAWAII DISTRICT

MEMORANDUM

LOG NO: 23178 ✓
DOC NO: 9904PM02

TO: Jon G. Giffin, Hawaii District Branch Manager
Division of Forestry and Wildlife

FROM: Don Hibbard, Administrator
Historic Preservation Division *DH*

SUBJECT: Draft Environmental Assessment for Commercial Harvesting of
Forest Products and Subsequent Reforestation of
Waiakea Management Area, Waikea, Upper Waiakea and
Ola'a Forest Reserves, South Hilo and Puna, Hawaii Island
TMK: 1-8-12:3; 2-4-8:1; 2-4-8:10, and 2-4-8:22

The Draft EA states that there are no known historic sites in the project area. As far we know this is true, but it is unclear as to whether or not any of the 12,000 plus acres that comprise the Waiakea Timber Management Area (WTMA) have ever been surveyed by an archaeologist. If you have any information in your files that indicates that an archaeological survey of any kind was done we suggest that you include this information in the Final EA.

It is our understanding that much of the WTMA was cleared prior to the beginning of reforestation about 35 years ago. It is highly unlikely that any significant historic sites would remain after the clearing. Some sites could be located, however, in the 460 acres of undisturbed native forest. The kinds of sites that one might expect to occur in this area would be primarily related to resource collection and processing (plants and birds, for example). Unfortunately, such sites leave little evidence and are hard to find. If historic sites should be found in the areas that are going to be harvested our office should be notified. With this understanding we believe that the proposed activities will have "no effect" on significant historic sites.

PM:amk



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE

P.O. BOX 4849
HILO, HAWAII 98720
(808) 974-4221
FAX (808) 974-4226

June 29, 1999

Don Hibbard
Administrator
Historic Preservation Division
State of Hawaii Department of Land and Natural Resources
Kakuhihewa Building, Room 555
601 Kamokila Boulevard
Kapolei, HI 96707

Dear Mr. Hibbard:

Subject: Draft Environmental Assessment
Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Island of Hawaii
TMKs: 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22

Thank you for your letter of April 7, 1999, received during the public comment phase for the subject project. We offer the following responses in the respective order of your comments:

1. DOFAW does not have any information that indicates if an archaeological study of any kind has ever been conducted within the WTMA.
2. The Timber Land License will include a requirement that if any evidence of archaeological or historic sites is found, all harvesting and silvicultural activities will cease in that area immediately. The Historic Preservation Division will be notified for further evaluation.

Your letter, along with this response, will be reproduced in the forthcoming Final Environmental Assessment. We appreciate your interest and participation in this phase of the project.

Very truly yours,

JON G. GIFFIN
Hawaii District Manager

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FORESTRY AND WILDLIFE
HAWAII DISTRICT

Hawaii Audubon Society
850 Richards St., Suite 505
Honolulu, Hawaii 96813
Ph: (808) 528-1432

Jon Giffin
Department of Land and Natural Resources
Division of Forestry and Wildlife
P.O. Box 4849
Hilo, Hawaii 96720

Dear Mr. Giffin,

The following comments are in regard to the draft environmental assessment for the Waiakea Timber Management Area Commercial Harvesting and Reforestation. We hope they prove useful to the environmental review process.

General Comments:

Simply requiring that all forest management activities comply with the State's Best Management Practices (BMPs) for maintaining water quality without agency provisions for monitoring and enforcement may again shortchange public resources (cf. Office of Environmental Quality and Control's Audit of Mitigation Measures). Further the BMPs themselves apparently do not specify provisions for applicants to monitor the effectiveness of the BMPs employed (e.g. monitoring water diversions during heavy rain events or monitoring pesticide, herbicide, and/or fertilizer levels in Stream Management Zones). It would seem to be in the applicant's monetary interests to be able to effectively re-direct chemical management practices to avoid waste. HAS would prefer that a policy of non-chemical management practices be instituted (e.g. manual thinning and canopy management to control weeds) given the risks of accumulated toxins in resident endangered species and downstream fauna and the loss of potentially important food resources. Addressing these concerns during the pre-harvest planning stages should help to alleviate risks to public trust resources.

