MAUI COUNTY PLANTING PLAN

THIRD EDITION

Maui County Arborist Committee

MAUI COUNTY PLANTING PLAN – THIRD EDITION

IT'S ALL ABOUT SHADE!

UH Maui College Science Parking Lot, E. H. Rezents photograph, taken January 2011.

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MAYOR'S MESSAGE

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Many individuals proofread this document. Any errors and omissions are unintentional.

PREFACE

The Maui County Planting Plan (MCPP) was prepared by the Maui County Arborist Committee in response to the mandate expressed in Chapter 12.24A of the Maui County Code (see Appendix B, page 220). The Planting Plan is to serve as a guide for government officials, design and landscape professionals, and the public. It provides information on the planting, replanting, care, pruning, preservation, and disposition of Exceptional Trees, trees in general, and other landscape plants in Maui County parks and public rights-of-way.

Periodically Maui County's annual rainfall has been insufficient to satisfy all of its water needs. Crops are under water stress, grassy fields are brown, stream flows have been in question, and often people are asked to conserve and reduce water consumption. The Maui County Arborist Committee is in full agreement with the Hawaiian statement: "*Hahai nō ka ua i ka ululāau"*. "The rainfall follows the forest". To this end, the Arborist Committee encourages Maui County, and the general public, to plant more trees and provide them better care. A healthy urban forest will have a positive impact in helping Maui County meet the community's water needs.

> *"Greenhouse gas emissions (carbon dioxide, methane, and ozone) in Hawaii surged 23 percent between 1990 and 2005 with busy roadways spewing carbon dioxide into the atmosphere, according to a report released Friday by the University of Hawaii Economic Research Organization."*
>
> *"The likely effects of climate change place Hawaii's ecosystem and economy in a precarious position."*
>
> *"… vehicles were the most significant source of emissions growth in the islands over the 15 year span, with an increase of 53%. However, the largest source of emissions in the state was from electrical power production..." – Maui News, page A3, January 31, 2009.*

To counter the impact of increased carbon dioxide released in Hawaii, more trees should be planted and given the care they need to reach maturity. Mature trees have a bigger impact on rainfall, absorption of atmospheric carbon dioxide, and improved ecological benefits for Maui County, than do young immature trees.

Mature trees, shrubs, hedges, and other landscape greenery are integral elements of the landscape in providing shade, comfort and tranquility, and in defining landscape character. Their beauty enhances the quality of the environment. In an attempt to improve Maui County's environment, the Arborist Committee is recommending that more trees be planted and provided the care they need to attain maturity to maximize their benefits.

Trees are an investment and not a cost because individually or collectively trees:

- Provide oxygen that we need to breathe.
- Remove the greenhouse gas carbon dioxide from the atmosphere and convert it into sugar and essential products for tree health and growth.
- Reduce surface temperatures by shading.
- Reduce air conditioning costs by lowering ambient temperatures and by shading buildings and parked cars.
- Trap and filter air particulates.
- Slow down forceful winds.
- Cut noise pollution by acting as a sound barrier.
- Soften outlines of masonry, metal, and glass.
- Reduce soil and water runoff.
- Mitigate peak storm water flow.
- Reduce patient hospital time when in view.
- Enhance a community's appeal and property value.
- Promote an environment that encourages rainfall and moisture retention,
- Provide habitats and sources of food for wildlife such as birds, butterflies, honeybees, etc.
- Create habitats that harbor a variety of plant pest predators that can keep in check pest population explosions.
- Reduce evaporation of fuel from vehicles parked in their shade.

(Some of the above statements were taken from Clark and Matheny, 2009.)

To achieve the above environmental benefits in Maui County, this edition of the MCPP provides an increased number of planting material choices, some of which are relatively new. Also included are proper tree pruning practices that provide larger canopies for increased shade along streets, in parks, and in parking lots.

As a precaution, some street, park, and parking lot trees produce hard round seeds. Their usage in the landscape requires placement that minimizes one's liability.

Unlike previous editions of the MCPP, this revised edition excludes post Captain Cook introduced species determined to be invasive by the Hawaii Pacific Weed Risk Assessment protocol. Some included plant species are marked with a single asterisk (*) because their assessment placed them between the "invasive" and "low risk" categories and require further evaluation. As more information is obtained, they will either be eliminated if determined to be

invasive or retained if they are a "low risk" to the environment. New species that meet the guidelines will be added without County Council approval.

Although projects funded by Federal and State agencies may not be obligated to follow these guidelines for Maui County, their projects will impact Maui County residents and environment. Therefore, it is recommended that they consider this document as applying to them as well. If Federal and State of Hawaii projects include plants not found in this publication, they are urged to request in writing to the Arborist Committee for permission to plant them.

Although landscape architects and landscapers are not obligated to follow these guidelines for plantings on private property, it is recommended that they consider this document as applying to them as well. If plants of their choice are not found in this publication, they are urged to request in writing to the Arborist Committee for permission to plant them.

Missing from the enclosed list of street trees are fruit trees because falling fruit render them inappropriate for planting along streets. Private property owners may include them in their landscapes without consulting with the Arborist Committee. Although community gardens and edible landscapes are not included in this document, it is not the intention that they be excluded from County property. With the appropriate documentation, the Arborist Committee recommends that such requests be considered.

The Hawaiian language diacritical marks are found in Chapter Eleven, "Native Hawaiian and Polynesian-Introduced Plants". Use them to assist with proper pronunciation and written expression of those plant common names.

Correct planting and post planting care must be provided to assure that trees and other landscape plants grow in a healthy manner to maximize their environmental and aesthetic benefits. To solidify and advance efforts for the establishment and care of trees, shrubs, turfgrass, and ground covers in Maui County, this comprehensive plan has been developed.

It is with great pleasure that the Arborist Committee presents this completely revised third edition of the Maui County Planting Plan to the people of the County of Maui. A brief history of the activities of the Arborist Committee can be found in Appendix A, page 217.

Literature Cited

Clark, J. and N. Matheny. June 2009. "The Benefit of Trees." *International Society of Arboriculture Arborist News.* pp 12-18.

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1.1 OBJECTIVES

1.101 Assess the tree carrying capacity of County roads, parks, parking lots, and open space, and plant trees to meet the established capacity.

1.102 Plan, grow, install and maintain a continuously expanding urban canopy on County lands with existing County nursery facilities and staff including maintenance, beautification, and nursery personnel.

1.103 Stop the loss of trees from the County's urban forest, but if removal is necessary, replace tree losses per Chapter Eight, "Construction Project Tree Protection and Replacement Program" guidelines.

1.104 Expand the urban canopy to realize the benefits of an urban forest, including shade, oxygen production, wind abatement, and others.

1.105 Expand the use of Native and Polynesian introduced plant species to perpetuate the botanical and ethno botanical identity of Maui County.

1.106 Develop standards for planting and care of trees, shrubs, turfgrass, and ground covers.

1.107 Promote and encourage the planting of trees, shrubs, turfgrass, and ground covers at every opportunity.

1.108 Preserve and protect Exceptional Trees for the benefit of future generations.

1.109 Establish and install trees and other landscape plants based upon climate, soil conditions, and availability of water as indicated by planting zones on maps for Maui, Moloka´i, Lāna´i, and Kaho´olawe.

1.110 Utilize trees and other plant material specified in the Maui County Planting Plan (MCPP) where size, type, characteristics and appropriate planting zones can be found. Chapter tables serve as a guide for the establishment of appropriate trees and plants along streets, in parks, and in areas identified by ordinance, or where regulations require special attention.

1.111 Discourage the use of plants that could become a threat to the Hawaiian environment.

1.112 These guidelines should be consulted when landscaping streets, parks, single and multifamily housing, commercial properties, and all other developments.

1.2 POLICIES

1.201 Maui County should take a leadership role in planting trees along County roads where none exist, replacing missing ones, and to work with abutting property

owners to provide appropriate care to landscapes fronting their property as required by 12.24A.070-E.

1.202 Solar and wind energy projects that require the relocation or elimination of required trees should be brought to the Maui County Arborist Committee for recommendations.

1.203 County staff, both administrative and line, whose work includes planting and caring for trees and other plantings in parks, along streets, and other public properties, should be provided periodic in-service training to improve and ensure quality work.

1.204 The County Arborist should conduct and maintain a tree inventory of all trees on County lands using available technology and mapping. Such an inventory should reflect the maintenance trees received or need, whether the planting site is empty and therefore needs to be replanted, and whether tree conditions warrant a removal and replacement. The tree inventory can also be used for making budgetary requests. An additional benefit will be a realization of the net worth in environmental dollars our urban forest provides.

1.204-A The tree inventory, with a summary of work done and areas of need, should be given to the Maui County Arborist Committee and Parks Maintenance Superintendent each year in time for the Department's budget preparation.

1.204-B Tree corrective actions should be identified and reported to Park Department supervisors for appropriate action.

1.204-C Records should be kept current so that tree losses can be reported to the County Nursery for propagation and timely replacement.

1.204-D Mature trees, trees with trunk diameters of eight inches and larger at breast height (fifty-four inches above ground), should receive additional attention and be assessed specially for individual treatment on a manageable schedule.

1.205 Annually the Parks and Recreation Department should assess the inventory of County owned parcels to formulate a plan for the year's landscaping and beautification.

1.205-A As outlined by the Maui County's job description, the Parks Maintenance Superintendent should direct and coordinate the County's beautification program to landscape and beautify all County parcels, prioritizing by volume of use by County residents and visitors.

1.205-B As outlined by the Maui County's job description, the Nursery Worker II should sketch a plan for each of the identified parcels proposed for planting so that plant propagation and acquisition can be planned accordingly.

1.205-C The Arborist Committee should review and approve County plans for new planting, pursuant to the Maui County Code section 12.24A.030.C.2.

1.205-D As outlined in the County's job description, the County Arborist should supervise the installation of tree plantings and keep records of progress for annual reporting to the Arborist Committee.

1.206 Government agencies shall promote the establishment of trees, shrubs, turfgrass, and ground covers where their jurisdictional functions allow.

1.207 The general public is encouraged to plant trees on their property as part of their landscape.

1.208 The private sector is encouraged to work with government to establish more trees and ground covers in a comprehensive manner.

1.209 Anyone can identify, locate, and nominate Exceptional Trees.

1.210 The government and general public should be encouraged to preserve and maintain Exceptional Trees.

1.211 The Arborist Committee shall provide guidelines for protecting Exceptional Trees.

1.212 The County Government shall promote public and private sector cooperation in establishing street trees, shrubs, turfgrass, and ground covers at the time of development and the proper care required to maintain them.

1.213 The County Government shall promote the use of Native and Polynesian introduced plants wherever and whenever feasible.

1.214 The County Government shall promote the use of drought tolerant plants wherever and whenever feasible.

1.215 The County of Maui shall promote the purpose and intent of the Maui County Planting Plan (MCPP) in historic districts, special districts, the Special Management Areas, and any other districts as determined by the County Council and the Planning Commission.

1.216 The Arborist Committee, along with the Directors of Public Works, Planning, and Parks and Recreation shall educate the public in identifying appropriate plant care needed as part of an educational package.

1.217 The Director of Planning shall promote the planting of trees within highway medial strips and along County rights of way in accordance with the MCPP guidelines.

1.218 The Director of Parks and Recreation shall promote the establishment of street trees, shrubs, turfgrass, and ground covers in already developed areas.

1.219 The Director of Parks and Recreation shall establish standards and permit processing and procedures for the removal, relocation, or replacement of Exceptional Trees based on the guidelines established by the Arborist Committee.

1.220 The Director of Parks and Recreation shall be responsible for planting adjustments which might be required to provide harmony between landscaping and practicality with other necessary elements within the planting strip. The requirements of utilities and public safety, including street illumination and traffic line of sight, shall be fully considered.

1.221 The Director of Parks and Recreation shall encourage the planting and proper maintenance of trees, shrubs, turfgrass, and ground covers in County parks and recreational facilities to beautify these areas and enhance the enjoyment of park and facility users.

1.3 PROVISIONS – GENERAL GUIDELINES

1.301 When permission from a private property owner is obtained, a tree may be given to the owner by the Director of Parks and Recreation for planting on private property within 10 feet of the County right-of-way, provided that such planting is in keeping with the MCPP.

1.302 In carrying out the planting plan, every effort shall be made to conserve existing physical beauty and historical sites.

1.303 All developers of residential subdivisions of four (4) or more lots are required to include in County-owned planting strips appropriate street trees, turfgrass, and ground covers as well as temporary or permanent irrigation for such in their plans. Said developers are further required to care for these plantings for one year after planting. Individuals who purchase the abutting property need to be informed by the developer at the time of sale regarding:

1.303-A The owners' obligation to maintain the tree(s) and turfgrass in the planting strip fronting their property after the initial year. In addition, the abutting property owner needs to be informed of the penalties for negligence and/or abuse of street trees. See 12.24A.100 Prohibited Acts, of the Maui County Code in Appendix B.

1.304 If the property is not sold after one year, the developer (owner) is obligated to continue to maintain the street tree and landscaping until sold. Maui County Code section 12.24A.100 Prohibited Acts applies here.

1.305 Developers are further required to include a minimum of one street tree per lot. It is recommended that large lots with long planting strips have more than one street tree. The distances between trees should not be closer than the mature radii of the two adjacent trees plus ten feet for maintenance. Restrictions such as distances from drive ways, fire hydrants, intersections, etc., and requirements for utilities should not be sacrificed.

1.306 Approved root barriers to encourage deep rooting and discourage lifting of road pavements and sidewalks and buckling of curbs will be required for trees in planting strips and wherever else such damage will occur.

1.307 It is suggested that developers retain trees eight inches and larger in diameter (minus the bark), measured at 54 inches above ground, as part of the finished landscape. If mature trees cannot be saved, it is recommended that they be replaced with young specimens in number to equal or exceed the environmental benefits of the mature trees. See Chapter Eight "Construction Project Tree Protection and Replacement Program" for details.

1.308 Developers are required to include a capped 2-inch minimum, schedule 40, PVC pipe sleeve under sidewalks and driveways (if needed) to facilitate installation of an irrigation system in the public planting strip by the abutting property owner. The number, length, and location of sleeves per lot should be such as to accommodate an irrigation system(s) for the trees and other plantings by the abutting property owner.

1.309 In addition to the lists of official plant material in the Maui County Planting Plan (MCPP), everyone shall have full use of the wide variety of new plant imports in an effort to develop new and better landscapes for the beautification of private property. However, prior to importing new plants into Maui County, questions about their invasiveness or ability to spread and become weedy, can be submitted by email to the weed risk specialists at **hpwra@yahoo.com**.

1.310 To use trees and other plants in landscapes that are not in the MCPP written requests should be made to the Arborist Committee. If these trees and other plant material are approved, their names and characteristics will be added to the appropriate list for landscape use.

1.311 The developers of parking lots need to include appropriate trees, turfgrass, and ground covers and a permanent irrigation system. The developer is to maintain

the plantings for one year unless the owner of the parking lot assumes this responsibility within the time period.

1.312 Publicly owned parking lots need to comply with the same landscaping and maintenance requirements as do privately owned parking lots.

1.313 Exceptional Trees are to be cared for by their owner and preserved so that their beauty can enhance the quality of life in Maui County.

1.4 PROVISIONS – DEFINITIONS

1.401 When used in this planting plan, the following words, phrases, and their definitions shall apply, unless the context clearly indicates otherwise:

1.401-A Bubbler: Irrigation head that water bubbles out and causes directed watering to an area such as a tree's watering basin.

1.401-B Department: Department of Parks and Recreation, Department of Public Works, or Department of Planning of the County of Maui.

1.401-C Director: Director of Parks and Recreation, Director of Public Works, or Director of Planning.

1.401-D Exceptional Tree List: A list of Exceptional Trees in accordance to Sections 12.24A.030C.8 of the Maui County Code.

1.401-E Hardscape: Asphalt, concrete, and other hard surfaces used as part of a landscape.

