Forest Management Plan for the Waiakea Timber Management Area

September 11, 1998

Prepared by:

State of Hawaii
Department of Land and Natural Resources
Division of Forestry and Wildlife

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Hawaii District certification: This plan was prepared by a team of Division of Forestry and Wildlife (DOFAW) staff to provide a management framework for the Forest Reserves listed. The plan was developed in consultation with other governmental agencies, community, and environmental organizations.

_____ _____

Jon Giffin - Hawaii District Branch Manager Date

DOFAW Administrator's approval: I have reviewed the enclosed Forest Management Plan and concur with the recommendations herein. I agree that resource management implementation will follow those specified in the Management Plan for the Forest Reserves listed.

_____ _____

Michael G. Buck - Administrator Date

Department of Land and Natural Resources Board approval: This plan meets the criteria established for State Forest Reserve Management Plans as mandated by Chapter 183, Section 16.5, Hawaii Revised Statutes.

_____ _____

Michael D. Wilson - Board Chairperson Date

I. INTRODUCTION

The Division of Forestry and Wildlife proposes to harvest timber from the Waiakea Timber Management Area (WTMA) to meet the goals stated in Section V of this document. After Board of Land and Natural Resources approval of the WTMA Plan, the following actions will be taken:

1. An Environmental Assessment will be submitted to the Office of Environmental Quality Control.
2. A Request for Proposals (RFP) will be issued and the best proposer selected by a Selection Committee using a comparative criteria evaluation based on value-added processing of local timber, number and types of direct and indirect jobs to be created by the selected proposer, and qualifications of the proposer.
3. A Land License will be issued to the selected proposer(s) after negotiating the terms and conditions of the license.

In 1991, the forest industry in Hawaii contributed 29 million dollars and 736 jobs to our economy. Its payroll exceeded 21 million dollars and the average salary was over $14/hour. Sustainable commercial forest management can bring economic stability, 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 as 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) which 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 the Prudential Timber company on KSBE lands. There is increasing interest from other companies, as well as large and small landowners in the next phases of forest development throughout the State.

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. The Waiakea Timber Management Area, which contains substantial State timber resources on the island of Hawaii, will influence how the forest industry develops and help define the role of public assets in overall commercial forestry development throughout the State.

II. DIVISION OF FORESTRY & WILDLIFE

Hawaii's Division of Forestry & 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 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. Of the over 400,000 acres, under five percent or 18,441 acres could be managed for timber harvesting.

Principal responsibilities for DOFAW statewide 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.

III. PURPOSE OF THE FOREST MANAGEMENT PLAN

This management plan for the Waiakea Timber Management Area (WTMA), is designed to meet the requirements of Chapter 183, Hawaii Revised Statutes (Appendix A) regarding timber harvesting on State lands. DOFAW's vision for the WTMA is to provide a model for Hawaii's developing forest industry -

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

The WTMA has several important public uses in addition to timber production such as recreation,

gathering, hunting, habitat for native resources and watershed protection. Developed with currently available data, the plan will ensure that all of these uses are considered and that Best Management Practices (Appendix B) will be employed to mitigate any potential impacts from commercial forestry activities. Plan revisions will be conducted as necessary to reflect environmental changes, technical advancements and cultural changes.

Through open dialogue and input, a mutually agreeable plan for the management of the WTMA can guide Hawaii's growing forest industry and fit within the broader management context of native forest protection. Input and assistance from special interest groups and local communities will be solicited. Community field trips will be held so interested parties can see the WTMA first hand. The final management plan will be the basis for a formal Environmental Assessment (EA) developed under HRS 343. The WTMA plan and the EA will be used as the basis for initiating commercial timber management within WTMA. DOFAW has already received numerous requests from the private sector for timber and other uses at Waiakea. The State of Hawaii intends to engage these interests through traditional timber licenses as well as a new forms of forest stewardship contracts (See Section IX).