Timber Harvesting:

The BMPs recommendation that excessive soil compaction should be avoided is a rather subjective guideline. We recommend that pre-harvest plans specify allowable percentages of compaction in work areas as a more quantifiable and enforceable guideline. Also the BMPs apparently do not mention the possibility of phasing work to minimize disturbances to large areas. Again, pre-harvest plans should consider phasing work especially near ecologically sensitive areas. However, the cumulative impact of repeated entries on a smaller scale needs to be weighed against the impact of single, large-scale harvest efforts.

Potentially Inadequate Native Invertebrate Surveys:

HAS is concerned about the adequacy of the native invertebrate surveys to be conducted prior to harvesting. The assumption that even larger populations of native invertebrates exist in unharvested stands of adjacent native vegetation may be not be supportable given the ability of many native invertebrates to exist quite well in alien vegetation. Competent surveys of areas to be harvested as well as areas left unharvested are needed to ensure that any locally abundant populations of native invertebrates remain abundant and any rare species remain protected. Given the general lack of biological information on the role of native invertebrates in nutrient cycling, food webs, and pollination it seems best to err on the side of conservation in regard to preserving known populations of native invertebrates.

Potentially Inadequate Hawaiian Bat Surveys:

Visual surveys for any roosting Hawaiian bats are probably not adequate to determine resident populations of this endangered species. We recommend the use of dusk and nighttime radar surveys to detect the presence of any Hawaiian bats in management areas so that appropriate management actions can be taken. Again, we recommend not using pesticides and herbicides to avoid risks to non-target flora and fauna.

Thank you for your time and consideration of these comments. If we can be of any more assistance please feel free to contact us at the above address.

Sincerely,



Daniel K. Sailer
Conservation Chair, Hawaii Audubon Society



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
P.O. BOX 4849
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June 29, 1999

Daniel K. Sailer
Conservation Chair
Hawaii Audubon Society
850 Richards Street, Suite 505
Honolulu, HI 96813

Dear Mr. Sailer:

Subject: Draft Environmental Assessment
Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Island of Hawaii
TMKs: 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22

Thank you for your letter, received on May 11, 1999, during the public comment phase for the subject project. We offer the following responses in the respective order of your comments:

"General Comments"

1. The State's Best Management Practices (BMPs) are intended to act as guidelines for maintaining water quality during and after timber harvesting. The contractee will be required to follow these broad guidelines. The detailed standards and specifications will be included in the Timber Land License (TLL). The license will include specific compliance requirements and monitoring provisions.
2. There are no perennial streams in the WTMA, and surface runoff will carry minimal sediment loads. Therefore, there are no Streamside Management Zones (SMZs) within the WTMA.
3. Economics and environmental health both are considered when DOFAW develops silvicultural plans for forestlands. In the WTMA, silvicultural chemical management will be limited to when it is deemed both necessary and practical. It is required by law that all pesticides be used in strict adherence to label directions and regulations concerning storage, transportation, mixing, application, and disposal. The State of Hawaii Department of Agriculture inspects, regulates, and enforces pesticide use in the state.

To control competing vegetation, minimal amounts of glyphosate-based herbicides (such as Roundup® or Rodeo®) will be used. Glyphosates are rated by the EPA as "practically nontoxic" in acute toxicity tests for aquatic invertebrates and fish. Rodeo is even approved for use in controlling weeds in delicate ecosystems such as estuaries, wetlands, and streamsides.

Chemical insecticides will not be used. Granular fertilizer will be used sparingly on eucalyptus (one-time application of approximately 2 oz. per seedling) and high value hardwoods such as

Mr. Daniel K. Sailer
Page 2

Queensland maple (about three times per year for two years, approximately 2 oz. per seedling per application).

"Timber Harvesting"

4. As mentioned in the draft EA, soils in the WTMA are thin, extremely stony (stones between 10 and 24 inches in diameter comprise at least 60 percent of the volume), and have formed over a'a or pahoehoe lava. The soils are made up of "muck," which is well-decomposed organic soil material. The potential for soil compaction in the WTMA is negligible. Additionally, high-use areas (such as landings) will be scarified and replanted after harvest.
5. Please see pages 15 through 17 of the draft EA regarding "phasing work." Concerns regarding the cumulative impact of repeated entries on a smaller scale versus the impact of a single harvest entry are acknowledged. DOFAW foresters recognize that a balance must be achieved.