1.401-F Irrigation Drip System: An irrigation system that conserves water by applying it where it is needed through plastic tubing. Systems often require an inline filter and a pressure regulator. Depending on the system, tubing can be placed above or below ground.

1.401-G Large Crown Shade Trees: Trees whose crowns equal or exceed the "mature spread" in feet as listed in the "Parking Lot Trees" tables.

1.401-H Maui County Arborist Committee: A committee created by Chapter 12.24A.030 of the Maui County Code which is comprised of nine members, who are residents of the county with professional or other interests in landscape beautification.

1.401-I Maui County Planting Plan: A plan for the establishment of plantings in a comprehensive fashion to enhance environmental and visual quality.

1.401-J Official List of Street, Park, and Parking Lot Trees: Lists of trees approved by the Arborist Committee for planting in these areas.

1.401-K Parking Lot Planter Definitions

- Continuous Planter: An in-ground planting area along property lines, or along entrance or exit roads, or in front of a single row of parking stalls, or between a double row of parking stalls.
- End Planter Island: A planter that is parallel with parking stalls. It is installed at the beginning and/or end of a double or single row of parking stalls.
- Tree Well/Planter: In-ground planters of various shapes dispersed throughout a parking area for the purpose of growing shade trees and other landscape plants. They are usually edged by concrete or asphalt curbing.

1.401-L Permit to Work on Public Streets. A permit is issued by the Department of Public Works for digging or otherwise excavating within public rights-of-way.

1.401-M Planting Strip: That portion between the curb line or pavement of a street and the adjacent property line intended for use by pedestrians; including any setback area acquired by the County for road widening purposes. The term also includes any street under the control and jurisdiction of the County, intended primarily for use by pedestrians.

1.401-N Root Barrier: Various synthetic products used to deflect tree roots from impacting with, and causing damage to, hardscapes and underground utilities.

1.401-O Stream Head: An irrigation head used to water the surface of a planted area. Water comes out in streams, as opposed to a spray, making for less wind deflection. It is used primarily for ground covers, turfgrass, and shrubs where surface roots are common.

1.401-P Street: The entire area between opposite property lines of a way, publicly owned and maintained, and used for the public purpose of vehicular or pedestrian travel or any private way which for more than five years has been continuously used by the public.

1.401-Q Street Tree: Any tree planted or growing within the rights-of-way of all streets, avenues, roads, or highways under the jurisdiction of the County of Maui.

1.401-R Street Tree Program: A program for the planting or growing trees within the rights-of-way of all streets, avenues, roads, or highways under the jurisdiction of the County of Maui. This program will make Maui County known as “Tree City USA.”

1.401-S Tree: Any woody plant usually having a single trunk and eventually attaining a height of at least 15 feet.

1.401-T Tree and Other Plant Characteristics Defined.

- Crown Density: Concentration of leaves.
  - Open: Permits lots of light through.
  - Medium: Permits some light through.
  - Dense: Permits little light penetration.
- Deciduous: Plants will drop leaves all year long even if marked with a "no." If a season is shown, this is the time when the bulk of leaves fall in preparation for flowering and new leaves.
- Elevation:
  - Low - Sea level to 1000 feet elevation.
  - Medium - 1000-3000 feet elevation.
  - High - Higher than 3000 feet elevation.
- Flower Color: A description of flower color.
- Foliage Color: Color of leaves.
  - Green/red means the leaves are green and red.
  - Green, red means some plants have leaves that are green and other plants have leaves that are red.
- Fragrant Flowers: Whether the flowers exhibit an aroma.
- Growth Habit:
  - Upright: Plants with strong apical dominance. Trees display a vertical upright appearance, e.g., Cook pine and Eucalyptus.
  - Upright/Round: Strong apical dominance and forms a rounded appearance, e.g., breadfruit, rainbow shower, and pink tecoma trees.
  - Round: Weaker apical dominance. Lateral branches develop early to give a round shape. Prune to encourage vertical growth and a canopy above, e.g., Hong Kong Orchid, fern tree and plumeria.
  - Spreading: Forms an umbrella canopy, e.g., monkeypod and royal poinciana.

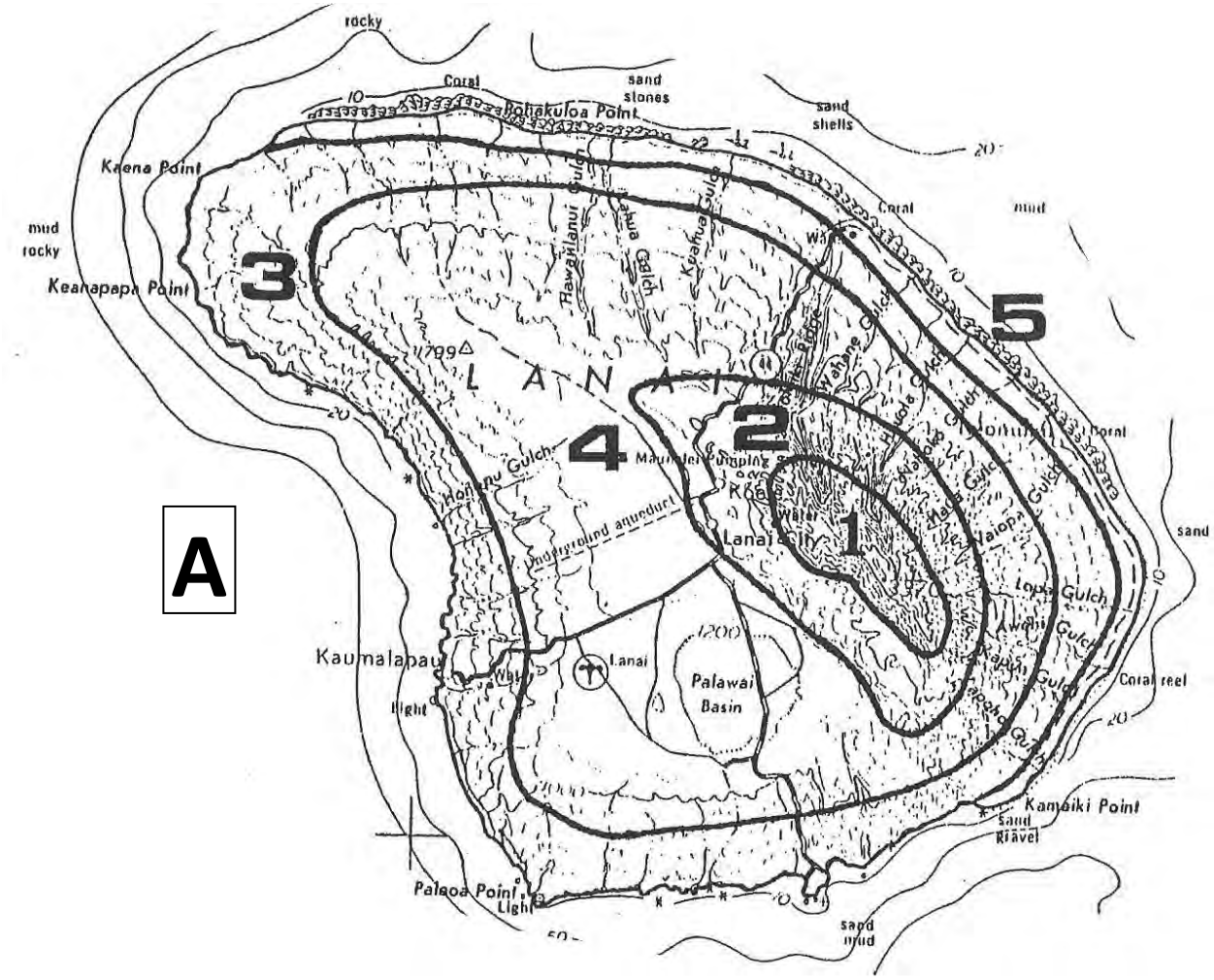
- Growth Rate: Depends on plant's environmental conditions and maturity; denotes rapidity of growth.
  - Slow
  - Medium
  - Fast
- Intrusive Roots: Roots will affect sidewalks, street curbs, and road pavement. Trees with intrusive roots cannot be planted in typical 3-4 foot planting strips without using an approved root barrier. Deep watering encourages deep rooting. Trees listed as not having intrusive roots may develop such roots if provided only shallow watering or planted in compacted or rocky soil with limited aeration.
- Maintenance Requirements: Indication of need for rubbish pick up.
  - Low
  - Medium
  - High
- Mature Height: A tree's ultimate height in feet. This dimension has been reduced slightly in the MCPP because the urban environment is less than ideal.
  - Small trees: Trees that grow 15-20 feet tall, have a spread between 15-20 feet, and have minimal surface roots. They are suitable for planting in two or more foot wide plantable spaces, under power lines, and have limitations imposed by utilities. Root barriers are required.
  - Medium trees: Trees that grow 21-35 feet tall, have a spread between 21-35 feet, and have a moderate amount of surface roots. They are suitable for planting in 3.5 feet or wider plantable spaces. Approved root barriers are required.
  - Large trees: Trees that grow more than 35 feet tall and have more than a 35 foot spread. They are suitable for planting in parks and other expansive grounds where large to majestic size and shade are desirable. If streets or highways have plantable spaces 40 feet or wider, a large tree can be planted at a distance of 30 feet inside of the curb or street pavement. These trees should not conflict with power lines and underground utilities. Approved root barriers may not be needed if surface roots are not a problem in parks and very wide planting strips. Large trees can be planted in parking lots to provide shade under specific conditions. See Chapter Four, Parking Lot Trees for guidelines.

- Spread: A tree canopy's ultimate spread in feet. This dimension has been reduced slightly in the MCPP tables because the urban environment is less than ideal.
- Planting Zones: A matured plant will grow naturally in the zones indicated. These plants may be successfully grown in drier and hotter zones if they receive supplemental irrigation or shade. These extensions to the normal growing zones are indicated within parentheses, e.g., Zone 1, (3), 4. (See the following pages of island maps for planting zones.)
  - Zone 1 -Wet areas. Windward part of Island.
  - Zone 2 -Cool, dry areas in higher elevations (above 1000 feet).
  - Zone 3 -Low, drier areas that are warm to hot.
  - Zone 4 -Lower elevations that are wetter due to proximity to mountains.
  - Zone 5 -Salt spray zone in Coastal areas on the windward side.
- Poisonous: Whether a plant is toxic to humans.
- Propagation: How plants can be multiplied.
  - Division - separation of mother plant into smaller clumps.
  - Stolons - use of soil surface stems.
  - Layers - air or ground layering for stem rooting.
  - Cuttings - use of stem or root pieces.
  - Seeds - self-explanatory.
- Producing Fruit and Nuts: Plants with messy fruit, pods and nuts are marked with a "yes." Plants with seeds or pods that are not messy are marked with a "no."
- Rubbish: All plants will produce some rubbish. This category indicates fruit, flowers, or leaves that fall.
  - Yes: Rubbish may be offensive.
  - Moderate: Some rubbish, but tolerant.
  - No: Rubbish produced is not offensive.
- Salt Tolerance:
  - Sensitive: Sensitive to salt spray. Plant far from ocean.
  - Moderate: Needs protection from salt spray. Plant behind hedges and buildings when along coastal areas.
  - Tolerant: Tolerant of salt spray.

- Shade Tree: All trees promote some shade. This rating indicates a shade area due to a canopy of leaves.
- Shade Tolerance:
  - Poor: Very low tolerance of shade.
  - Medium: Somewhat tolerant of shade
  - Good: Tolerant of shade.
  - High: Very tolerant of shade.
- Spacing: The center to center distance between plants.
- Time of Flowering: This may vary depending on temperature, day length, watering, etc., where Sp=Spring, Su=Summer, Fa=Fall, Wn=Winter.
- Water Requirements: Plants need the amount of rainfall indicated. When they are grown in areas providing less than their required rainfall, supplemental irrigation will be necessary. For plant species where this is possible, the designated water requirement is extended to a drier category and is indicated within parentheses, e.g., (dry) med-wet.
  - Dry: Less than 20 inches of rain per year. Plants will need more than 20 inches of rain per year until they become well established. Matured plantings with this characteristic will tolerate this low rainfall.
  - Medium: 20-40 inches of rain per year.
  - Wet: More than 40 inches of rain per year.
- Wind Tolerance:
  - Poor: Does not grow well without protection from strong winds.
  - Medium: Tolerant of wind. Some wind training may be evident.
  - Good: Tolerant of wind. Protection from wind at planting will help tree to become established faster.

1.401-U Water Basin: The area, usually four feet in diameter, surrounding a newly planted tree and formed by mounding a six inch high berm of onsite soil. The basin collects water for tree irrigation.

FIGURE 1-1: MAUI COUNTY PLANTING ZONES – ISLANDS OF LANAI (A) AND KAHOOLAWE (B)



Zone Legend:

#1 – Wet areas. Windward part of Island
#2 – Cool, dry areas in higher elevations (above 1,000 feet)
#3 – Low, drier areas that are warm to hot
#4 – Lower elevations that are wetter due to proximity to mountains
#5 – Salt spray zone in coastal areas on the windward side

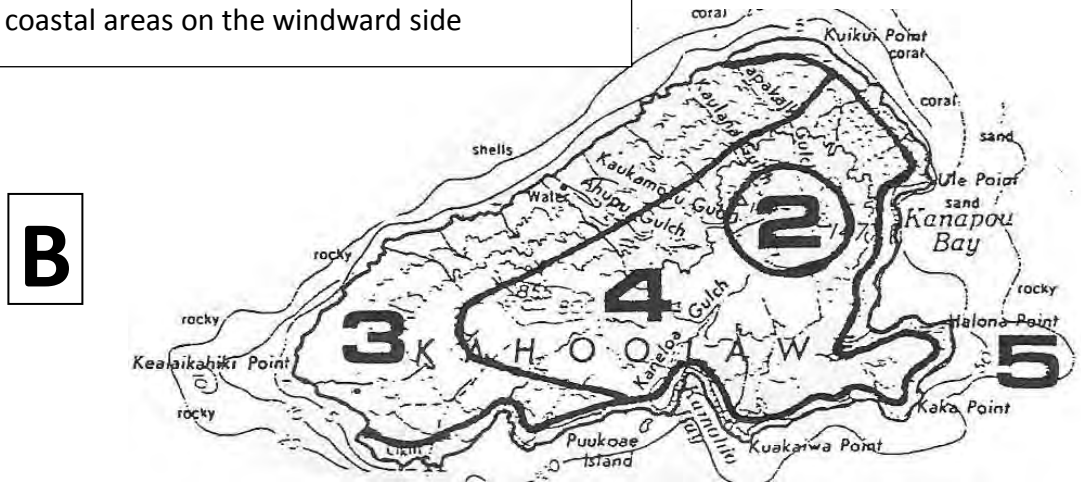
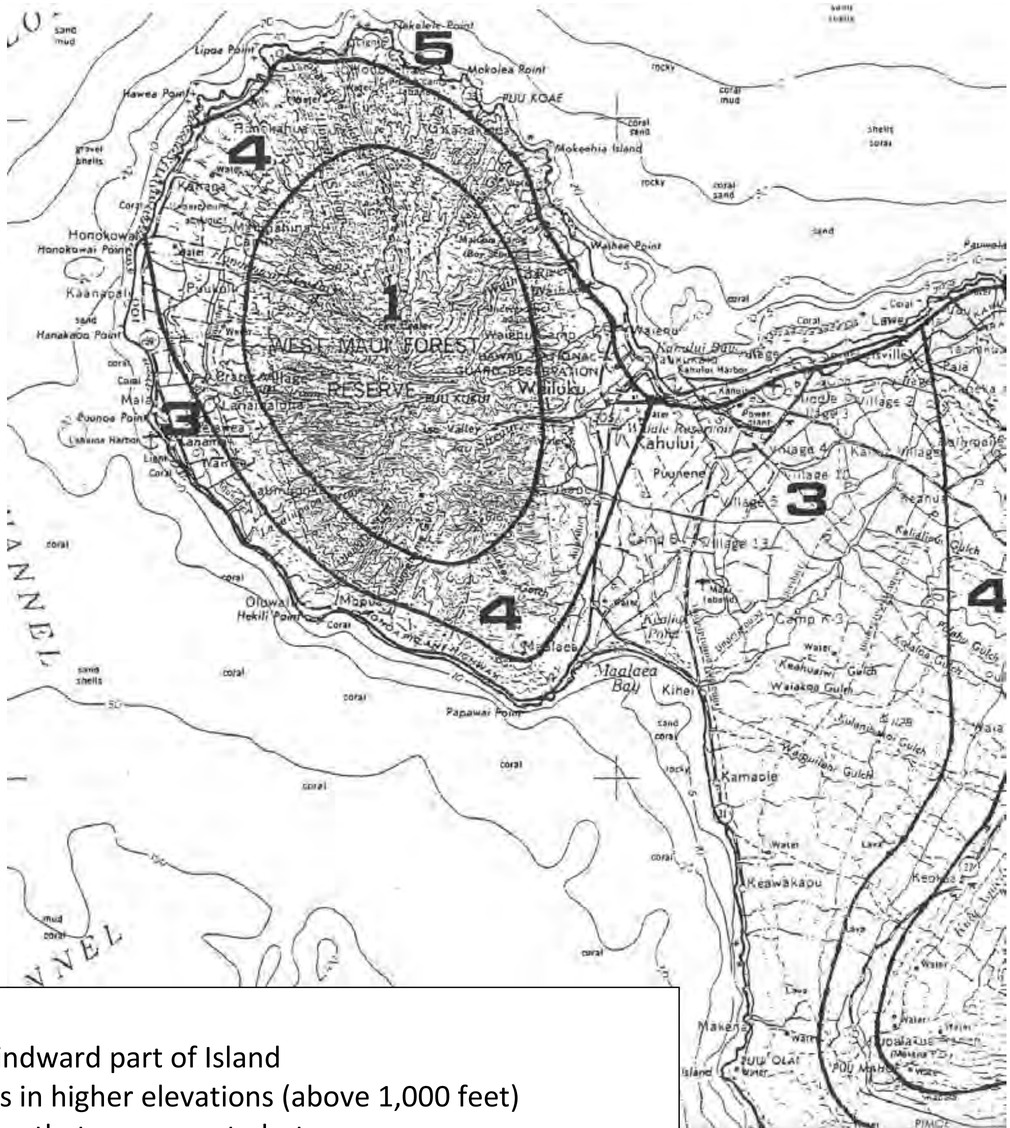