IV. THE WAIAKEA TIMBER MANAGEMENT AREA

A. Location: The 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. It is situated along the Stainback Highway, extending from 400 to 3,200 feet in elevation. Portions of the Waiakea, (WFR), Upper Waiakea (UWFR), and Olaa Forest Reserves (OFR) comprise the 12,000 acre unit (Figure 1). 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 (TMK 2-4-08-22) are currently included at the east end of WTMA.

B. Physical site data: 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. Mean annual temperature at 1,800 foot elevation is approximately 79E. The WTMA is situated on relatively young, shallow a'a and pahoehoe lava flows ranging from 150 to 9,000 years old. Soils overlay lava substrata and are composed primarily of thin ash layers with high organic matter content. Silica and base cations in surface soil layers are low in concentration due to extreme leaching conditions. Swampy conditions are found in some areas due to impermeable substrata. Slopes within the WTMA are very constant, averaging six percent.

C. Purpose of the WTMA: The original purpose of the WTMA was to establish a forest resource base which could provide a constant wood supply for Hawaii's forest products industry. From 1956-1960, 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. Approximately 330 acres of land formerly leased to

the Puna Sugar Company was also planted in the early 1980's. 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 60-80 acres of understocked forest plantation are being replanted annually.

D. Existing vegetation: During initial land clearing operations, large native trees such as ohi`a lehua (*Metrosideros polymorpha*), koa (*Acacia koa*), and loulu (*Pritchardia spp*.) were left undisturbed. Today, these plants are intermixed with non-native timber species. Primary understory species include hapuu (*Cibotium spp*.), guava (*Psidium spp*.), uluhe (*Dicranopteris spp.*) , palm grass (*Setaria palmifolia*), *Melastoma spp*. and scattered native Hawaiian understory shrub species. 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 (Appendix C). Recent inventory data summarize the current acreage breakdown based on dominant overstory tree species (Figure 2).

E. Access: Vehicular access to the subject area is available via paved highways. Stainback Highway provides the primary access and is maintained by the State Department of Public Safety and the County of Hawaii. North Kulani Road runs from Stainback Highway to Highway 11 near Mountain View. 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 DOFAW for hunting, recreation, non-timber forest product gathering, forest protection and timber management.

F. Timber Harvesting: From 1985 to 1988, Puna Sugar Company and the State entered into a timber harvest agreement for 2000 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 replanted with *Eucalyptus*. Little to no harvesting of other planted hardwoods has occurred with the exception of small-scale sales and 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 areas, tree ferns have subsequently grown back vigorously in some the planted areas.

G. Other public uses within the WTMA: 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. 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.

V. MANAGEMENT GOALS FOR THE WTMA

The following eight guiding principles were used to develop this plan and will be used in the disposition of the commercial forest resources within the WTMA:

Guiding Principle # 1

Hawaii's future in the forest products industry will depend on ***maximizing local processing***, not simply growing the trees. This will ensure the greatest number and quality of jobs. Many kinds of wood products can be processed from plantation timber in the WTMA, such as logs, lumber, furniture, cabinetry, veneer, plywood, wood chips, and craft wood.

Guiding Principle # 2

The State should utilize its land and timber within the WTMA to encourage the development of ***integrated processing facilities*** that provide suitable outlets for the range of species and grades of wood that currently exist and are now being planted. The availability of current plantation forest resources within the WTMA will allow the immediate development of wood processing plants, such as veneer, plywood, or lumber mills. This will provide ***immediate employment opportunities***. It will also encourage other investors and landowners to become involved in plantation forestry at the onset, stimulating additional employment opportunities.

Guiding Principle # 3

Effective soil erosion control practices, safe use of herbicides, and visual buffers along major transportation corridors will be required for all commercial forest operations within the WTMA as outlined in the State's ***Best Management Practices.***

Guiding Principle # 4

The need to ***involve the public*** in project planning and development is very important, especially when it affects local communities. Careful integration of timber management with ***hunting, recreational and gathering activities*** will aid in developing community support for growing and processing timber resources.