"Potentially Inadequate Native Invertebrate Surveys"

6. DOFAW recognizes that current biological surveys may be inadequate for certain purposes. Because of this, DOFAW management must base its decisions on experience and education. Management proposes to harvest parcels that are scattered throughout the area so insect and other invertebrate populations have time and opportunity to become reestablished in adjacent areas. Again, the WTMA was cleared completely 35 to 40 years ago, and many native populations have reestablished themselves. DOFAW is not aware of any endangered, rare, or threatened invertebrates in the WTMA.

(Funding for DOFAW has been decreasing each year, which is a primary reason for limited biological surveys completed within the agency. We must depend on other agencies and organizations, both public and private, for information and surveys. DOFAW would appreciate legislative support for conducting inventories and surveys.)

"Potentially Inadequate Hawaiian Bat Surveys"

7. Visual bat surveys admittedly are a non-scientific way of determining resident bat populations. Because bats do fly before dark, visual surveys are still an effective means of determining the probability of the presence of roosting bats. We agree that sophisticated equipment should be used in conjunction with the visual surveys.
8. Please see answer #3 above regarding silvicultural chemical use.

Your letter, along with this response, will be reproduced in the forthcoming Final Environmental Assessment. If needed, corrections or clarifications have been made in the document. We appreciate your interest and participation in this phase of the project.

Very truly yours,

JON G. GIFFIN
Hawaii District Manager

Theresa Menard
University of Hawaii
Department of Zoology
2538 The Mall
Honolulu, Hawaii 96822

May 10, 1999

Mr. Jon Giffin
Department of Land and Natural Resources
Division of Forestry and Wildlife
PO Box 4849
Hilo, HI 96720

Dear Mr. Giffin,

RE: Draft Environmental Assessment for Commercial Harvesting of Forest Products and Subsequent Reforestation of Waiakea Timber Management Area, Island of Hawaii

As you know, I am studying the endangered Hawaiian hoary bat for my thesis research project at the University of Hawaii. Before entering graduate school at UH, I was the Associate Biologist for the Nature Conservancy of Hawaii. In this capacity, I maintained the Heritage Program's database on bat distribution and conducted surveys for bats on several Hawaiian islands (i.e. Maui, Kahoolawe, Oahu, and the Big Island). Presently, the focus of my research is on seasonal patterns of habitat use by the bat on the island of Hawaii. Since 1996, I have spent several hundred person-hours observing bat activity along an elevational gradient (from sea level to 6,300 ft). In addition, I am familiar with nearly all the previously published literature on hoary bats in Hawaii, as well as in North and South America. Also, I have had the opportunity to examine the Hawaiian hoary bat specimen collections at the Bernice P. Bishop Museum (Honolulu) and the Smithsonian Institution's National Museum of Natural History (Washington DC).

I have reviewed the above mentioned draft environmental assessment, and based on my knowledge of hoary bats, I cannot concur with the agency's determination that "the project will not have a significant impact" on an endangered animal. Timber harvesting in a roost area is likely to disturb hoary bats because hoary bats roost in trees, not caves. Although tree-roosting bats generally have alternate roost trees and roost areas to move between (Lewis 1995), during the breeding season (June and July) mother bats are quite site-faithful to an individual tree (Tuttle 1988). Mother hoary bats do not carry their young with them in flight as they forage, rather the young cling to one tree until they are capable of flight on their own at about 4 weeks of age (Koehler 1991). Pups do not finish nursing until they are 6 weeks old (Koehler 1991). Disturbance in the roost area during the breeding season could easily be fatal to both the mother and young. For example, if their roost tree is cut, the pre-volant young could be crushed when the tree hits the ground. Although, the mother bat will probably attempt to carry her young if they are disturbed at the roost, the move is risky because mother hoary bats have difficulty flying while carrying their young. She will most likely fall to the ground with her young still attached (Bailey 1937) where they are all likely to die from exposure or predation.