FIGURE 1-2: MAUI COUNTY PLANTING ZONES – ISLAND OF MAUI



Zone Legend:
#1 – Wet areas. Windward part of Island
#2 – Cool, dry areas in higher elevations (above 1,000 feet)
#3 – Low, drier areas that are warm to hot
#4 – Lower elevations that are wetter due to proximity to mountains
#5 – Salt spray zone in coastal areas on the windward side

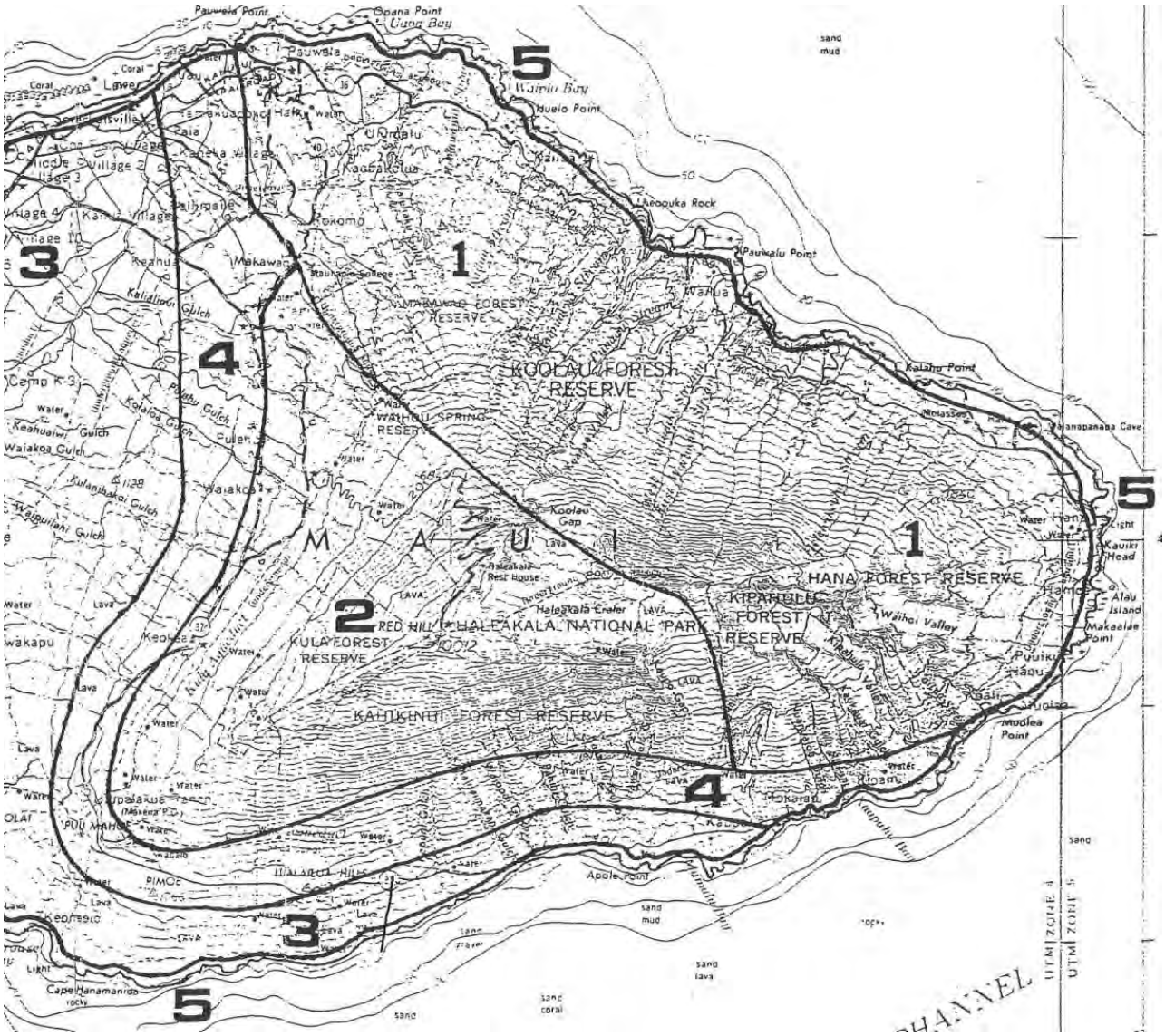
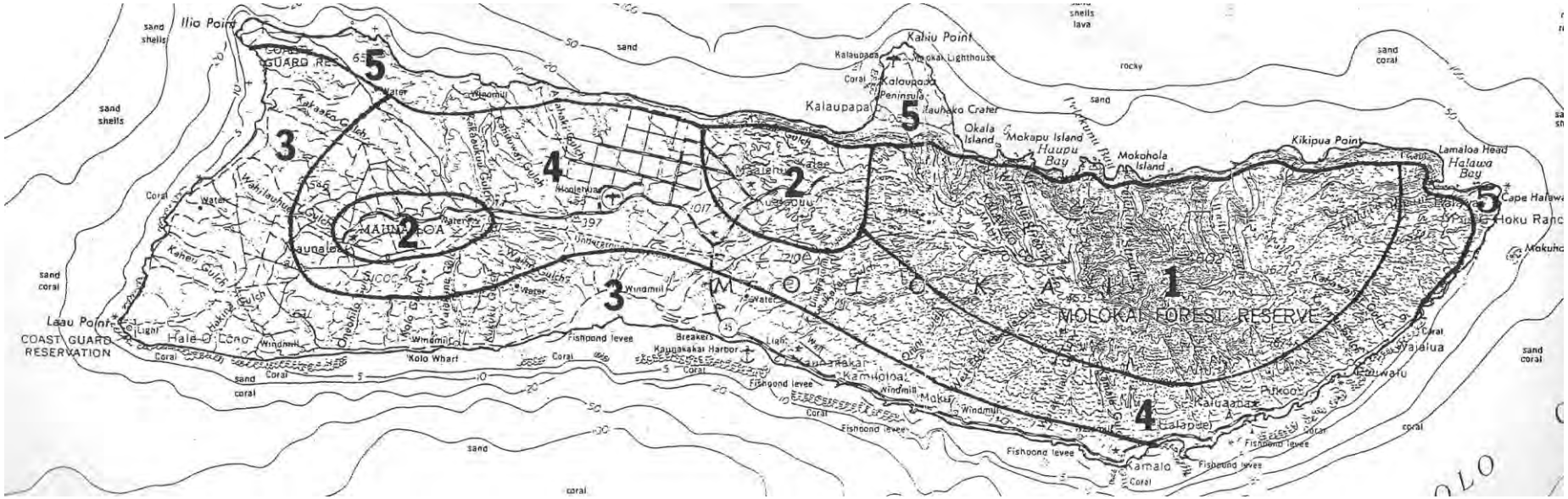


FIGURE 1-3: MAUI COUNTY PLANTING ZONES – ISLAND OF MOLOKAI



Zone Legend:

#1 – Wet areas. Windward part of Island
#2 – Cool, dry areas in higher elevations (above 1,000 feet)
#3 – Low, drier areas that are warm to hot
#4 – Lower elevations that are wetter due to proximity to mountains
#5 – Salt spray zone in coastal areas on the windward side

CHAPTER 2. STREET AND HIGHWAY MEDIAN TREE PROGRAM

2.1 STREET TREES

2.101 The Official Street and Highway Median Tree List is a collection of trees selected for their appropriateness and beauty when planted within public rights-of-way under specific site conditions. Emphasis is placed on outstanding characteristics of growth habit, foliage display, flower color, hardiness, and general adaptability.

2.102 As defined in Chapter 12.24A.020, of the Maui County Code, *Street trees* mean all trees planted or growing within the right-of-way of all streets, avenues, roads, or highways under the jurisdiction of the county.

2.103 Research has shown that roads planted with street trees cause drivers to travel at reduced speeds. (Rosenblatt Naders, et. al. 2006)

2.104 The County's intent for planting street trees includes, but is not limited to, providing shade to sidewalks, roads, and roadside parked vehicles. To satisfy the intention of "providing shade", street trees must receive the required care to enable them to develop a spreading canopy, but within the constraints of public safety.

2.105 The requirement of one tree per lot shall be met by planting and maintaining a shade tree in the public right of way in front of each lot.

2.106 When a lot frontage or size will not permit the planting of a shade tree in the public right of way in front of a lot, the shade tree shall be planted in the public right of way somewhere else along that particular roadway within no more than one half mile of the subdivided lot's frontage. It is important that the street trees be as evenly spaced as possible to maximize the distribution of shade along the roadway. The total number of shade trees shall not be less than the total number of lots on that particular street.

2.107 In the event that the access portion of a cul-de-sac roadway is too short to allow planting of any street trees, the equivalent number of trees shall be planted on adjacent roadways within the project, or within a half mile, whichever is closer.

2.108 A partial solution to the above problem is to have a circular planting island within the cul- de-sac to plant a large shade tree. If the diameter of such a planter is at a minimum 25 feet, a large tree, such as a monkeypod, could be planted. A continuous root barrier along the planter's inside edge, an irrigation system for deep watering, and removal of all rocks and construction material would be necessary to encourage root containment. Pending appropriate approval, the shade of this one large tree could be used to offset the shade of some of the

trees not planted due to the cul-de-sac's frontage limitations. See Chapter Four, "Parking Lot Trees" for tree shade square foot values in the tables at the end of that chapter for determining how many street trees can be replaced by the one large tree in the circular planter, based on area of shade produced in 15 years.

2.109 A long continuous planting strip configuration is ideal for planting street trees because their roots will share the common growing space.

2.110 For lots with long frontages, such as in agriculture subdivisions, one shade street tree shall be planted for each 100 feet of frontage, or part thereof. (For example: plant one tree for a 100 foot frontage and two trees for a 125 foot frontage. Allow ten feet or more between trees for maintenance.) These trees shall be planted within the public right of way and distributed along the roadway as evenly as possible. In no case shall the tree count be less than one shade tree per lot.

2.111 Within the public right of way, approved root barriers at least 24 inches wide and covering a distance of 20 linear feet shall be centered on each tree to protect underground utilities and hardscapes such as sidewalks, curbs, walls, etc. Installation of root barriers shall be in compliance with the manufacturer's guidelines. Root barriers are not to encase tree roots in a circular manner resembling a planting container because this reduces tree stability. Root barriers may eventually need to be replaced as they age or roots undermine.

2.112 Within private property, any wall or hardscape constructed or repaired adjacent to a public right of way where a street tree is planted, or will be planted, that property owner should take the responsibility to install an approved root barrier in conformance with manufacturer's guidelines. If at all possible, architects and developers should inform the abutting property owner of the benefits from installing a root barrier. If at all possible, the Maui County Arborist should be contacted prior to commencing work to avoid causing damage to any existing street tree. The intent of this recommendation is to avoid conflict between publicly owned trees and private property.

2.113 To encourage a variety of plant pest predators, and to avoid the negative effects of a monoculture where just one type of tree is planted, streets will be planted with trees from different genera in compliance with the paragraphs below.

2.113-A For subdivisions of four or more lots, each street will be planted with trees belonging to three different genera. The genera selected are at the discretion of the landscape architect but must be from the tables at the end of this chapter, unless approved by the arborist committee through written request.

2.113-B The number of trees on a street belonging to the same genus and providing the dominant "theme" cannot exceed 60% of the total tree count for that street. The number of trees belonging to the second and third genera should be close to, if not equal to, 20% each of the total tree count for that street.

2.114 In the "Street Trees – Small" and "Street Trees – Medium" tables at the end of this chapter, tree scientific names are provided. For example, in the scientific name *Bauhinia binata*, Bauhinia is the tree's genus (genera for plural) and binata is the tree's species. (Note: In scientific nomenclature the word "species" is now changed to "specific epithet". For the sake of simplicity, however, the word "species" will be used for the second part of a plant's scientific name.)The tree mix will be based on using specimens from different genera. In this example, the required percentage of street trees belonging to the genus Bauhinia will be planted. These Bauhinia trees may all belong to one species or different species. Some Bauhinia species are: binata, blakeana, variegata, etc. But they all belong to the genus Bauhinia. Locating trees belonging to the same genus, such as Bauhinia, is easily done by referring to the "Plant Index" in the back of this book where trees are listed alphabetically by genus as well as common names. Therefore, trees with the same genus will be grouped together.

2.115 An example of a street tree mix for a street requiring 60 trees:

Tree Count	Tree Genera Selected
60% of 60 = 36	Tabebuia (36 trees with the genus Tabebuia will be planted.)
20% of 60 = 12	Colvillea (12 trees with the genus Colvillea will be planted.)
20% of 60 = 12	Bauhinia (12 trees with the genus Bauhinia will be planted.)

2.116 Trees belonging to the various genera should be comingled along the street to avoid grouping.

2.117 Pursuant with County Code, paragraph 12.24A.070.E, "The department of parks and recreation shall be responsible for all general maintenance on street trees designated to be maintained by the County." However, "the property owner abutting any planting strip shall be responsible for watering and occasional fertilizing. The property owner abutting any planting strip shall also be responsible for maintaining and weeding of the planting strip." Developers and realtors need to communicate this responsibility to individuals who purchase property.

2.118 The list of street and median trees will be updated periodically to allow for the addition of promising new species, or the removal of species which exhibit unforeseen planting, establishment, or maintenance problems, or if they are determined to be invasive.