Guiding Principle # 5

A portion of the timber within the WTMA should be reserved to ***supply local entrepreneurs and small businesses***, thus increasing community recognition regarding the economic opportunities offered by sustainable forest management. The ***higher value timber*** within the WTMA can provide wood needed to take advantage of new forest marketing programs to stimulate the ***creation of niche markets for locally grown woods***. Portions of the WTMA should also be used for the development of non-timber forest products.

Guiding Principle # 6

Hawaii's public forest estate (11th largest in the U.S.) has ***a low level of public investment*** (e.g. one forester per 100,000 acres of public forest reserve on the Island of Hawaii). This investment

is not expected to increase significantly with Hawaii's current fiscal situation. In order to manage the WTMA sustainably, a portion of the timber proceeds should be ***reinvested back into the forest***.

Guiding Principle # 7

Timber management and research activities in the WTMA can provide a ***valuable educational role in extension and training***, contributing practical information to both the government and private sectors while helping create a professional forestry work force. Portions of the forest can be used as an outdoor laboratory for the forestry curriculum of the College of Agriculture, Forestry and Natural Resource Management at the University of Hawaii Hilo campus.

Guiding Principle # 8

There will be no timber harvesting, forest clearing, or other commercial timber operations within designated **native forest** sections of the WTMA. Special harvesting permits for the cultural gathering of native species may be granted.

VI. FOREST MANAGEMENT OPPORTUNITIES

Timber inventory data from 1997 indicate that the WTMA contains over 17,000,000 ft^3 of timber on a gross merchantable basis (Table 1). This represents enough wood to build and panel approximately 6,800 houses.

Table 1. ***1997 Forest inventory data summary for the WTMA***[1].

Tree Species	Acreage	Cubic Feet
Queensland maple *(Flindersia brayleyana*)	1,485	2,607,000
Eucalyptus saligna & *grandis*	3,749	9,669,000
Eucalyptus robusta	227	1,177,000
Eucalyptus deglupta & *pilularis*	54	94,000
Australian red cedar *(Toona ciliata)*	3,500	2,667,000
Tropical ash *(Fraxinus uhdei)*	2,060	1,052,000
Sugi *(Cryptomeria japonica)*	102	25,000
Nepal alder *(Alnus nepalensis)*	24	119,000
TOTALS	11,704	17,410,000

A. *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

[1] *Data represent total stem volume from one foot stump height to a four inch diameter top, and for all tree stems having a minimum diameter of eight inches at breast height*.

make them desirable for a wide variety of processing opportunities including dimensional lumber, veneer and plywood, poles, and chips. *Eucalyptus* does not spread readily into adjacent areas of native forest in the WTMA area. Current *Eucalyptus* wood resources within the WTMA range from newly planted seedlings, to stands which contain medium or "pole" sized (6-12" diameter) trees, and mature or "saw timber" sized (> 12" 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.

B. Queensland maple: While initially planted on a smaller scale than the *Eucalyptus*, Queensland maple (*Flindersia brayleyana*) 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 the *Eucalyptus*, a full range of stand ages and tree sizes are present, allowing for both immediate harvest opportunities, and new plantings.

C. Other species: Large areas (Figure 2) of the WTMA were originally planted 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 convertion to *Eucalyptus*, Queensland maple, or other high-value species can be done. 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 (Section I).

D. Education and research: DOFAW is in the process of establishing permanent growth plots and thinning studies in the WTMA. These will be designed to provide information on how to manage each species through their various phases of growth and development for maximum yield. In addition, the University of Hawaii at Hilo (UHH) is developing a forestry curriculum in their agriculture program. The close proximity UHH to the WTMA could allow forestry students the opportunity for hands-on training in applied forest management techniques, while providing DOFAW with additional silvicultural data.