Of course, the great mystery is whether or not the WKTMA is a bat breeding site. Although as the draft EA states (page 11) that "there are no records of bats breeding in the area", this is not surprising because obtaining data on this elusive animal is difficult. In fact, I know of only one instance in which a mother and her pups were found together (1 female captured with 2 young in June 1899 at an unknown elevation in Hilo; NMNH Specimen #98148). I strongly suspect that bats are indeed breeding in the WKTMA because the site is forested and temperatures in the area are conducive to breeding (i.e. pups do not risk freezing to death as they would further upslope). Moreover, on the Big Island, bat pups are known from 1,800 feet (BPBM Specimen #161228) and lactating females are known from sites at 2,200 feet (D. Jacobs, personal communication). This elevational range is contained within the WKTMA. In light of these facts, I recommend that timber harvesting be suspended in the WKTMA during the months of June and July so as not to interfere with the breeding season of the endangered Hawaiian hoary bat.

With regard to the failure of DOFAW biologists to detect bats in the WKTMA, this is not surprising given that the surveys were conducted in winter (Dec - Feb). At my low elevation study sites (that is sites ranging from sea level to 1,500 feet), the period of least activity is winter. No doubt, bats will be detected at WKTMA in other seasons, especially fall.

One final comment, the draft EA states that "if any rare animal roosting trees are encountered, a no-harvest zone (250 feet in radius) will be established around each site" (page 33). While this is well intentioned, the likelihood that a bat will be found at the roost is slim. I have never encountered a bat at the roost. Even when Jacobs and I radio-tracked a bat back to its roost tree, we were unable to locate it. These bats are tiny and cryptic. Waiting for a roost site to be discovered and then suspending operations in the area of the roost tree is not a practical approach to managing bat habitat, rather it is better to simply suspend harvesting during the months when the bats are at their most vulnerable (i.e. during the breeding season in June and July).

Sincerely,

Theresa Menard

Theresa Menard
Graduate Student
Ecology, Evolution, and Conservation
Biology Program,
University of Hawaii

cc: OEQC



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
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June 29, 1999

Theresa Menard
University of Hawaii
Department of Zoology
2538 The Mall
Honolulu, HI 96822

Dear Ms. Menard:

Subject: Draft Environmental Assessment
Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Island of Hawaii
TMKs: 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22

Thank you for your letter of May 10, 1999, received during the public comment phase for the subject project. We offer the following responses in the respective order of your comments:

1. There are no observations of roosting or breeding bats in the WTMA. We cannot assume that, because the WTMA is "forested and temperatures in the area are conducive to breeding," that there are indeed breeding bats in the area. As you stated, "the great mystery is whether or not the WTMA is a bat breeding site." The age and condition of the trees within the WTMA must be considered. Most trees in the eucalyptus planting are 14 years of age and in their second rotation, meaning that this is the second scheduled harvesting for this timber species within the WTMA. The Queensland maple planting will be managed by selection harvesting, meaning that the larger, dominant trees will not be harvested probably for another 15 to 20 years. The first priority of harvesting will be the smaller, poorly formed trees.

Bats have been observed in Hilo town proper, especially around streetlights where there are abundant insects for food. It is probable that bats also roost near these food sources.

Every precaution will be taken to avoid any impacts to the Hawaiian hoary bat from harvesting or other silvicultural activities within the WTMA. As stated in the draft EA, not all trees in an area will be harvested. Within a 40-acre patch cut, for instance, a number of trees will be left for wildlife and aesthetics. During harvesting, if a visual sighting determines that bats are probably breeding in the area, that particular 40-acre patch will not be cut. Visual surveys, together with sonar equipment testing at night, should increase the probability of detecting any bats that may be breeding in the area.

Also, the logging contractee and workers will be trained and educated about the Hawaiian hoary bat. If they see a bat fall to the ground, they must cease operations and call DOFAW immediately. The DOFAW Wildlife Biologists will provide appropriate services, including

Ms. Theresa Menard
Page 2

possibly moving and rearing the bat, and/or turning it over to an appropriate endangered species propagation program (such as the Peregrine Fund).

2. When and if bats are proven to breed in the WTMA, we agree that harvesting activities will cease during their breeding season (June and July). We will continue with visual and sonic detection during all seasons, especially in new prospective harvest areas.

Your letter, along with this response, will be reproduced in the forthcoming Final Environmental Assessment. We appreciate your interest and participation in this phase of the project.