2.119 Tree heights and widths in this chapter's tables have been slightly reduced in some cases from trees normally growing in nonurban settings because the urban forest is exposed to environmentally harsh conditions.

2.120 Even though street trees listed in the tables at the end of this chapter are small and medium in size, larger specimens can be planted under certain conditions.

2.120-A Planters need to be, at a minimum, eight feet in width.

2.120-B Planters need to have, at a minimum, an area as listed in the Parking Lot Trees tables for that particular species. A larger area for those with "intrusive roots" is recommended.

2.120-C Planters have a continuous root barrier along the inside of a circular planter and a length equal to twice the tree's mature spread in feet when along continuous hardscapes.

2.120-D Trees are maintained to provide traffic clearance.

2.120-E After tree establishment, provide deep rather than shallow watering to encourage deep rooting.

2.121 Because palm trees are not considered to be street shade trees, they cannot be counted as satisfying the one tree per lot requirement. However, they may be planted along streets where shade trees are inappropriate and/or used as an accent or complement to a design. Appropriate palms for planting in the above situations are found Table 2-3: PALMS for Streets and 10-15 ft. Wide Medians on page 22.

2.122 For clarification of tree characteristics and planting zones in the tables at the end of this chapter, please see the Chapter One topic, "Tree and Other Plant Characteristics Defined" on page 8.

2.123 Plants with a single asterisk (*) next to their scientific name in Table 2-1, Table 2-2, and Table 2-3 at the end of this chapter are currently being evaluated by the Hawaii Pacific Weed Risk Assessment (HPWRA) protocol. If they are found to be invasive at a later date, they will be removed from this list of plants appropriate for planting in Maui County.

2.124 Plants with a double asterisk (**) next to their scientific name were designated as being invasive using the HPWRA protocol. Because they have fulfilled their potential for invasiveness and occupy mainly lower elevation areas, they are

considered as "okay to plant". Only kukui, *Aleurites moluccana*; noni, *Morinda citrifolia*; and milo, *Thespesia populnea,* fall into this category.

2.2 HIGHWAY AND MEDIAN TREES AND PALMS

2.201 When highway medians are used with a planting space of 10 to 15 feet in width, small trees and/or palms included in tables at the end of this chapter shall be planted. Bushes and groundcover should also be considered as part of the landscape.

2.202 Both small trees and palms shall be planted at intervals equal to their "matured spread" in feet, as shown in Table 2-1 and Table 2-3, plus 10 feet on both sides for maintenance.

2.203 When highway medians are used and they provide a planting space larger than 15 feet in width, they shall be planted with medium and large shade trees (not palms) provided that their canopies are above, or do not interfere with, traffic. These trees shall be planted at intervals equal to their "matured spread" in feet, plus 10 feet on both sides for maintenance. The "mature spread" for medium sized trees is in Table 2-2: Street Trees – MEDIUM. The "mature spread" for large sized trees is in Table 3-3: Park, Greenway, and Open Space Trees – LARGE on page 53.

2.204 Trees and palms planted within medians shall be planted no closer than 30 feet from intersections to maintain a "line of sight". If Maui County's regulations change this distance in the future, the distance in this paragraph will change automatically to be in conformance.

2.205 An irrigation system, including controllers with rain sensors and automatic shut offs, is required for the median's landscaping. See Chapter 12, "Irrigation and Water Conservation; Drought Tolerant Plants" for more information.

2.206 Twenty feet long by 24 inches wide root barriers, centered where trees (not palms) are planted, are required along both sides of median curbs. They are to be installed in conformance with the manufacturer's guidelines.

2.3 LITERATURE CITED

Rosenblatt Naders, J., B. S. Kweon, and P. Maghelal. 2006. "The Street Tree Effect and Driver Safety." ITE Journal on the web/February 2008. Transportation Research Board 85th Annual Meeting, July 27, 2006.

STREET TREES - SMALL

Require two feet or wider plantable spaces, a minimum of 16 square feet, and approved root barriers.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Bauhinia hookeri (Fabaceae) alibangbang	20	15	med; upright: round	slow; poor	good	mod	no	white/red SpSuWn	(dry) med	fruit/nuts; nondecid.	no rubbish; low maint.	med	1,2,(3), 4,(5)
Clusia rosea* (Clusiaceae) autograph tree, copey	20	25	med; round	med; med	good	tol	yes	white SpWn	(dry) med-wet	fruit/nuts; nondecid.	mod (fruit); med maint.	low-med	1,(3), 4,5
Tournefortia argentea (Boraginaceae) beach heliotrope, tahinu	15	15	dense; round	med; poor	good	tol	no	white SpSuFaWn	dry-med	none; nondecid.	no rubbish; med maint.	low	3,4,5
Conocarpus erectus (Combretaceae) buttonwood, silver buttonwood	20	20	dense; round	med; poor	good	tol	no	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Ceratonia siliqua (Fabaceae) carob	20	20	med; upright: round	med; poor	good	mod	no	inconspic.	dry-med	fruit/nuts; nondecid.	low (fruit); low maint.	low-med	2,3,4
Lagerstroemia indica (Lythraceae) crape myrtle	15	10	open; upright	fast; poor	med	mod	no	pink, white SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Cordia sebestena (Boraginaceae) kou haole	20	15	dense; upright: round	med; med	good	mod	no	red/ orange SpSuFa	dry-med-wet	fruit/nuts; nondecid.	low (fruit); med maint.	low-med	1,3,4,5
Diospyros sandwicensis (Ebenaceae) lama NATIVE (ENDEMIC)	12	15	dense; spreading	slow; poor	good	sens	no	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

STREET TREES - SMALL

Require two feet or wider plantable spaces, a minimum of 16 square feet, and approved root barriers.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Tabebuia impetiginosa (Bignoniaceae) lavender trumpet	15	15	med; round	med; med	med	sens	no	purple (dark) SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4
Stemmadenia littoralis (Apocynaceae) lecheso, lechoso	15	15	med; round	med; good	med	sens	no	white SpSuFaWn	(dry) med-wet poisonous	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Guaiacum officinale (Zygophyllaceae) lignum vitae	15	12	med; upright: round	slow; med	med	mod	no	lavender blue Sp	dry-med-wet	none; nondecid.	no rubbish; low maint.	low	1,3,4, (5)
Heritiera littoralis (Sterculiaceae) looking glass tree	20	20	med; spreading	slow; poor	med	tol	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Gliricidia sepium (Fabaceae) madre de cacao	20	20	open; round	fast; poor	good	tol	no	violet SpWn	dry-med	fruit/nuts; nondecid.	mod (lvs); med maint.	low-med	3,4,5
Majidea zanquebarica (Sapindaceae) mgambo, velvet seed, black pearl	20	20	dense; round	fast; poor	good	sens	no	chartruse SuFa	(dry) med	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4
Metrosideros polymorpha (Myrtaceae) ohia lehua NATIVE (ENDEMIC)	20	15	open; round	slow; med	good	sens	no	red, orange, yellow SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4
Cheirodendron trigynum (Araliaceae) olapa NATIVE (ENDEMIC)	20	20	med; round	med; good	med	sens	no	inconspic.	med-wet	none; nondecid.	no rubbish; low maint.	med-high	1,2,4

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

STREET TREES - SMALL

Require two feet or wider plantable spaces, a minimum of 16 square feet, and approved root barriers.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Andira inermis (Fabaceae) partridge wood	15	20	med; spreading	med; good	good	mod	no	lilac SpWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Callistemon citrinus (Myrtaceae) red bottlebrush, crimson bottlebrush	20	15	dense; upright: round	med; med	good	mod	no	red SpSuFaWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,3,4
Bolusanthus speciosus (Fabaceae) Rhodesian wisteria	15	15	med; round	med; med	med	sens	no	blue/violet SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med-high	2
Eucalyptus platypus (Myrtaceae) round-leafed moort	15	10	dense; upright	fast; med	good	mod	no	yellow SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low	2,3,4, (5)
Eucalyptus stoatei (Myrtaceae) scarlet pear gum	20	10	open; upright	fast; med	good	mod	no	yellow SuFa	dry-med	none; fa	mod (lvs); med maint.	low	1,2,3,4, (5)
Coccoloba uvifera (Polygonaceae) sea grape	20	20	dense; round	med; med	good	tol	no	white Sp	dry-med	fruit/nuts; nondecid.	low (lvs, fruit); low maint.	low	(3),4,5
Tabebuia aurea (Bignoniaceae) silver trumpet	20	20	med; upright: round	fast; poor	med	mod	no	yellow SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Eucalyptus kruseana (Myrtaceae) tidy blue	20	20	med; upright: spreading	med; med	good	mod	no	yellow FaWn	dry-med	none; nondecid.	no rubbish; low maint.	low	2,3,4, (5)

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

STREET TREES - SMALL

Require two feet or wider plantable spaces, a minimum of 16 square feet, and approved root barriers.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Schotia brachypetala (Fabaceae) tree fuchsia, schotia	20	15	med; upright	slow; med	good	mod	no	red SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4, (5)
Posoqueria latifolia (Rubiaceae) tree jasmine, needle flower tree	15	10	dense; upright: round	fast; good	med	sens	no	white SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Bauhinia tomentosa (Fabaceae) yellow bauhinia	20	15	med; upright: round	med; poor	med	sens	no	yellow SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Cordia lutea (Boraginaceae) yellow geiger, Peruvian cordia	20	15	med; upright: round	med; poor	good	mod	no	yellow SpSuFaWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,(5)

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Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

STREET TREES - MEDIUM

Require 3.5 feet or wider plantable spaces, a minimum of 64 square feet, and approved root barriers.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Brachychiton acerifolius (Sterculiaceae) Australian flame tree	30	20	med; upright: round	med; poor	good	mod	no	red SuFa	med	none; fa	low (lvs); low maint.	med	1,2,4
Cassia bakeriana (Fabaceae) Baker's shower tree	35	30	med; upright: round	fast; med	med	mod	no	pink/white SpSu	(dry) med-wet	fruit/nuts; wn	mod (lvs, pods); med maint.	low-med	1,2,(3), 4
Eucalyptus gardneri (Myrtaceae) blue mallet	25	25	dense; upright	fast; med	good	mod	no	yellow Fa	dry-med	none; su-fa	no rubbish; low maint.	low	1,2,3,4, (5)
Podocarpus elatus (Podocarpaceae) brown pine	25	15	med; upright	med; med	med	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4
Cochlospermum vitifolium (Bixaceae) buttercup tree	35	30	med; upright: round	fast; poor	med	mod	no	yellow Wn	dry-med-wet	none; wn	no rubbish; low maint.	low-med	1,(3),4, (5)
Colvillea racemosa (Fabaceae) colvillea	30	25	med; upright: round	med; med	good	mod	no	orange SuFa	dry-med-wet	fruit/nuts; wn-sp	no rubbish; low maint.	low-med	1,2,3,4, (5)
Eucalyptus torquata (Myrtaceae) coral gum	35	30	dense; upright: round	fast; med	good	mod	no	pink/ yellow, pink/ white Fa	dry-med	none; nondecid.	no rubbish; low maint.	low	1,2,3,4, (5)
Cochlospermum vitifolium 'Pena' (Bixaceae) double buttercup tree	30	25	med; upright: round	med; poor	med	mod	no	yellow Wn	dry-med-wet	none; wn	no rubbish; low maint.	low-med	1,(3),4, (5)

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

STREET TREES - MEDIUM

Require 3.5 feet or wider plantable spaces, a minimum of 64 square feet, and approved root barriers.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Elaeodendron orientale (Celastraceae) false olive	30	25	dense; upright: round	med; med	med	mod	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Ficus lyrata (Moraceae) fiddle leaf fig	35	35	dense; upright: round	med; med	good	tol	no	inconspic. SpSuFaWn	(dry) med	none; nondecid.	mod (lvs); med maint.	low-med	1,2,3,4, 5
Bucida buceras (Combretaceae) geometry tree	25	25	med; upright: round	med; med	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Lagerstroemia speciosa (Lythraceae) giant crape myrtle	30	25	med; upright: round	med; poor	med	sens	no	lavender SpSu	(dry) med-wet	none; wn	no rubbish; low maint.	low-med	1,2,(3), 4
Cassia fistula (Fabaceae) golden shower tree	30	25	open; spreading	fast; poor	med	sens	yes	yellow SuFa	(dry) med-wet	fruit/nuts; wn	mod (lvs, pods); med maint.	low-med	1,(3),4
Tabebuia berteroi (Bignoniaceae) Hispaniolan rosy trumpet tree	30	20	med; upright: round	fast; poor	med	sens	no	light pink SpSuFa	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4, (5)
Bauhinia x blakeana (Fabaceae) Hong Kong orchid tree	25	25	open; round	fast; good	med	sens	no	purple SpSuFa	(dry) med-wet	none; nondecid.	mod (flwrs); med maint.	low-med	1,2,(3), 4,(5)
Cordia subcordata (Boraginaceae) kou NATIVE	30	25	dense; upright: round	fast; poor	med	tol	no	orange SpSuFaWn	(dry) med-wet	fruit/nuts; nondecid.	low (fruit); med maint.	low	1,(3), 4,5

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

STREET TREES - MEDIUM

Require 3.5 feet or wider plantable spaces, a minimum of 64 square feet, and approved root barriers.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Hernandia nymphaeifolia (Hernandiaceae) lantern tree, jack in the box, bing-a-bing	30	25	dense; upright: round	med; med	med	tol	no	white SpSuFaWn	med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low	(3),(5)
Thespesia grandiflora (Malvaceae) maga	30	25	dense; upright: round	fast; med	med	sens	yes	red SuFa	dry-med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,3,4
Magnolia grandiflora 'Little Gem' (Magnoliaceae) magnolia little gem	25	15	dense; upright: round	med; med	med	sens	no	white SpSu	med-wet	none; nondecd.	mod (lvs); med maint.	low-med	1,2,(3),4
Swietenia mahagoni (Meliaceae) mahogany	35	25	dense; round	slow; poor	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Thespesia populnea** (Malvaceae) milo NATIVE	25	25	dense; round	fast; med	good	tol	no	yellow SpSuFa	(dry) med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low-med	1,2,(3),4,5
Michelia champaca (Magnoliaceae) mulang, orange champak	35	25	dense; upright: round	med; med	med	sens	no	yellow/ orange SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	med	1,2,(3),4
Reynoldsia sandwicensis (Araliaceae) ohe makai NATIVE (ENDEMIC)	25	20	med; round	med; poor	good	sens	no	inconspic.	dry	none; su	low (lvs); low maint.	low-med	2,3,4
Michelia x alba (Magnoliaceae) paklan, white champak	30	25	dense; upright: round	med; med	med	sens	no	white SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,2,(3),4

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Zones: Numbers in parentheses need site modification for good plant growth.