VII. FOREST MANAGEMENT PRESCRIPTIONS

All field management prescriptions related to commercial timber management will be guided by

Best Management Practices (BMP) policies (Appendix B). DOFAW has more than 30 years of management experience in the WTMA and recommends the following general guidelines for commercial timber management:

A. <u>Commercial forest management</u>:

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, while a`a sites are more productive then pahoehoe. 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 clearance using saws and machetes can be implemented where brush and trees are relatively sparse and short in height. Manual clearance 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 usually 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 need to 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 manually applied as needed. Weed control may be required in newly planted stands to reduce seedling mortality and competition. Spray should be limited to manual applications in an area about two to three feet in radius around seedlings. Chemical quantities will be carefully prescribed at levels to control the specified target population, and will not be applied in buffer zones for surface waters. Only approved chemicals will be used in the WTMA in strict accordance with the manufacturer's label.

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

B. Native forest management: Within the WTMA, native forest inclusions 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 60 percent or more native forest cover. Management of threatened and endangered plants, and forest protection measures in native forest inclusions will follow the guidelines discussed below.

1. Threatened and endangered species: Historical plantation establishment that cleared the majority of the native forest in the WTMA surely impacted the native plants that once were found in the WTMA. Endangered plant species historically found within the WTMA include ohe (*Joinvillea ascendens* ssp. *ascendens* - last observed in 1950), na`u (*Gardeniaremyi* - last observed in 1952), *Phyllostegia vestita* (last observed in 1957), and *Phyllostegia floribunda* (last observed in 1973). 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 Area Reserve. Another endangered species of haha (*Cyanea platyphylla*) has been out planted in a fenced exclosure within the Waiakea Arboretum, and though there is no record of wild individuals occurring within the WTMA, the historical range of this species includes the greater WFR area (Hawaii Natural Heritage Program, 1989).

Endangered plant information in this plan is derived from The Nature Conservancy of Hawaii's Rare Plant Database and should not be considered comprehensive. In order to insure that no rare plant species are accidentally destroyed, botanical surveys will be conducted throughout areas that will be impacted by commercial timber management activities. If threatened or endangered species are encountered within introduced timber plantations, a buffer zone of 50 feet of undisturbed vegetation will be fenced around the plant individual or population in question. Known locations of threatened and endangered plant species will be visited to collect seed or cuttings for propagation efforts as needed. Such activity will lead to out planting in areas actively managed for rare plant species that are within that species' historical range. Potential out planting sites include the blocks of native forest scattered throughout the WTMA. A map and associated database for threatened and endangered species within the WTMA will be maintained by DOFAW.

C. Noxious weed management: Although it has not been a major problem to date, non-native timber species may spread into native forest areas adjacent to the WTMA. This encroachment may be exacerbated if a major disturbance such as fire or hurricane occurs and opens the native forest canopy, providing suitable habitat for exotic and pest species to become established. DOFAW will monitor any spread that occurs and provide control if necessary.

Noxious or invasive weeds are a serious threat within WTMA and can be spread rapidly by birds,

wind and mammals, including humans. Invasive weed species that occur in thick and fast-growing patches throughout the WTMA include strawberry guava (*Psidium cattelianum*), palm grass (*Setaria palmifolia*), *Clidemia hirta var. hirta*, *Melastoma candidum,* and *Tibouchina urvilleana*. Additional fast-growing species that could cause weed problems in this area include Australian tree fern (*Angiopteris evecta*), miconia (*Miconia calvescens*), yellow Himalayan raspberry (*Rubus ellipticus var. obcordatus*), and gunpowder tree (*Trema orientalis*). These latter species are scattered throughout the area, but have the potential to become dominant species in a given location.

D. Insects and disease monitoring: Phytophthora cinnamomi (root rot disease) will cause limited damage to some tree seedlings planted on pahoehoe lava flows that have poor water drainage. The tree species affected are Spanish cedar *(Cedrela odorata)*, *Casuarina spp*. and various mahogany species. Whenever this disease problem occurs, other tree species are subsequently selected for planting such as Australian red cedar, Queensland maple, or eucalypts. At times, the black twig borer (*Zylosandrus compactus*) becomes a problem at lower elevations in 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 do hinder their growth and development.