Very truly yours,

JON G. GIFFIN
Hawaii District Manager

RECEIVED

Hawaii Society of American Foresters

MAY 3 11 03 AM '99

2217 Noah Street, Honolulu, HI 96816

FOREST STAFF
April 30, 1999
PRINT

Mr. Jon Giffin
Hawaii District Branch Manager
DLNR-Division of Forestry and Wildlife
PO Box 4849
Hilo, Hawaii 96720

Dear Mr. Giffin,

Thank you for the opportunity to comment on your Draft Environmental Assessment for "Commercial Harvesting of Forest Products and Subsequent Reforestation of the Waieka Timber Management Area". The Hawaii SAF strongly supports your overall goals and objectives as you attempt to create a valuable commercial/multiple-use forest management model that will hopefully contribute to both the growth of Hawaii's forest industry, and to DOFAW's ability to effectively manage our state Forest Reserves. The success of your project is very important to both our industry, and to our forestry profession here in Hawaii. We would therefore appreciate your consideration of the following concerns and recommendations that have been communicated to me by our members.

The expected determination of a Finding of No Significant Impact as well as the course of action described throughout the document relies heavily upon the attachment of DLNR BMP's to the eventual TLL. These BMP's were fairly recently approved by the DLNR, include considerable latitude in some of their quantitative requirements, and have had little actual field testing to date. The WTMA is not a very sensitive sight for soil erosion, so it is probably a relatively easy place to start with the application of BMP's. To take advantage of this "pilot" opportunity, it is suggested that: Specific plans be made for monitoring of BMP compliance; a specific provision be made for hypothetically possible changes in the BMP's during the next 20 years (either to be more or less restrictive); and some level of applied research be planned to monitor the effectiveness and cost-efficiency of the BMP's.

In dealing with T&E species, the EA explains that 50 foot buffer zones would be created around identified plants. It is not clear, however, who would be tasked with surveying for, or identifying such plants. Those bidding on the lease should rightly be concerned that substantial areas of the WTMA could be declared off-limits. DOFAW may want to establish a more clear and practical procedure for identifying and dealing with T&E plant species.

The EA does not establish an acceptable, or maximum level of harvesting under the "Proposed Action". We understand that the actual level/rate of harvesting will be determined in the bidding and negotiation process. The only opportunity, then, for public comment on the level/rate of harvest is now, during the EA stage. Our concern is that if the level of harvesting to take place is left ambiguous, or undefined, then there could hypothetically be little difference between the "Proposed Action" and "Even-Aged Management Throughout the WTMA" alternative (p.27). The "Even-Aged" alternative is accompanied by language predicting severe negative impacts. The EA should therefore be more specific about to what extent the RFP (Request for Proposals) and the WTMA Plan require proposals to limit harvesting levels/rates.

Our last major concern is that the EA does not explain the Request for Proposals, bidding and negotiation procedures that will take place, or how DOFAW will maintain administrative control over these procedures. Administrative control would include a means of assuring that reforestation will take place by bond other means; a means of monitoring of compliance with BMP's; and a means of surveying T&E species or significant archeological sites. These controls cannot be left to the bidder/contractor.

Again, we want to reiterate our support for DOFAW's intent to establish a working, multiple-use Waieka Timber Management Area. We offer you our suggestions and concerns because we so very much want you to succeed.

Sincerely,



Karl R. Dalla Rosa
Chair



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
P.O. BOX 4849
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June 29, 1999

Karl R. Dalla Rosa
Chair
Hawaii Society of American Foresters
2217 Noah Street
Honolulu, HI 96816

Dear Mr. Dalla Rosa:

Subject: Draft Environmental Assessment
Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Island of Hawaii
TMKs: 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22

Thank you for your letter of April 30, 1999, received during the public comment phase for the subject project. We offer the following responses in the respective order of your comments:

1. Specific plans for monitoring BMP compliance will be incorporated into the Timber Land License. The logging contractee will be required to follow all specifications and standards as a condition of the license. DOFAW will enforce compliance to this land license.
2. If DOFAW (or others) become aware that the BMPs are not effective in their application to the WTMA (either too lax or too stringent), DOFAW administration will review the BMPs and recommend changes to the Board of Land and Natural Resources (BLNR).
3. DOFAW is responsible for surveys to identify threatened and endangered species (T&E) with the use of staff biologists and botanists. DOFAW will construct any fences required to protect T&E species. Again, there are no known T&E species within the WTMA.
4. It is true that the draft EA does not establish maximum harvest levels. Acceptable and maximum harvest levels will be determined in the negotiations with the logging contractee, and the terms will be specified in the Timber Land License. (The BLNR has specified maximum eucalyptus harvest levels of 500 acres/year.) Comments and concerns about harvest levels may be addressed to the BLNR when the Timber Land License is submitted and reviewed for its merits.
5. You are correct that the draft EA does not address the Request for Proposals process, bidding, or negotiation procedures, because these topics are not within the scope of an Environmental Assessment. DOFAW is part of the RFP selection committee, and will be directly involved in the final selection of the proposal. Other administrative control has been detailed in the RFP, and will be included in the land license.

Mr. Karl Dalla Rosa
Page 2

6. DOFAW will have the task of enforcing the logging contractee's compliance to the BMPs, and will be responsible for surveying for T&E species. The DLNR Historic Preservation Division has indicated that there are no known historic sites in the project area, and that "the proposed activities will have 'no effect' on significant historic sites."

Your letter, along with this response, will be reproduced in the forthcoming Final Environmental Assessment. We appreciate your interest and participation in this phase of the project.

Very truly yours,

JON G. GIFFIN
Hawaii District Manager

Received 4/24/99

Keaau Maintenance Association
P.O. Box 1886, Keaau, Hawaii 96749

OFFICERS

David Dewenter
President

Eric Weinert
Vice President
Treasurer

Viktor Lawcock
Secretary

22 April 1999

Mr. Howard Horiuchi
Dept. of Land & Natural Resources
P.O. Box 4849
Hilo, Hawaii 96720

Re: Waiakea Forest Reserve Road

Dear Mr. Horiuchi,

The Keaau Maintenance Association owns the road that fronts the Waiakea Forest Reserve. Enclosed is a tax map key indicating the road in subject.

It is our understanding that the Waiakea Forest Reserve adjacent to our road and right of way is part of lands being leased for logging. Our concern is the logging activities using our road as access. In the past, large trucks and bulldozers has used our road as access to improve the roads within the forest reserve making access to our road easily available for future use.

The Keaau Maintenance Association consist of a small number of homeowners with limited funds to maintain our roads. We would like to suggest a cooperative maintenance agreement on our right of way. We appreciate your input and concern of this matter.

Please feel free to contact me at 936-3518 or 895-0816 to discuss this matter further.

Mahalo Nui Loa,



David Dewenter
President



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE

P.O. BOX 4849
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June 29, 1999

Mr. David Deweter
President
Keaau Maintenance Association
PO Box 1886
Keaau, HI 96740

Dear Mr. Deweter:

Subject: Draft Environmental Assessment
Commercial Harvesting of Forest Products and Subsequent Reforestation
Waiakea Timber Management Area, Island of Hawaii
TMKs: 1-8-12:3, 2-4-8:1, 2-4-8:10, and 2-4-8:22

Thank you for your letter of April 22, 1999, received during the public comment phase for the subject project. We offer the following responses in the respective order of your comments:

1. The State would not enter into a cooperative road maintenance agreement as you have suggested. The successful permittee acquiring the harvesting rights for the Waiakea Timber Management Area would have the road maintenance responsibilities. We also have concerns that portions of this road may go through State land. A standard condition that we include in our Timber Land License has the following language: "All roads, landings, and skid trails used for harvesting will be restored to original conditions. Restored as used in this Land License does not include road reconstruction or repairs of an extraordinary nature. Any road maintenance requirements would be the responsibility of the permittee acquiring this license."
2. We also believe that Puna Sugar Co. constructed the road within the Waiakea Forest Reserve over 30 years ago. We have requested that a state survey be conducted along the Waiakea Forest Reserve boundary. The survey may take a year to complete.

If you have any questions, call Howard Horiuchi, Forestry Manager, at 974-4221.

Your letter, along with this response, will be reproduced in the forthcoming Final Environmental Assessment. We appreciate your interest and participation in this phase of the project.

Very truly yours,

JON G. GIFFIN
Hawaii District Manager