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Require 3.5 feet or wider plantable spaces, a minimum of 64 square feet, and approved root barriers.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Tabebuia heterophylla (Bignoniaceae) pink tecoma	35	25	dense; upright: round	med; med	med	mod	no	pink SpSuFa	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4, (5)
Tabebuia rosea* (Bignoniaceae) pink trumpet tree	30	25	med; round	fast; med	med	sens	no	pink SpSu	(dry) med-wet	none; wn	mod(lvs); med maint.	low-med	1,2,(3), 4
Cassia javanica (Fabaceae) pink/white shower tree	25	25	med; upright: round	fast; med	good	mod	no	pink/white SpSu	(dry) med-wet	fruit/nuts; wn	mod (pods); med maint.	low-med	1,2,(3), 4
Afrocarpus falcatus (Podocarpaceae) podocarpus, African fern pine	30	20	dense; upright: round	slow; good	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4
Pongamia pinnata (Fabaceae) pongamia	25	25	dense; round	fast; med	good	tol	no	pink/white SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Cassia x nealiae (Fabaceae) rainbow shower tree	35	30	med; upright: round	fast; poor	med	sens	yes	pink/ yellow SpSu	(dry) med-wet	none; wn	mod (lvs, flws); med maint.	low-med	1,(3),4
Saraca declinata (Fabaceae) red saraca	25	25	med; upright: spreading	med; med	poor	sens	no	red/ orange SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Brownea macrophylla (Fabaceae) rouge puff	30	25	dense; upright: round	med; med	poor	sens	no	orange SpWn	med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4

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Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Saraca indica (Fabaceae) shasoka tree	25	25	med; upright: spreading	med; med	poor	sens	no	yellow/ red/ orange SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Eucalyptus cinerea (Myrtaceae) silver dollar eucalyptus	35	25	dense; upright: round	fast; med	good	mod	yes	inconspic.	dry-med	none; nondecid.	mod (lvs); med maint.	low-med-high	2,(3),4
Saraca asoca (Fabaceae) sorrowless tree, asoka	25	25	med; upright: spreading	med; med	poor	sens	no	yellow/red/ orange SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Tipuana tipu (Fabaceae) tipa	30	25	open; spreading	med; poor	good	tol	no	yellow SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Harpullia pendula (Sapindaceae) tulipwood	25	20	med; upright: round	fast; med	med	sens	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4
Bauhinia variegata 'Candida' (Fabaceae) white orchid tree	30	25	med; round	fast; med	med	sens	no	white SpWn	(dry) med	fruit/nuts; nondecid.	mod (lvs); low maint.	low-med	2,(3),4
Saraca thaipingensis (Fabaceae) yellow saraca	25	25	med; upright: spreading	med; med	poor	sens	no	yellow SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Tabebuia ochracea (Bignoniaceae) yellow trumpet tree	35	30	med; upright: round	med; poor	med	sens	no	yellow SpSu	dry-med-wet	none; wn	mod (lvs); low maint.	low-med	1,3,4

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Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Catalpa longissima (Bignoniaceae) yokewood	35	25	dense; upright	med; med	good	mod	no	wnite SpSu	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	(3),4

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PALMS FOR STREETS AND 10-15 FT WIDE MEDIANS

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Hyophorbe lagenicaulis (Arecaceae) bottle palm	15	10	open; upright	slow; poor	good	sens	no	white SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Livistona chinensis* (Arecaceae) Chinese fan palm	30	10	dense; upright	slow; med	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4, (5)
Pritchardia pacifica (Arecaceae) Fiji/Tonga fan palm	25	15	dense; upright	slow; low	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4, (5)
Pritchardia hillebrandii (Arecaceae) loulu, loulu-lelo (Molokai) **NATIVE (ENDEMIC)**	20	10	dense; upright	slow; med	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Veitchia merrillii (Arecaceae) Manila palm	20	10	open; upright	slow; med	good	mod	no	white SpSuFa	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Ptychosperma elegans* (Arecaceae) solitaire palm	20	10	med; upright	fast; med	good	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Thrinax parviflora (Arecaceae) thrinax palm, pea berry palm	20	10	med; upright	med; med	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4, (5)
Pritchardia thurstonii (Arecaceae) Thurston/Fiji fan palm	25	10	dense; upright	slow; poor	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5

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CHAPTER 3. PARK, GREENWAY, AND OPEN SPACE TREE PROGRAM

3.1 PARK, GREENWAY, AND OPEN SPACE TREES

3.101 The following inclusive tables list not only the street trees of Chapter Two, but also additional trees too large or otherwise inappropriate as street trees due to the limited space in public rights-of-way. All of these trees are beautiful as individual specimens or groupings and may be planted for shade, flowers, and framing vistas in parks, greenways, and open spaces of public and private properties.

3.102 Small, medium, and large palm trees appropriate for park and open space planting are listed separately for the user's convenience in Table 3-4, Table 3-5 and Table 3-6 at the end of this chapter.

3.103 Park, greenway, and open space trees will need to have root barriers installed along walkways, curbs, underground utilities, and road pavement if they are planted closer than 30 feet from, or have surface roots that will impact with, the above features. Trees requiring root barriers will be centered on a root barrier that covers 20 linear feet and be at least 24 inches wide. Installation of root barriers shall be in compliance with the manufacturer's guidelines. Root barriers may eventually need to be replaced as they age or roots undermine.

3.104 An irrigation system, including controllers with rain sensors and automatic shut offs, is required for the park, greenway, and open space tree landscaping.

3.105 Tree heights and widths in this chapter's tables have been slightly reduced in some cases from trees normally growing in nonurban settings because the urban forest is exposed to environmentally harsh conditions.

3.106 For clarification of tree characteristics and planting zones in the tables at the end of this chapter, please see the Chapter One topic "Tree and Other Plant Characteristics Defined" on page 8.

3.107 Plants with a single asterisk (*) next to their scientific name in the tables at the end of this chapter are currently being evaluated by the Hawaii Pacific Weed Risk Assessment (HPWRA) protocol. If they are found to be invasive at a later date, they will be removed from this list of plants appropriate for planting in Maui County.

3.108 Plants with a double asterisk (**) next to their scientific name were designated as being invasive using the HPWRA protocol. Because they have fulfilled their potential for invasiveness and occupy mainly lower elevation areas, they are considered as “okay to plant”. Only kukui, *Aleurites moluccana*; noni, *Morinda citrifolia*; and milo, *Thespesia populnea*, fall into this category.

PARK, GREENWAY, AND OPEN SPACE TREES - SMALL

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Dodonaea viscosa (Sapindaceae) aalii NATIVE	6	8	med; spreading	med; poor	good	tol	no	n/a	dry-med	fruit/nuts; nondecid.	no rubbish; low maint.	low-high	2,3,4,5
Psydrax odorata (Rubiaceae) alahee NATIVE	15	8	dense; upright: round	slow; med	good	sens	no	white SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Bauhinia hookeri (Fabaceae) alibangbang	20	15	med; upright: round	slow; poor	good	mod	no	white/red SpSuWn	(dry) med	fruit/nuts; nondecid.	no rubbish; low maint.	med	1,2,(3), 4,(5)
Clusia rosea* (Clusiaceae) autograph tree, copey	20	25	med; round	med; med	good	tol	yes	white SpWn	(dry) med-wet	fruit/nuts; nondecid.	mod (fruit); med maint.	low-med	1,(3), 4,5
Piper methysticum (Piperaceae) awa POLYN. INTRO	10	10	med; round	med; good	poor	sens	no	green/ maroon	wet	none; nondecid.	no rubbish; low maint.	low	1
Michelia figo (Magnoliaceae) banana shrub, ainahau	12	12	dense; round	med; poor	med	sens	no	yellow/ red SpSuFaWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	2,(3),4
Tournefortia argentea (Boraginaceae) beach heliotrope, tahinu	15	15	dense; round	med; poor	good	tol	no	white SpSuFaWn	dry-med	none; nondecid.	no rubbish; med maint.	low	3,4,5
Conocarpus erectus (Combretaceae) buttonwood, silver buttonwood	20	20	dense; round	med; poor	good	tol	no	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Theobroma cacao (Stericulaceae) cacao	20	20	dense; upright: round	med; good	med	sens	no	yellow SpSuFaWn	med-wet	fruit/nuts; nondecid.	no rubbish; med maint.	low	1

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Crescentia cujete (Bignoniaceae) calabash tree	20	20	dense; round	med; med	med	mod	no	green/ maroon	(dry) med-wet	fruit/nuts; nondecid.	mod (fruit); low maint.	low-med	1,2,(3), 4,5
Ceratonia siliqua (Fabaceae) carob	20	20	med; upright: round	med; poor	good	mod	no	inconspic.	dry-med	fruit/nuts; nondecid.	low (fruit); low maint.	low-med	2,3,4
Aglaia odorata (Meliaceae) Chinese rice flower, mock lime	20	10	med; upright: round	med; good	med	sens	no	creamy white SpSuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4
Erythrina crista-galli (Fabaceae) coral tree	20	15	med; round	med; poor	good	tol	no	red Sp	dry-med	none; wn	low (lvs); low maint.	low	3,4,5
Lagerstroemia indica (Lythraceae) crape myrtle	15	10	open; upright	fast; poor	med	mod	no	pink, white SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Tabernaemontana divaricata (Apocynaceae) crepe jasmine, paper gardenia	15	6	med; upright: round	med; med	med	sens	no	white/yellow SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-high	1,2,3,4
Mussaenda philippica 'Dona Aurora' (Rubiaceae) Dona Aurora mussaenda	10	6	med; upright: round	med; poor	poor	sens	no	cream SpSuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4
Mussaenda x 'Dona Luz' (Rubiaceae) Dona Luz mussaenda	10	6	med; upright: round	med; poor	poor	sens	no	pink SpSuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4

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Mussaenda erythrophylla 'Dona Trining' (Rubiaceae) Dona Trining mussaenda	10	6	med; upright: round	med; poor	poor	sens	no	red SpSuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4
Dracaena draco (Liliaceae) dragon tree	20	20	open; upright: round	slow; med	good	tol	no	yellow Wn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4,5
Caesalpinia pulcherrima (Fabaceae) dwarf poinciana	15	15	open; round	fast; poor	good	tol	no	red/yellow SpSuFaWn	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4, 5
Chamelaucium uncinatum (Myrtaceae) Geraldton wax flower	9	9	med; upright: round	med; med	med	sens	no	pink SpSuFaWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4
Pleomele auwahiensis (Agavaceae) hala pepe NATIVE (ENDEMIC)	15	10	open; upright: round	med; poor	good	sens	no	yellow Sp	dry-med	none; nondecid.	no rubbish; low maint.	med	2,3,4
Rauvolfia sandwicensis (Apocynaceae) hao NATIVE (ENDEMIC)	20	15	med; upright: round	slow; poor	good	sens	no	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Hibiscadelphus giffardianus*** (Malvaceae) hau kuahiwi (Big Island) NATIVE (ENDEMIC)	20	15	dense; upright: round	med; med	med	sens	no	maroon SpWn	med	none; fa	mod (lvs); med maint.	med	2,4
Pittosporum hosmeri (Pittosporaceae) hoawa NATIVE (ENDEMIC)	12	10	med; round	slow; med	med	sens	no	white SpWn	med	fruit/nuts; nondecid.	no rubbish; med maint.	med	2,4

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Nesoluma polynesicum (Sapotaceae) keahi NATIVE	15	15	dense; round	slow; poor	good	sens	no	inconspic.	dry	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Acacia koaia (Fabaceae) koaia, koaie NATIVE (ENDEMIC)	20	25	open; spreading	med; poor	good	sens	no	yellow SpWn	dry-med	none; nondecid.	low (lvs); low maint.	low-med	2,3,4
Hibiscus waimeae*** (Malvaceae) kokio keokeo (Kauai) NATIVE (ENDEMIC)	15	10	dense; round	fast; mod	med	sens	no	white/red SpSuWn	(dry) med	none; fa	mod (lvs); low maint.	med	2,(3),4
Hibiscus immaculatus (Malvaceae) kokio keokeo (Maui & Molokai) NATIVE (ENDEMIC)	15	10	dense; upright: round	fast; med	med	sens	no	white SpSuWn	(dry) med-wet	none; fa	mod (lvs); low maint.	low-med	1,(3),4
Hibiscus kokio (Malvaceae) kokio ula ula NATIVE (ENDEMIC)	10-12	5	open; upright	fast; med	med	sens	no	red, orange SpSuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4, (5)
Kokia drynarioides*** (Malvaceae) kokio, kokia NATIVE (ENDEMIC)	15	15	open; round	med; med	med	sens	no	red/ orange SpSuFa	dry-med	none; fa	mod (lvs); low maint.	low-med	2,3,4
Myrsine lessertiana (Myrsinaceae) kolea NATIVE (ENDEMIC)	15	12	dense; round	slow; med	good	sens	no	inconspic.	med-wet	none; nondecid.	no rubbish; med maint.	med	2,4
Senna surattensis* (Fabaceae) kolomona, scrambled eggs	15	10	med; round	fast; med	good	mod	no	yellow SpSuFaWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	1,3,4,5

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Cordia sebestena (Boraginaceae) kou haole	20	15	dense; upright: round	med; med	good	mod	no	red/ orange SpSuFa	dry-med-wet	fruit/nuts; nondecid.	low (fruit); med maint.	low-med	1,3,4,5
Brunfelsia americana (Solanaceae) lady of the night	10	5	med; upright: round	med; poor	med	sens	no	green FaWn	dry-med poisonous	none; nondecid.	no rubbish; low maint.	low-med	1,3,4
Diospyros sandwicensis (Ebenaceae) lama NATIVE (ENDEMIC)	12	15	dense; spreading	slow; poor	good	sens	no	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Tabebuia impetiginosa (Bignoniaceae) lavender trumpet	15	15	med; round	med; med	med	sens	no	purple (dark) SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4
Stemmadenia littoralis (Apocynaceae) lecheso, lechoso	15	15	med; round	med; good	med	sens	no	white SpSuFaWn	(dry) med-wet poisonous	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Calliandra haematocephala (Fabaceae) lehua haole	8	10	dense; round	fast; poor	good	mod	no	red, pink, white FaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4
Guaiacum officinale (Zygophyllaceae) lignum vitae	15	12	med; upright: round	slow; med	med	mod	no	lavender blue Sp	dry-med-wet	none; nondecid.	no rubbish; low maint.	low	1,3,4, (5)
Heritiera littoralis (Sterculiaceae) looking glass tree	20	20	med; spreading	slow; poor	med	tol	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low	1,(3), 4,5

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PARK, GREENWAY, AND OPEN SPACE TREES - SMALL

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Eriobotrya japonica* (Rosaceae) loquat	20	15	dense; upright	med; med	good	sens	no	white Sp	(dry) med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	med-high	2,(3),4
Gliricidia sepium (Fabaceae) madre de cacao	20	20	open; round	fast; poor	good	tol	no	violet SpWn	dry-med	fruit/nuts; nondecid.	mod (lvs); med maint.	low-med	3,4,5
Musa acuminata (Musaceae) maia, banana POLYN. INTRO	6-30	6-30	dense; upright	fast; poor	med	sens	no	white SpSu	(dry) med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); high maint.	low-med	1,(3),4
Pachira aquatica (Bombaceae) Malabar chestnut	15	15	med; upright: round	med; med	med	sens	no	green SpSuFaWn	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; med maint.	low-med-high	1,2,(3), 4
Sophora chrysophylla (Fabaceae) mamane NATIVE (ENDEMIC)	15	15	med; round	slow; poor	good	sens	no	yellow SpSu	med	none; nondecid.	no rubbish; med maint.	med-high	2,4
Hibiscus brackenridgei*** (Malvaceae) mao hau hele (Hawaii state flower) NATIVE (ENDEMIC)	8	8	dense; round	fast; poor	good	sens	no	yellow SpWn	dry-med	none; su	mod (lvs); low maint.	low-med	2,3,4
Pterocarpus rohrii (Fabaceae)	15	15	dense; round	slow; poor	good	sens	no	golden/yellow Sp	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4, (5)
Majidea zanquebarica (Sapindaceae) mgambo, velvet seed, black pearl	20	20	dense; round	fast; poor	good	sens	no	chartruse SuFa	(dry) med	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4