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

E. Fire prevention and control: The WTMA is located in a high rainfall zone where wild fire 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 was in the Panaewa Forest Reserve. Smaller fires occurred more recently in 1970-1972, and 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 is normally very wet and will not readily burn. 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 fire risk.

F. Harvesting: All timber harvesting activities will be conducted according to a timber harvesting plan approved by DOFAW. The timber harvesting plan shall include all of the forest management practices that are specified in the BMPs (Appendix B) for timber harvesting. 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 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 (Panaewa Zoo) as well as the State Department of Corrections (Kulani Prison) must be consulted for use of Stainback Highway.

G. Watershed Management: The WTMA has extensive tree and ground cover making the area a valuable 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. Tree and ground cover will ensure steady infiltration of surface water into ground water systems. All water courses will be protected in order to retard rapid runoff of storm flows, prevent soil erosion, improve water quality, prolong periods of stream flow and aid in recharging underground aquifers. A 50 foot buffer adjacent to all streams and wetlands will be established within the WTMA prior to timber management activities to ensure maintenance of water quality.

H. Wildlife Management: Wildlife offers many opportunities such as hunting for recreational and subsistence purposes, bird watching and rare species restoration.

1. Public Hunting: DOFAW promulgates hunting rules to regulate seasons and bag limits while wildlife enforcement responsibilities lie with the Division of Conservation and Resources Enforcement. Hunting rules are set forth in Chapter 122, Rules Regulating Game Bird Hunting and Chapter 123, Rules Regulating Game Mammal Hunting. 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 report game harvests on official field forms.

The WTMA supports several species of game and non-game wildlife (Appendix D). Feral pigs are the most common and actively managed big game species found in the area. Pig hunting is allowed year-round, however, the use of dogs is restricted at some locations when checking station data and field observations show the need to conserve game. The persistence of illegal hunting activity has forced the Hawaii Wildlife Branch to construct a series of gates and berms across certain roadways to redirect access for better control of hunters. Illegal night hunting is the single most important factor limiting pig abundance in the WTMA.

Kalij pheasants are the most plentiful game bird inhabiting the WTMA. Other game bird species are present, but are usually restricted to forest edges or along roadways and lava flows. Game bird hunting is open on weekends and holidays from the first Saturday of November through the third Sunday in January. Game bird populations are managed primarily by opening and closing hunting season and by setting bag limits.

Most timber management blocks within the WTMA are too overgrown with introduced weeds to offer good wildlife habitat. 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 wild turkeys, Kalij pheasants, wild pigs and other game species. The positive effects of timber harvesting on animal abundance was demonstrated in the Laupahoehoe section of Hilo Forest Reserve in the 1970's. Harvesting of koa and `ohi`a along Blair Road significantly increased the number of wild turkeys and feral pigs in the area for several years.

2. Native species: 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 no information on the density and distribution of these animals is available. There are no records of bats breeding in the area.

Native birds are the primary form of native wildlife found in the WTMA. Common endemic species inhabiting the forest are amakihi *(Hemignathus virens)*, apapane, *(Himatione sanguinea),* i`iwi *(Vestiaria coccinea)*, omao *(Myadestes obscurus)*, elepaio, *(Chasiempis sandwichensis)* and pueo *(Asio flammeus)*. These birds are most frequently observed above 3,000 feet elevation, which is the upper extreme of the WTMA. In recent years, no threatened or endangered birds, except the Hawaiian hawk or i`o *(Buteo solitarius),* have been observed in the WTMA. However, other rare species occur in native forests adjacent to the WTMA. These include the o`u *(Psittirostra psittacea)*, `akiapola`au (*Hemignathus munroi)*, and Hawaii akepa (*Loxops coccineus)*. It is unlikely that any of these rare species permanently inhabit the WTMA as introduced timber species fail to provide the necessary habitat requirements for these rare birds. Native bats and birds are 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.

The impact of timber harvesting activities on native bat and bird populations is expected to be minimal. Very few native 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. Surveys for threatened and endangered bats and birds will be made by DOFAW prior to the commencement of harvest activities. 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.

I. <u>Non-timber forest products</u>: Non-timber forest products are commonly collected within the WTMA. They include:

C mosses C tree seedlings C guava poles C firewood

C fruits C ferns C maile C hapuu fronds
C ti leaves C mushrooms C flowers

Gathering of material from plant species that are not on Federal or State threatened and endangered species lists will be permitted and regulated by DOFAW through standard forest permit procedures. Gathering of plant materials from threatened or endangered species may be allowed if individuals have obtained 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 can be obtained from the DOFAW-Hilo office at 19 E. Kawili Street. Hours are Monday through Friday except State holidays from 7:45 am to 4:30 pm. These permits are free and are available for non-commercial, home use only. Approximately 750 permits are issued for the Waiakea area on an annual basis.

J. Education and research: Forest plantations in the WTMA provide excellent opportunities for individuals, organizations and institutions to study both native and introduced forest communities. In the 1960's to the 1970's, the State Department of Health conducted studies on the population dynamics of rodents in WRF. 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 explosives 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 included nutrient recycling, watershed quality of various native forest plant communities, wood properties of commercial native tree species and `ohi`a decline occurrence.

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. Forestry instructors at the University of Hawaii, Hilo Campus, frequently use the WTMA for field laboratory exercises.

VIII. SPECIES SPECIFIC CONSIDERATIONS

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

A. Queensland maple: 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. This timber species will be managed under the guidelines of

selective tree harvesting to create and maintain an uneven age timber stand. Six type classes of Queensland maple currently exist within the WTMA, coded FB00, FB11, FB22, FB33, FB44 and FB55 (Appendix E). Initially, intensive forest management practices will be applied to type class FB33 and FB44. These two type classes are comprised of 290 acres of medium and high-stocked timber, with a merchantable volume of 1,338,000 ft^3 or 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 in FB33 and FB44 could provide as much as 55,000 ft^3 of wood to the island's markets each year for 15 years.[2] Wood marketing and utilization will both 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 which are young or composed primarily of smaller diameter trees. Such activities would include re-planting, weeding and pre-commercial thinning. DOFAW will also consider making wood available for export should there be a demand for small diameter logs.

B. <u>Eucalyptus Species</u>: The WTMA contains a total merchantable volume of 10,941,000 ft^3 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 (Table 1). The following are the recommended harvesting guidelines for the *Eucalyptus* species:

a. Harvest units will not exceed 40 acres. Due to clear cutting concerns, a modified method of clear-cutting will be the preferred harvesting method for *Eucalyptus* because these species require an open, well prepared site to regenerate and grow vigorously.
b. Specific conditions for leave or residual trees within the 40 acre harvesting blocks will be specified in the Timber Land License. These residual trees are for wildlife habitat, regeneration enhancement, and aesthitics.
c. All harvested areas will be replanted with either *Eucalyptus* species, Queensland maple, or other high value hardwood timber species.

To manage the 4,030 acres of *Eucalyptus* species on a sustained yield bases, up to 500 acres of *Eucalyptus* could to be harvested and replanted annually based on a 14-year rotation cycle. The 14 year cycle is desirable for maximizing wood production over time and maintaining harvest log size near a 12 inch DBH, since larger logs are prone to splitting and checking. This prescription may be changed based on shorter rotations or different end product mixes. Annual wood production from the harvest of *Eucalyptus* in the WTMA may contribute to supporting a local wood manufacturing company which obtains its wood requirements from a variety of sources. The *Eucalyptus* appear to grow well in all areas of the WTMA except on very shallow pahoehoe lava flows.

[2] For common tree sizes in the WTMA, one cubic foot of wood is equivalent to 4-6 board feet (Cahill, 1984).

C. <u>Tropical ash and Australian red cedar</u>: After more than 35 years of growth, a majority of Australian red cedar and tropical ash trees are still pole sized. Due to this poor performance, no additional plantings of either species will take place. DOFAW will prioritize conversion of acreage containing Australian red cedar and tropical ash to *Eucalyptus* species and Queensland maple, and other prospective high-value species such as brush box *(Lophostemon confertus)*, Spanish cedar and African mahogany. Prior to replacement plantings, salvage sales will be conducted to utilize any Australian red cedar or tropical ash wood resources that have commercial value.