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Gardenia brighamii*** (Rubiaceae) nanu, nau NATIVE (ENDEMIC)	15	10	dense; round	med; med	good	sens	no	white SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Morinda citrifolia** (Rubiaceae) noni, Indian mulberry POLYN. INTRO	20	15	med; upright: round	fast; med	good	tol	no	white SpSuWn	dry-med-wet	fruit/nuts; nondecid.	mod (fruit); low maint.	low	1,3,4,5
Metrosideros polymorpha (Myrtaceae) ohia lehua NATIVE (ENDEMIC)	20	15	open; round	slow; med	good	sens	no	red, orange, yellow SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4
Cheirodendron trigynum (Araliaceae) olapa NATIVE (ENDEMIC)	20	20	med; round	med; good	med	sens	no	inconspic.	med-wet	none; nondecid.	no rubbish; low maint.	med-high	1,2,4
Nestegis sandwicensis (Oleaceae) olopua NATIVE (ENDEMIC)	15	15	dense; round	slow; poor	good	sens	no	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	med	2,(3),4
Platycladus orientalis (Cupressaceae) oriental arborvitae	15	12	dense; upright: spreading	slow; med	good	sens	no	inconspic.	(dry) med	none; nondecid.	no rubbish; low maint.	low-med-high	2,(3),4
Pisonia brunoniana (Nyctaginaceae) papala kepau NATIVE	15	15	med; round	med; poor	good	sens	no	inconspic.	med	fruit/nuts; nondecid.	no rubbish; low maint.	med-high	2,4
Pisonia sandwicensis (Nyctaginaceae) papala kepau, aulu NATIVE (ENDEMIC)	15	15	med; round	med; med	med	sens	no	inconspic.	med	fruit/nuts; nondecid.	no rubbish; low maint.	med	2,4

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Andira inermis (Fabaceae) partridge wood	15	20	med; spreading	med; good	good	mod	no	lilac SpWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Plumeria rubra (Apocynaceae) plumeria, frangipani	20	15	dense; round	med; med	good	tol	no	red, white/ yellow, etc. SpSuFa	dry-med poisonous	none; wn	mod (lvs); med maint.	low-med	1,2,3,4, 5
Fagraea berteroana (Loganiaceae) pua kenikeni	20	15	dense; upright: round	med; med	good	sens	no	white/ orange SpSuFaWn	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Callistemon citrinus (Myrtaceae) red bottlebrush, crimson bottlebrush	20	15	dense; upright: round	med; med	good	mod	no	red SpSuFaWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,3,4
Bolusanthus speciosus (Fabaceae) Rhodesian wisteria	15	15	med; round	med; med	med	sens	no	blue/violet SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med-high	2
Rondeletia odorata (Rubiaceae) rondeletia	6	5	dense; upright: round	fast; poor	good	sens	no	yellow/ orange SpSuFaWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4, (5)
Jatropha integerrima (Euphorbiaceae) rose-flowered jatropha	15	15	open; round	med; poor	good	mod	no	red SpSuFaWn	dry-med poisonous	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Eucalyptus platypus (Myrtaceae) round-leafed moort	15	10	dense; upright	fast; med	good	mod	no	yellow SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low	2,3,4, (5)
Eucalyptus stoatei (Myrtaceae) scarlet pear gum	20	10	open; upright	fast; med	good	mod	no	yellow SuFa	dry-med	none; fa	mod (lvs); med maint.	low	1,2,3,4, (5)

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Coccoloba uvifera (Polygonaceae) sea grape	20	20	dense; round	med; med	good	tol	no	white Sp	dry-med	fruit/nuts; nondecid.	low (lvs, fruit); low maint.	low	(3),4,5
Sophora tomentosa (Fabaceae) silver bush	15	15	med; round	med; poor	good	tol	no	yellow SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Tabebuia aurea (Bignoniaceae) silver trumpet	20	20	med; upright: round	fast; poor	med	mod	no	yellow SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Plumeria obtusa (Apocynaceae) Singapore plumeria	20	20	dense; round	med; med	good	tol	no	white SpSuFaWn	(dry) med-wet poisonous	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Callistemon rigidus (Myrtaceae) stiff bottlebrush	7	5	dense; upright: round	slow; med	good	mod	no	red SpSuFa	dry-med	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,3,4
Gardenia taitensis (Rubiaceae) tiare, Tahitian gardenia	15	15	med; round	med; med	med	sens	no	white SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Eucalyptus kruseana (Myrtaceae) tidy blue	20	20	med; upright: spreading	med; med	good	mod	no	yellow FaWn	dry-med	none; nondecid.	no rubbish; low maint.	low	2,3,4, (5)
Schotia brachypetala (Fabaceae) tree fuchsia, schotia	20	15	med; upright	slow; med	good	mod	no	red SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4, (5)

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Posoqueria latifolia (Rubiaceae) tree jasmine, needle flower tree	15	10	dense; upright: round	fast; good	med	sens	no	white SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Bauhinia tomentosa (Fabaceae) yellow bauhinia	20	15	med; upright: round	med; poor	med	sens	no	yellow SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Cordia lutea (Boraginaceae) yellow geiger, Peruvian cordia	20	15	med; upright: round	med; poor	good	mod	no	yellow SpSuFaWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,(5)
Brunfelsia australis (Solanaceae) yesterday, today, and tomorrow	12	8	dense; upright: round	med; good	med	sens	no	purple, white SpWn	med-wet	none; nondecid.	no rubbish; low maint.	low-high	1,2,(3),4

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Brachychiton acerifolius (Sterculiaceae) Australian flame tree	30	20	med; upright: round	med; poor	good	mod	no	red SuFa	med	none; fa	low (lvs); low maint.	med	1,2,4
Cassia bakeriana (Fabaceae) Baker's shower tree	35	30	med; upright: round	fast; med	med	mod	no	pink/white SpSu	(dry) med-wet	fruit/nuts; wn	mod (lvs, pods); med maint.	low-med	1,2,(3),4
Adansonia digitata (Bombacaceae) baobab, dead rat tree	35	40	med; spreading	slow; poor	good	mod	yes	white Sp	dry-med	fruit/nuts; wn	mod (lvs, fruit); low maint.	low	3,4,(5)
Eucalyptus gardneri (Myrtaceae) blue mallet	25	25	dense; upright	fast; med	good	mod	no	yellow Fa	dry-med	none; su-fa	no rubbish; low maint.	low	1,2,3,4,(5)
Podocarpus elatus (Podocarpaceae) brown pine	25	15	med; upright	med; med	med	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Cochlospermum vitifolium (Bixaceae) buttercup tree	35	30	med; upright: round	fast; poor	med	mod	no	yellow Wn	dry-med-wet	none; wn	no rubbish; low maint.	low-med	1,(3),4,(5)
Colvillea racemosa (Fabaceae) colvillea	30	25	med; upright: round	med; med	good	mod	no	orange SuFa	dry-med-wet	fruit/nuts; wn-sp	no rubbish; low maint.	low-med	1,2,3,4,(5)
Eucalyptus torquata (Myrtaceae) coral gum	35	30	dense; upright: round	fast; med	good	mod	no	pink/ yellow, pink/ white Fa	dry-med	none; nondecid.	no rubbish; low maint.	low	1,2,3,4,(5)

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Cochlospermum vitifolium 'Pena' (Bixaceae) double buttercup tree	30	25	med; upright: round	med; poor	med	mod	no	yellow Wn	dry-med-wet	none; wn	no rubbish; low maint.	low-med	1,(3),4,(5)
Elaeodendron orientale (Celastraceae) false olive	30	25	dense; upright: round	med; med	med	mod	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Filicium decipiens* (Sapindaceae) fern tree	30	25	dense; round	med; med	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	low (fruit); low maint.	low-med	1,(3),4,5
Ficus lyrata (Moraceae) fiddle leaf fig	35	35	dense; upright: round	med; med	good	tol	no	inconspic. SpSuFaWn	(dry) med	none; nondecid.	mod (lvs); med maint.	low-med	1,2,3,4,5
Bucida buceras (Combretaceae) geometry tree	25	25	med; upright: round	med; med	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4,5
Lagerstroemia speciosa (Lythraceae) giant crape myrtle	30	25	med; upright: round	med; poor	med	sens	no	lavender SpSu	(dry) med-wet	none; wn	no rubbish; low maint.	low-med	1,2,(3),4
Cassia fistula (Fabaceae) golden shower tree	30	25	open; spreading	fast; poor	med	sens	yes	yellow SuFa	(dry) med-wet	fruit/nuts; wn	mod (lvs, pods); med maint.	low-med	1,(3),4
Pandanus tectorius (Pandanaceae) hala, pandanus NATIVE	25	20	dense; round	med; med	good	tol	no	white SpSuFaWn	(dry) med-wet	fruit/nuts; nondecid.	high (lvs, fruit); high maint.	low	1,(3),4,5

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Tabebuia berteroi (Bignoniaceae) Hispaniolan rosy trumpet tree	30	20	med; upright: round	fast; poor	med	sens	no	light pink SpSuFa	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4, (5)
Juniperus chinensis ssp. torulosa (Cupressaceae) Hollywood twisted juniper	35	8	dense; upright	med; med	good	mod	no	n/a	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4
Bauhinia x blakeana (Fabaceae) Hong Kong orchid tree	25	25	open; round	fast; good	med	sens	no	purple SpSuFa	(dry) med-wet	none; nondecid.	mod (flwrs); med maint.	low-med	1,2,(3), 4,(5)
Barringtonia asiatica (Lecythidaceae) hutu	35	35	open; upright: round	med; poor	good	tol	no	white SpSuFa	(dry) med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low	1,(3), 4,5
Artocarpus heterophyllus (Moraceae) jack fruit	35	30	dense; upright: round	med; good	good	mod	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low-med	1,(3),4
Cordia subcordata (Boraginaceae) kou NATIVE	30	25	dense; upright: round	fast; poor	med	tol	no	orange SpSuFaWn	(dry) med-wet	fruit/nuts; nondecid.	low (fruit); med maint.	low	1,(3), 4,5
Aleurites moluccana** (Euphorbiaceae) kukui POLYN. INTRO	35	30	dense; upright: round	fast; good	med	mod	no	white	(dry) med-wet	fruit/nuts; nondecid.	mod (lvs, seeds); med maint.	low-med	1,(3), 4,5
Hernandia nymphaeifolia (Hernandiaceae) lantern tree, jack in the box, bing-a-bing	30	25	dense; upright: round	med; med	med	tol	no	white SpSuFaWn	med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low	(3),(5)

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Noronhia emarginata* (Oleaceae) Madagascar olive	35	25	dense; upright: round	med; med	good	tol	no	inconspic.	dry-med-wet	fruit/nuts; nondecid.	mod (fruit); med maint.	low-med	3,4,5
Thespesia grandiflora (Malvaceae) maga	30	25	dense; upright: round	fast; med	med	sens	yes	red SuFa	dry-med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,3,4
Magnolia grandiflora 'Little Gem' (Magnoliaceae) magnolia little gem	25	15	dense; upright: round	med; med	med	sens	no	white SpSu	med-wet	none; nondecd.	mod (lvs); med maint.	low-med	1,2,(3), 4
Swietenia mahagoni (Meliaceae) mahogany	35	25	dense; round	slow; poor	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Sapindus saponaria (Sapindaceae) manele, soapberry NATIVE	35	25	open; round	fast; med	med	sens	no	inconspic.	med	fruit/nuts; wn	no rubbish; low maint.	med-high	1,2,4
Artocarpus odoratissimus (Moraceae) marang	35	20	med; upright	fast; med	med	mod	no	inconspic.	med-wet	fruit/nuts; nondecid.	mod (lvs); med maint.	low	1,4,5
Thespesia populnea** (Malvaceae) milo NATIVE	25	25	dense; round	fast; med	good	tol	no	yellow SpSuFa	(dry) med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low-med	1,2,(3), 4,5
Syzygium malaccense (Myrtaceae) mountain apple, ohia ai POLYN. INTRO	35	25	med; upright: round	med; good	poor	sens	no	red, white SpSuFa	med-wet	fruit/nuts; nondecid.	mod (fruit); med maint.	low-med	1,(3),4

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Michelia champaca (Magnoliaceae) mulang, orange champak	35	25	dense; upright: round	med; med	med	sens	no	yellow/ orange SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	med	1,2,(3), 4
Pterocarpus indicus (Fabaceae) narra	40	35	dense; upright: round	fast; poor	med	mod	no	yellow/ gold Sp	(dry) med-wet	fruit/nuts; wn	mod (lvs); low maint.	low-med	1,2,(3), 4,(5)
Reynoldsia sandwicensis (Araliaceae) ohe makai NATIVE (ENDEMIC)	25	20	med; round	med; poor	good	sens	no	inconspic.	dry	none; su	low (lvs); low maint.	low-med	2,3,4
Michelia x alba (Magnoliaceae) paklan, white champak	30	25	dense; upright: round	med; med	med	sens	no	white SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,2,(3), 4
Pisonia umbellifera (Nyctaginaceae) papala kepau, aulu NATIVE	25	20	med; upright: round	fast; good	poor	sens	no	inconspic.	wet	none; nondecid.	no rubbish; low maint.	low	1,4
Tabebuia heterophylla (Bignoniaceae) pink tecoma	35	25	dense; upright: round	med; med	med	mod	no	pink SpSuFa	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4, (5)
Tabebuia rosea* (Bignoniaceae) pink trumpet tree	30	25	med; round	fast; med	med	sens	no	pink SpSu	(dry) med-wet	none; wn	mod(lvs); med maint.	low-med	1,2,(3), 4
Cassia javanica (Fabaceae) pink/white shower tree	25	25	med; upright: round	fast; med	good	mod	no	pink/white SpSu	(dry) med-wet	fruit/nuts; wn	mod (pods); med maint.	low-med	1,2,(3), 4

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PARK, GREENWAY, AND OPEN SPACE TREES - MEDIUM

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Afrocarpus falcatus (Podocarpaceae) podocarpus, African fern pine	30	20	dense; upright: round	slow; good	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4
Pongamia pinnata (Fabaceae) pongamia	25	25	dense; round	fast; med	good	tol	no	pink/white SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Amherstia nobilis (Fabaceae) pride of Burma, amherstia	30	25	med; upright: round	slow; good	poor	sens	no	pink/ yellow Sp	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4
Cassia x nealiae (Fabaceae) rainbow shower tree	35	30	med; upright: round	fast; poor	med	sens	yes	pink/ yellow SpSu	(dry) med-wet	none; wn	mod (lvs, flws); med maint.	low-med	1,(3),4
Saraca declinata (Fabaceae) red saraca	25	25	med; upright: spreading	med; med	poor	sens	no	red/ orange SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Brownea macrophylla (Fabaceae) rouge puff	30	25	dense; upright: round	med; med	poor	sens	no	orange SpWn	med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4
Delonix regia (Fabaceae) royal poinciana	30	40	med; spreading	fast; poor	good	sens	yes	red, orange SpSu	dry-med-wet	fruit/nuts; wn	mod (pods); med maint.	low-med	1,2,3,4
Kigelia africana (Bignoniaceae) sausage tree	25	25	med; upright: round	med; poor	med	tol	no	red SpSu	(dry) med	fruit/nuts; nondecid.	mod (fruit); low maint.	low-med	1,2,(3), 4,5

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Saraca indica (Fabaceae) shasoka tree	25	25	med; upright: spreading	med; med	poor	sens	no	yellow/ red/ orange SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Eucalyptus cinerea (Myrtaceae) silver dollar eucalyptus	35	25	dense; upright: round	fast; med	good	mod	yes	inconspic.	dry-med	none; nondecid.	mod (lvs); med maint.	low-med-high	2,(3),4
Saraca asoca (Fabaceae) sorrowless tree, asoka	25	25	med; upright: spreading	med; med	poor	sens	no	yellow/red/ orange SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Erythrina variegata (Fabaceae) tiger's claw, Indian coral	30	30	med; upright: round	fast; poor	good	tol	yes	red, white Sp	dry-med	fruit/nuts; wn	mod (lvs, pods); high maint.	low	3,4,5
Tipuana tipu (Fabaceae) tipa	30	25	open; spreading	med; poor	good	tol	no	yellow SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Ravenala madagascariensis (Strelitziaceae) traveler's tree	25	15	open; upright	med; med	good	mod	no	green bracts SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Erythrina variegata 'Tropic Coral' (Fabaceae) tropic coral	30	8	dense; upright	fast; poor	good	sens	no	orange Wn	(dry) med	none; nondecid.	mod (lvs); low maint.	low	1,(3),4
Harpullia pendula (Sapindaceae) tulipwood	25	20	med; upright: round	fast; med	med	sens	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4

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Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Pandanus tectorius 'Baptistii' (Pandanaceae) variegated pandanus	25	20	dense; upright	med; med	good	tol	no	white SpSuFaWn	(dry) med-wet	none; nondecid.	high (lvs); high maint.	low-med	1,2,(3), 4,5
Callistemon viminalis (Myrtaceae) weeping botttlebrush	25	20	dense; upright: round	med; med	good	mod	no	red SpSuFaWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4
Bauhinia variegata 'Candida' (Fabaceae) white orchid tree	30	25	med; round	fast; med	med	sens	no	white SpWn	(dry) med	fruit/nuts; nondecid.	mod (lvs); low maint.	low-med	2,(3),4
Erythrina sandwicensis (Fabaceae) wiliwili NATIVE (ENDEMIC)	30	25	med; spreading	fast; poor	good	mod	yes	red, orange, white, green, yellow SpSu	dry-med	none; su-fa	mod (lvs, pods); med maint.	low	2,3,4, (5)
Saraca thaipingensis (Fabaceae) yellow saraca	25	25	med; upright: spreading	med; med	poor	sens	no	yellow SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Tabebuia ochracea (Bignoniaceae) yellow trumpet tree	35	30	med; upright: round	med; poor	med	sens	no	yellow SpSu	dry-med-wet	none; wn	mod (lvs); low maint.	low-med	1,3,4
Catalpa longissima (Bignoniaceae) yokewood	35	25	dense; upright	med; med	good	mod	no	wnite SpSu	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	(3),4

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PARK, GREENWAY, AND OPEN SPACE TREES - LARGE

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Guettarda speciosa (Rubiaceae) beach gardenia, pua pua, wut	40	30	dense; upright: spreading	med; poor	med	tol	no	white SpSuFaWn	(dry) med	fruit/nuts; nondecid.	low, lvs, fruit; med maint.	low-med	3,4,5
Corymbia intermedia (Myrtaceae) bloodwood	50	30	med; upright	fast; med	good	sens	no	white SpSu	med	none; nondecid.	mod (lvs); med maint.	med-high	2
Elaeocarpus angustifolius* (Elaeocarpaceae) blue marble tree	50	25	med; upright	fast; med	med	sens	no	white	med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,4
Ficus religiosa (Moraceae) bo tree, peepul tree	50	70	med; upright: round	med; poor	good	tol	no	inconspic. SuFa	dry-med-wet	none; nondecid.	low (lvs); low maint.	low-med	1,3,4,5
Cinnamomum aromaticum (Lauraceae) cassia bark tree	40	35	dense; round	fast; good	good	sens	yes	inconspic.	med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,4
Araucaria columnaris (Araucariaceae) Cook pine	130	20	dense; upright	fast; med	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	low (branches); med maint.	low-med	1,2,(3), 4,5
Enterolobium cyclocarpum (Fabaceae) earpod tree	80	80	open; upright: spreading	fast; med	good	mod	yes	white	dry-med	fruit/nuts; wn	low (pods); med maint.	low-med	1,3,4
Eucalyptus tereticornis (Myrtaceae) forest redgum	60	35	med; upright	fast; med	good	sens	yes	white	dry-med	none; nondecid.	mod (lvs); med maint.	med-high	1,2,4
Eucalyptus salubris (Myrtaceae) gimlet	60	40	dense; upright: spreading	fast; med	good	tol	no	yellow SpSu	dry-med	none; su	no rubbish; low maint.	low	2,3,4,5

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Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Tabebuia donnell-smithii (Bignoniaceae) gold tree, prima vera	75	30	med; upright	med; poor	poor	mod	no	yellow SpSu	dry-med-wet	none; fa-wn	mod (lvs, flwrs); low maint.	low-med	1,3,4, (5)
Ficus benghalensis (Moraceae) Indian banyan	60	70	dense; upright: round	med; poor	good	tol	yes	red Fa	dry-med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low	1,3,4,5
Ficus elastica (Moraceae) Indian rubber tree	60	60	dense; round	fast; med	good	tol	yes	inconspic.	dry-med-wet	fruit/nuts; nondecid.	high (lvs); high maint.	low-med	1,2,3,4, 5
Allocasuarina verticillata (Casuarinaceae) ironwood (long leaf)	60	30	med; upright	fast; med	good	tol	no	pink SpSuFaWn	med	none; nondecid.	mod (lvs); low maint.	med	2
Jacaranda mimosifolia (Bignoniaceae) jacaranda	45	40	med; upright: spreading	fast; poor	med	sens	yes	blue SpSu	med-wet	fruit/nuts; sp	mod:lvs, flwrs, pods; med maint.	low-med	1,2,(3), 4
Calophyllum inophyllum* (Clusiaceae) kamani POLYN. INTRO	40	30	dense; upright: round	med; poor	good	tol	yes	white SpSuFa	(dry) med-wet	fruit/nuts; nondecid.	mod (nuts); med maint.	low-med	1,(3), 4,5
Ceiba pentandra (Bombacaceae) kapok, silk-cotton tree	100	50	med; upright	fast; poor	good	mod	yes	pink FaWn	(dry) med-wet	fruit/nuts; fa	mod (lvs, silk); low maint.	low-med	1,2,(3), 4
Acacia koa (Fabaceae) koa NATIVE (ENDEMIC)	50	50	open; round	fast; poor	med	sens	yes	creamy yellow SpWn	med-wet	none; nondecid.	low (lvs); med maint.	med-high	1,2,4

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Magnolia grandiflora (Magnoliaceae) magnolia	55	50	dense; upright: round	med; med	med	sens	no	white SpSuFa	med-wet	none; nondecid.	mod (lvs); med maint.	low-med-high	1,2,(3), 4
Samanea saman (Fabaceae) monkeypod tree	50	80	dense; spreading	fast; poor	med	sens	yes	pink SpSu	(dry) med-wet	fruit/nuts; wn	mod (lvs, fruit); med maint.	low-med	1,(3), 4,5
Ficus macrophylla* (Moraceae) Moreton bay fig	60	60	dense; round	fast; med	good	tol	yes	inconspic.	dry-med-wet	fruit/nuts; nondecid.	mod (lvs); high maint.	low-med	1,2,3,4, 5
Eucalyptus crebra (Myrtaceae) narrow-leafed ironbark	60	30	med; upright	fast; med	good	sens	no	inconspic.	dry-med	none; nondecid.	mod (lvs); med maint.	med-high	2
Araucaria heterophylla (Araucariaceae) Norfolk Island pine	130	40	dense; upright	fast; poor	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	low, (branches); med maint.	low-med	1,2,(3), 4,5
Senna siamea (Fabaceae) pheasant wood, kassod tree	50	40	med; upright: round	fast; med	good	mod	no	yellow SuFa	(dry) med	fruit/nuts; wn	no rubbish; med maint.	low-med	1,(3),4
Cassia grandis (Fabaceae) pink shower tree, coral shower tree	40	30	open; upright: round	fast; poor	med	sens	yes	pink SpSu	dry-med-wet	fruit/nuts; wn	mod (lvs, pods); med maint.	low-med	1,3,4
Agathis robusta (Araucariaceae) Queensland kauri	80	30	med; upright	fast; poor	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4

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Eucalyptus deglupta (Myrtaceae) rainbow eucalyptus, mindanao gum	60	30	open; upright	fast; med	med	mod	no	white SpWn	med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Eucalyptus sideroxylon (Myrtaceae) red ironbark	40	35	open; round	fast; med	good	sens	yes	white FaWn	dry-med	none; nondecid.	mod (lvs); low maint.	med-high	2,4
Pseudobombax ellipticum (Bombaceae) shaving brush tree	40	35	med; upright: round	med; poor	med	mod	no	pink, white SpWn	dry-med	none; wn	mod (lvs, flwrs); med maint.	low	1,3,4
Pinus elliotii* (Pinaceae) slash pine	50	30	dense; upright	fast; med	good	sens	no	inconspic.	med	fruit/nuts; nondecid.	no rubbish; low maint.	med	2
Tamarindus indica (Fabaceae) tamarind	40	30	dense; upright: round	med; med	good	mod	no	yellow/green SpSuFaWn	dry-med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,3,4
Tectona grandis (Verbenaceae) teak	60	45	med; upright: round	fast; med	med	sens	no	white	med-wet	fruit/nuts; wn	mod (lvs); med maint.	low	1,(3),4
Terminalia catappa (Combretaceae) tropical almond, false kamani	45	60	med; spreading	med; poor	good	tol	yes	white Fa	dry-med-wet	fruit/nuts; nondecid.	high (lvs, fruit); high maint.	low	1,3,4,5
Artocarpus altilis (Moraceae) ulu, breadfruit POLYN. INTRO	40	30	med; upright: round	med; med	poor	mod	no	inconspic. Fa	(dry) med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low-med	1,(3),4

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Lophostemon confertus (Myrtaceae) vinegar tree, brush box, Brisbane box	50	30	dense; upright	fast; med	good	mod	no	inconspic.	med	none; nondecid.	mod (lvs); med maint.	med-high	1,2,(3), 4
Ficus benjamina* (Moraceae) weeping banyan	50	70	dense; spreading	fast; good	good	tol	yes	inconspic.	dry-med-wet	none; nondecid.	low (lvs, fruit); low maint.	low	1,2,3,4, 5
Peltophorum pterocarpum (Fabaceae) yellow poinciana	40	35	med; upright: round	med; med	good	sens	yes	yellow SpSu	dry-med-wet	fruit/nuts; nondecid.	mod (pods); low maint.	low-med	1,3,4,5

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PARK, GREENWAY, AND OPEN SPACE PALM TREES - SMALL

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Hyophorbe lagenicaulis (Arecaceae) bottle palm	15	10	open; upright	slow; poor	good	sens	no	white SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Pritchardia glabrata (Arecaceae) drawf-loulu (W. Maui) NATIVE (ENDEMIC)	6	6	dense; round	slow; med	good	sens	no	yellow SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	med	2,(3),4
Phoenix roebelinii (Arecaceae) dwarf date palm	15	8	open; upright	med; med	good	mod	no	white SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4, (5)
Pinanga kuhlii* (Arecaceae) ivory cane palm	12	4	open; upright	med; good	poor	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3)
Howea forsteriana* (Arecaceae) kentia palm	15	10	med; upright	slow; good	poor	mod	no	white SpSuFa	med-wet	fruit/nuts; nondecid.	low (lvs); low maint.	med-high	1,2,(3), 4
Pritchardia hillebrandii (Arecaceae) loulu, loulu-lelo (Molokai) NATIVE (ENDEMIC)	20	10	dense; upright	slow; med	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Veitchia merrillii (Arecaceae) Manila palm	20	10	open; upright	slow; med	good	mod	no	white SpSuFa	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Cyrtostachys renda* (Arecaceae) red sealing wax palm	20	15	open; upright	med; good	med	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3)
Ptychosperma elegans* (Arecaceae) solitaire palm	20	10	med; upright	fast; med	good	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4

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PARK, GREENWAY, AND OPEN SPACE PALM TREES - SMALL

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Thrinax parviflora (Arecaceae) thrinax palm, pea berry palm	20	10	med; upright	med; med	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4, (5)

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Latania loddigesii (Arecaceae blue latan palm	25	15	dense; upright	slow; med	med	mod	no	white SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Livistona chinensis* (Arecaceae) Chinese fan palm	30	10	dense; upright	slow; med	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4, (5)
Pritchardia pacifica (Arecaceae) Fiji/Tonga fan palm	25	15	dense; upright	slow; low	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4, (5)
Caryota mitis* (Arecaceae) fishtail palm	25	15	dense; upright	fast; med	med	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3)
Wodyetia bifurcata (Arecaceae) foxtail palm	30	12	open; upright	fast; poor	good	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4, (5)
Pritchardia arecina (Arecaceae) golden loulu (E. Maui) NATIVE (ENDEMIC)	30	10	dense; upright	slow; med	good	mod	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,(2),4
Veitchia joannis (Arecaceae) Joannis palm, Fiji ivory palm	35	20	open; upright	fast; good	med	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Veitchia montgomeryana (Arecaceae) Montgomery palm	30	20	open; upright	fast; good	good	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Dictyosperma album var. album (Arecaceae) princess palm	35	20	med; upright	med; poor	med	tol	no	creamy red	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Syagrus romanzoffiana (Arecaceae) queen palm	30	20	med; upright	med; good	good	mod	no	inconspic.	dry-med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low	1,3,4, (5)

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARK, GREENWAY, AND OPEN SPACE PALM TREES - MEDIUM

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Livistona rotundifolia (Arecaceae) Sadang palm	30	10	med; upright	med; good	med	mod	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Coccothrinax barbadensis* (Arecaceae) silver thatch palm	35	8	med; upright	med; poor	good	tol	no	yellow	dry-med	none; nondecid.	low (lvs); low maint.	low	2,3,5
Pritchardia thurstonii (Arecaceae) Thurston/Fiji fan palm	25	10	dense; upright	slow; poor	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Dypsis decaryi (Arecaceae) triangle palm	30	15	med; upright	med; poor	good	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,3,4
Veitchia winin (Arecaceae) Winin palm	30	15	open; upright	fast; good	good	sens	no	inconspic.	med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARK, GREENWAY, AND OPEN SPACE PALM TREES - LARGE

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Archontophoenix alexandrae* (Arecaceae) Alexandra palm	45	15	med; upright	fast; good	med	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Bismarckia nobilis (Arecaceae) Bismarck palm	50	30	dense; upright	med; poor	good	tol	no	cream	dry-med	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,3,4, (5)
Roystonea oleracea (Arecaceae) Caribbee royal palm, cabbage palm	80	20	med; upright	fast; med	good	mod	no	yellow	(dry) med-wet	none; nondecid.	mod (lvs); med maint.	low-med	1,(3),4, (5)
Carpentaria acuminata (Arecaceae) Carpentaria palm	40	15	med; upright	fast; poor	med	sens	no	white	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,3,4, (5)
Roystonea regia (Arecaceae) Cuban royal palm	50	20	med; upright	fast; med	good	mod	no	yellow	(dry) med-wet	none; nondecid.	mod (lvs); med maint.	low-med	1,(3),4, (5)
Metroxylon amicarum (Arecaceae) ivory nut palm	80	35	med; upright	fast; good	med	mod	no	white	med-wet	fruit/nuts; nondecid.	mod (lvs); low maint.	low	1
Ravenea rivularis (Arecaceae) majesty palm	40	15	open; upright	med; good	poor	sens	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3)
Cocos nucifera (Arecaceae) niu, coconut POLYN. INTRO	100	30	open; upright	med; poor	good	tol	no	white SpSuFaWn	dry-med-wet	fruit/nuts; nondecid.	mod (lvs, nuts); high maint.	low	1,3,4,5
Archontophoenix cunninghamiana (Arecaceae) Seaforthia palm	45	15	med; upright	fast; med	good	sens	no	lavender	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

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CHAPTER 4. PARKING LOT TREES

Some of the definitions below are repeated here from Chapter One for convenience of the reader.

4.1 DEFINITIONS

4.101 Bubbler: Irrigation head that water bubbles out and causes directed watering to an area such as a tree's watering basin.

4.102 Continuous Planter: An in-ground planting area along property lines, or along entrance or exit roads, or in front of a single row of parking stalls, or between a double row of parking stalls, or along a building.

4.103 Crown/Canopy: The upper portion of a tree consisting of its branches and leaves.

4.104 Hardscape: Asphalt, concrete, and other hard surfaces used as part of a landscape.

4.105 Large Crown Shade Trees: Trees whose crowns equal or exceed the "mature spread" in feet as listed in the "Parking Lot Trees" tables.

4.106 Root Barrier: Various synthetic products used to deflect tree roots from impacting with, and causing damage to, hardscapes and underground utilities.