IX. OPTIONS FOR DISPOSITION OF TIMBER

DOFAW has already received numerous requests from the private sector for access to the timber within the WTMA. These have come from out-of-state forest developers interested in wood chips, veneer, plywood, lumber and local forest companies wanting access to process higher value forest products. Traditionally, DOFAW disposed of larger quantities of timber through forms of public bidding with a final timber license approved by the Board of Land and Natural Resources. Small-scale sales or timber salvage operations, where commercial value did not exceed $1,000 were handled directly by the Hawaii DistrictBranch.

While this process may still be used, more flexible forms of public disposition of forest products will be needed to optimize the commercial forest potential within the WTMA. Although DOFAW is charged to make the Forest Reserve system as self sustaining as possible, it has no authority to utilize receipts of revenue from timber and other products to fund needed forest management activities. Existing budgets allow for only 60 acres per year to be harvested and reforested sustainably. Increased monitoring and compliance responsibilities will also demand more concentrated staff time.

For any major commercial harvesting activities to occur within the WTMA, reforestation and other essential forest management activities must be supported. This can be done by reinvesting a portion of the value derived from existing forest resources in the WTMA. Reinvested revenues can improve forest health as well as stimulate job creation and value-added processing, without impacting existing general funds. The public is likely to respond more favorably to the use of its forest resources if proceeds derived from harvesting can be reinvested into our forests. To achieve such balance, DOFAW is recommending the use of stewardship contracting to assure the sustainable management of the WTMA.

Stewardship contracting originated as part of a pilot project on several National Forests in 1992 in response to shrinking budgets, reduced personnel, and demands for a broader range of outputs from public lands. The contracts were meant to save money and provide the flexibility for the execution of unique site-specific prescriptions by the purchaser of the timber. A stewardship contract would allow a portion of the value owed from the purchase of timber from the WTMA to be used as an offset against the cost of specific stewardship services performed. These could

include site preparation, replanting, wildlife habitat enhancement, silviculture programs, and watershed improvements.

For example, a condition of a stewardship contract for a larger operation could be to reforest two acres for every acre that is harvested with performance standards that will dictate future harvesting opportunities. Other options for a larger stewardship contract could be the creation of a community log yard to provide logs to small purchasers. Stewardship contracting could also allow local entrepreneurs, who lack initial capital, an opportunity to trade forest management services for access to raw materials for their business, thus improving the viability of the public forests and small wood manufacturing businesses.

The stewardship contracts would be open to all bidders based on qualification criteria and the evaluation of s
Final approval by the Board of Land and Natural Resources would be required for each contract. Stewardsh
guided by technical forest management plans that document the establishment, growth and harvesting activit
minimum, would address the following: planting design and timetable, minimum stocking levels, site prepa
measures, fire control measures, riparian protection guidelines, road construction and maintenance, weed co
timber stand improvement, insect and disease management, harvesting operations, and replanting plans.

APPENDIX A. COPY OF HAWAII REVISED STATUTES, CHAPTER 183, PART II. FOREST RESERVES

[§183-16.5] Harvesting from state-owned lands. All harvesting of trees on public lands shall be done in accordance with a management plan approved by the board, and in accordance with the provisions regarding conservation of aquatic life, wildlife, and land plants, and the provisions regarding environmental impact statements. For any harvesting of native trees from public lands, the department shall use existing fire prevention and management programs and ensure that appropriate silvicultural practices are used to encourage native biodiversity and ecosystem processes. No native forests on public lands shall be converted to introduced forest plantations. [L 1997, c 256, §1]

APPENDIX B. BEST MANAGEMENT PRACTICES

Available by request from DOFAW in Hilo and Honolulu

APPENDIX C. COMMON COMPONENTS OF FORESTS IN THE WAIAKEA AREA

Native species

- loulu palms (*Pritchardia beccariana*)
- `ohi`a (Metrosideros polymorpha)
- olapa (*Cheirodendron trigynum*)
- alani (*Melicope* spp.)
- kawa`u (*Ilex anomala*)
- ho`i`o (*Athyrium sandwichianum*)
- ama`u (*Sadleria* spp.)
- ala ala wai nui (*Peperomia* spp.)
- 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* spp.)
- pilo (*Coprosma* sp.)
- kanawao (*Broussaisia arguta*)
- *Thelypteris sandwicensis*
- uluhe (*Dicranopteris linearis*)
- mamaki (*Pipturus albidus*)
- `i`e`i`e (*Freycinetia arborea*)
- maile (*Alyxia olivaeformis*)
- moa (*Psilotum nudum*)
- olomea (*Perrottetia sandwicensis*)
- *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 alexandrae*)
- Maile pilau (*Paederia foetida*)
- Maui pamakani (*Ageratina adenophora*)
- sourbush (*Pluchea symphitifolia*)
- sweet granadilla (*Passiflora ligularis*)
- *Melochia umbellata*
- *Melastoma candidum*
- palm grass (*Setaria palmifolia*)
- dog tail (*Buddleia asiatica*)
- Koster's 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 (Geopella striata)
		Japanese Quail (Coturnix japonica)
Non-Game Species	**Introduced Mammals**	Feral Dog (Canis familiaris)
		Feral Cat (Felis catus)
		Mongoose (Herpestes auropunctatus)
		Rat (Rattus spp.)
	Native mammal	Bat (Lasiurus cinereus semotus)
	Native Birds	Akepa (Loxops coccineus)
		Akiapolaau (Hemignathus munroi)
		Amakihi (Hemignathus virens)
		Apapane (Himatione sanguinea)
		Elepaio (Chasiempis sandwichensis)
		Iiwi (Vestiaria coccinea)
		I'o (Buteo solitarius)
		Omao (Myadestes obscurus)
		O'u (Psittirostra psittacea)
		Pueo (Asio flammeus)
	Introduced Birds	Barn Owl (Tyto alba)
		Common Mynah (Acridotheres tristis)
		House Finch (Carpodacus mexicanus)
		House Sparrow (Passer domesticus)
		Japanese White Eye (Zosterops japonicus)
		Melodious Laughing Thrush (Garrulax canorus)
		Northern Cardinal (Cardinalis cardinalis)
		Red-Billed Leiothrix (Leiothrix lutea)

How to interpret type and volume data: Sapling, pole and saw timber sized trees are defined as 0-6", 6-12", and > 12" in diameter, respectively (DBH is tree diameter measured 4.5 feet above the ground). Each type class has a typical gross volume range within which most stands of that type are included. Gross volume is defined as total cubic volume from tree base to tip. Occasionally a stand within a type class may have more or less gross volume than the specified range, but its structure and composition are still best described by the type class.

Consider *Eucalyptus saligna* and *Eucalyptus grandis* type class ES22: low to moderate volume pole and saw timber. In the WTMA there are several ES22 stands, summing 1447 acres. Most ES22 stands have gross timber volume ranging from 2000-2800 ft^3 per acre. Volumes reported within this table follow the theoretical assumption that all trees have been felled and cut into marketable lengths. Within the 1447 acres of this type class, logs with minimum small-end diameters ranging from 4-8", 8-12", and > 12" have a total merchantable volume of 1,260,294 ft^3, 1,206,654 ft^3, and 296,795 ft^3 respectively. Merchantable volume is equal to gross volume with the following deductions: volume below a 1' stump; volume above a 4" top; and gross volume of all trees with DBH < 8". Though the acreage in this type class is primarily composed of poles, saw timber sized trees are also scattered throughout the area. Keep in mind that timber type descriptions are broad.

NOTE: These volume and acreage data represent estimates for use in forest management planning only. The data should not be relied upon as a basis for conducting timber sales. Each timber sale will require intensive survey work within harvest units.

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