4.107 Stream Head: An irrigation head used to water the surface of a planter. Water comes out in streams, as opposed to a spray, making for less wind deflection. It is used primarily for ground covers, turfgrass, and shrubs where surface roots are more common.

4.108 Tree Well/Planter: In-ground planters of various shapes and sizes dispersed throughout a parking area for the purpose of growing shade trees and other landscape plants. They are usually edged by concrete or asphalt curbing.

4.109 Water Basin: The area, usually four feet in diameter, surrounding a newly planted tree and formed by mounding a six inch high berm of onsite soil. The basin collects water for tree irrigation.

4.110 Some of the above definitions are repeated here from Chapter One for convenience of the reader.

4.2 PURPOSE

4.201 This chapter is written to be more specific in the implementation of 19.36A.070.A.2 of the Maui County Code which says, "Large crown shade trees shall be provided at minimum regular intervals for every five spaces throughout each parking area. Appropriate hedge material and/or earth mounds, and shrubs shall be provided in linear masses to function as visual screens." This chapter will address how trees can be placed and maintained to fulfill their "large crown shade tree" mission in parking lots. Other chapters address hedges and ground covers available for use in parking lot landscaping.

4.202 Because well planted and well maintained landscaping in parking lots improve the overall quality of life in Maui County, this chapter provides guidelines for use by engineers, architects, developers, and parking lot owners to help them with tree choices, planting, and post planting maintenance. Because people go out of their way to park under shade, this chapter reflects a desire to provide the shade people want and be in conformance with Chapter 19.36A of the Maui County Code.

4.203 When 19.36A.070 of the Maui County Code was first written, the purpose was for providing shade for people comfort and landscape aesthetics. With the drastic increase in cars and scientific documentation that parked cars under shade volatize less air pollutants that contribute to global warming, the placement of trees and the amount of shade they provide take on a greater importance (Scott, et. al. 1999).

4.204 Following are a few excerpts taken from professionally written articles on the scientific research that support the positive role large canopied parking lot shade trees have in providing shade, reducing air pollution, and providing a healthier, more comfortable, and more attractive environment for people and business. See literature citations at the end of this chapter.

4.204-A Parking lots can be characterized as miniature heat islands and sources of motor-vehicle pollutants (Hahn and Pfeifer 1994; Asaeda, et. al. 1996).

4.204-B Through cooling of heat islands, urban forests may reduce vehicle hydrocarbon emissions (Cardelino and Chameides 1990; Taha 1996, 1997).

4.204-C Vegetation canopies cool microclimates by direct shading of the ground surface and indirectly by the transpiration of water through leaves (Lee 1978; Oke 1987).

4.204-D An experiment was done in a Davis, California shopping center parking lot during August 5-7, 1997 (Scott, et. al. 1999). The lot contained shaded and unshaded portions. Twenty-nine percent of the parking lot was shaded by trees with a crown density (amount of leaves) of only 63% due to a drought. With more foliage temperature differences would have been greater between shaded and unshaded portions. A summary of the study's parking lot tree shade benefits follows:

Area	Heat Difference of Shaded-Unshaded Lots
Air Temperature	Shaded parts of lot averaged 1^{o}C to 2^{o}C (1.8^{o}F to 3.6^{o}F) cooler than unshaded portions.
Vehicle Cabin Temperature	Shaded vehicle cabins averaged 26.2^{o}C (47.2^{o}F) cooler than unshaded vehicles.
Vehicle Fuel Tank Temperature	Shaded vehicle tanks averaged 2^{o}C to 4^{o}C (3.6^{o}F to 7.2^{o}F) cooler than for unshaded vehicles.

4.204-E From a business point of view, research has shown that shopping centers with well cared for landscapes with large shade trees in their parking lots are more inviting to customers who will travel further to shop there, will stay longer, spend more money, and make more return visits. The increase in sales will help to offset the costs for planting and providing proper tree and landscape care (Wolf 2005). Merchants often have different and lesser appreciation for trees and may assume that shoppers share their attitudes (Wolf 2009). In spite of a financial gain for merchants, there is an apparent disconnect between merchant and customer appreciation of parking lot shade trees as shown by Wolf's 2005 and 2009 studies.

4.205 Besides a reduction of vehicle emissions and a mitigation of urban heat islands, readings support additional parking lot shade tree benefits such as: a potential for prolonged pavement life due to shade, reduced human exposure to UV radiation due to canopy interception, air pollutant uptake by tree canopies, and mitigation of urban storm water runoff.

4.206 Because trees provide more than just shade, photovoltaic, windmill, and solar energy projects that necessitate the removal or elimination of

required trees should be brought to the Maui County Arborist Committee for recommendations.

4.3 THE GOAL

4.301 The goal of this chapter is to provide a minimum of 25% parking lot shade from trees within fifteen years after planting, and that this percentage of shade, or more, is maintained thereafter by the parking lot's owner.

4.302 The Maui County Arborist Committee calculated the percentage of shade produced by trees in a commercial parking lot utilizing Maui County Planning Department 19.36A standards and obtained a minimum of 25% shade when using medium sized tree canopies at maturity.

4.303 If noncommercial parking lots have a difficulty meeting the 25% shade in fifteen years, owners may communicate in writing with the Arborist Committee for recommendations.

4.304 If an existing parking lot owner is required to bring their parking lot up to current standards and does not have the space for a sufficient number of trees to meet the 25% shade goal, the parking lot owner may communicate in writing with the Arborist Committee for recommendations.

4.305 Supported by local references, the Arborist Committee is of the opinion that when trees are well cared for and pruned correctly without topping, the amount of shade their canopies provide at maturity will be at a minimum what is found in the "Parking Lot Trees" tables at the end of this chapter (Staples, et. al. 2005; Rauch, et. al. 2006, 2009.)

4.306 To achieve this percentage of shade, engineers, architects, developers, and parking lot owners need to:

- 4.306-A Locate trees to optimize their shade onto where cars park and maneuver.
- 4.306-B Plant the right size tree in the right size planter.
- 4.306-C Plant a few extra trees or use ones with larger canopies, planting space available, to make up any shade deficiency.
- 4.306-D Allow canopies to grow to their expected spread.

4.307 If existing on-site trees will be used as part of the parking lot's tree count and shade calculation, they need to be provided protection during construction. See Chapter Eight, "Construction Project Tree Protection and Replacement Program" for guidelines. Additional information can be

obtained from Trees and Development, a *Technical Guide to Preservation of Trees during Land Development* by Nelda Matheny and James R. Clark, ISBN: 1-881956-20-2, an ISA publication, 184 pages, 1998.

4.308 After planting, replace trees that are missing, or dead, or not doing well. Unless otherwise approved by the Planning Department, replacement tree(s) shall be the same size and type as initially approved.

4.309 If for some reason matured trees are replaced, larger specimens than initially approved should be planted. Consult with the Planning Department for recommendations.

4.310 All pruning shall be performed with an overall goal of providing maximum tree canopy development to provide and maintain a minimum of 25% shade within 15 years. It is not true that trees need to be "cut back" every few years. Topping trees and pruning them to resemble lollipops are contrary to the intent of this chapter. Hire pruners who are currently International Society of Arboriculture (ISA) Certified Arborists or Certified Tree Workers, who use pruning procedures recommended by the ISA. If in doubt, consult with the International Society of Arboriculture at **isa@isa-arbor.com** or the Maui County Arborist Committee.

4.311 Because this parking lot shade goal is the first of its kind in Hawaii, the committee is aware that it may need to make adjustments in the future. However, parking lot owners need to grow healthy, well cared for trees with broad canopies that are properly pruned following ISA standards.

4.4 PROCEDURES

4.401 The parking lot's planting plan should be submitted, along with other required documents, to the Department of Public Works when applying for a building permit. The plan needs to provide all the required information discussed in this chapter.

4.402 Only trees from the "Parking Lot Trees" tables found at the end of this chapter may be used unless a request in writing to the Arborist Committee has been approved.

4.403 For clarification of tree characteristics, please see the Chapter One topic "Tree and Other Plant Characteristics Defined" on Page 8.

4.5 PARKING LOT TREE DIVERSITY

4.501 Tree diversity will be based on a tree's genus (plural "genera"), taken from its scientific name. As discussed in Chapter Two, and repeated here for the

reader's convenience, a tree's genus is the first word of its scientific name. For example, the tree, *Bauhinia variegata*, Bauhinia is the genus part of its scientific name and variegata is the species part of its scientific name. Tree scientific and common names are found in the "Parking Lot Trees" tables, beginning on page 83.

4.502 Trees of different genera are necessary when 26 or more parking stalls require landscaping. Trees of the same genus can be planted along a boundary, or in small groups. Groupings of different tree genera should be comingled in large parking lots. Current research supports that tree diversity provides habitats for a variety of insect pest predators for growing healthier trees.

4.503 Tree Diversity Requirements

Number of Parking Spaces	Minimum Number of Tree Genera Required
1-25	1 genus of trees.
26-75	No more than 50% of the trees may be of the same genus.
76 plus	No more than 25% of the trees may be of the same genus.

4.6 DETERMINING THE SQUARE FEET OF A PARKING LOT SURFACE TO BE TREE SHADED

4.601 If a site has two or more unconnected parking areas, their areas to be tree shaded are calculated separately. If the parking areas are connected by a joining drive, their areas to be tree shaded are calculated as one whole.

4.602 Areas under covered stalls (e.g. parking towers) may be excluded in determining the area requiring 25% shade. However, that tree count to meet the one tree per five parking spaces should be used in adjacent areas on the property.

4.603 Parking tower uncovered roof top parking area will be included in the area requiring 25% tree shade, even if the trees need to be planted in uncovered stalls on ground level.

4.604 Paved parking lot areas included in the computation to receive a minimum of 25% tree shade shall be clearly indicated on the parking lot plan by darkened boundaries, hatch marks, etc. and will include: all parking stalls and loading areas; all areas vehicles maneuver on and drive within the

property line. Include tree planter surfaces, whole or in part, that are located within this area. See Figure 4-1: Parking Lot Plan on page 77.

4.605 The following are excluded from the area requiring 25% tree shade:

4.605-A Areas used exclusively for truck loading and unloading and separated by a barrier.

4.605-B Truck maneuvering and truck parking areas unconnected to, or exclusive of, any vehicle parking or maneuvering.

4.605-C Surfaced areas for automobile dealerships, lumber yards, and similar facilities that are used for display, sales, service, and vehicle storage. However, all parking areas for patrons and workers are subject to the 25% shading requirement.

4.605-D Surfaced areas not used for vehicle parking, driving or maneuvering, provided they are made inaccessible to vehicles by a barrier.

4.606 Using the above information, determine the parking lot area (in square feet) to be shaded by trees and use that information in Figure 4-2: Calculating Percentage of Parking Lot Shade, Part B on page 78.

4.7 DETERMINING THE SQUARE FEET OF SHADE THAT PARKING LOT TREES WILL PROVIDE

4.701 Shade credit is given in 25% increments based on the proportion of shading from a tree's crown that covers the parking area – and not outside of it. "Round up" for trees falling between percentages. Overlapping shade does not count twice.

4.702 Tree shade that falls on tree planter surfaces within the parking lot, whole or in part, is included in the calculation of the total amount of shade provided by the trees.

4.703 Using the plan on page 77 as an example, parking lot plans will clearly show:

4.703-A Tree locations with their expected matured tree canopies drawn to scale.

4.703-B The percentage of shade credit provided by each tree clearly indicated using words, numbers, or letters such as F, TQ, H, and Q. (F for 100%, TQ for 75%, H for 50%, and Q for 25%).

4.703-C Number of different tree types, quantity of each type, and amount of shade provided by each tree. Include both their scientific and common names as found in the "Parking Lot Trees" tables beginning on page 83.

4.704 The "square feet" of shade provided by each tree is determined by using the percentage of shade each provides on the parking lot's surface (100%, 75%, 50%, or 25%), and locating its square foot equivalence as shown at the top of each "Parking Lot Trees" table beginning on page 83.

4.705 Using the "square feet" of shade each tree provides, complete Figure 4-2: Calculating Percentage of Parking Lot Shade, Part A on page 78.

4.8 CALCULATING PERCENTAGE OF PARKING LOT SHADE

4.801 Using information from 4.606 and 4.705, complete Figure 4-2: Calculating Percentage of Parking Lot Shade on page 78.

4.802 The proposed parking lot's percentage of tree shade should reach a minimum of 25%.

4.803 Submit a completed Figure 4-1: Parking Lot Plan and Figure 4-2: Calculating Percentage of Parking Lot Shade, along with the parking lot plans to the Department of Public Works when applying for a building permit.

4.9 PARKING LOT PLANTERS

4.901 Individual tree wells shall have plantable areas no less than:

Tree Canopy Diameter	Minimum Tree Well Area	Possible Configuration
15 ft.	16 sq. ft.	2 ft. x 8 ft., 4 ft. x 4 ft., etc.
20 ft., 25 ft., and 30 ft.	64 sq. ft. (Consider larger for trees with intrusive roots.)	7.5 ft. x 8 ft., 8 ft. x 8 ft., etc.
35 ft. and 40 ft.	144 sq. ft.	8 ft. x 18 ft., a 14 ft. diameter circle, etc.
70 ft. or greater	400 sq. ft.	8 ft. wide x 50 ft. long, a 25 ft. min. diameter circle, etc.

4.902 At best, odd shaped planters should provide more than the required surface area above. This provision is especially true if there is a limited horizontal distance between the trunk and curb that will restrict root growth.

4.903 Continuous planters permit planting multiple trees at distances reflecting matured canopies plus ten feet for maintenance; tree roots will comingle. Continuous planters can be designed to receive surface water runoff to aid in the prevention of flooding, restoration of ground water, and reduction of ocean pollution.

4.903-A Continuous planters with an eight foot wide planting distance will accommodate all parking lot shade tree types.

4.903-B Planter Materials. Planters shall contain on-site soil, trees, shrubs, hedges, grass, living ground covers, and coarse organic mulch on the surface. If on-site soil is not available, or insufficient in amount, good imported soil of the same kind can be thoroughly mixed in and used. Non-living ground covers such as glass, rock, marble, synthetic grass, etc. are not recommended. They are difficult to keep confined and research has shown they do not contribute to temperature reduction and soil improvement. However, a letter requesting their usage may be written to the Arborist Committee. Grates may be utilized in high foot traffic areas.

4.904 Because in some cases car bumpers may project over a tree planter's curb, trees should be located to provide adequate space for tree growth without bumper damage. Use tire stops when necessary.

4.10 PLANTING AND POST PLANTING CARE

4.1001 Prepare the soil and plant when the soil is dry. Planting when the soil is moist will lead to soil compaction. Compacted soil has fewer air pores, resulting in poor tree and plant growth.

4.1002 Excavate the soil within the entire tree planter to a depth of 4 feet. Rocks, wood, and debris should be removed to provide maximum space for root growth. Ensure that crusher waste or other fill material is not making a hardpan. If so, break through and remove the impervious layer material. Add a sufficient amount of unamended soil, similar to the type on-site, as replacement. Firm, but without compacting, the soil in the planting hole where the tree's root ball is placed to avoid tree settling. Bring the soil to the level needed to plant the tree at the depth it grew in the field or container. Irrigation lines and root barriers are to be installed. Remove tree from its container and carefully open up circling roots (container's bottom and side) to encourage outward growth. Plant the tree, stake or guy it if necessary, and create a 6 inch high berm 2 feet from the tree as a watering basin. See Chapter Six, "Policies, Procedures, and Standards for

Planting, Pruning, and Maintaining Trees" for additional planting and staking information.

4.1003 Root Barriers

4.1003-A Root barriers should be no less than 24 inches deep and installed along the inside perimeter of tree planters per manufacturer specifications. Root barriers are NOT to encase tree roots in a circular manner resembling a planting container. If trees are planted along entry/exit roads, or along parking lot borders, or within any long planter such as next to buildings, root barriers should be 20 feet long and centered on the tree. These root barriers may need to be installed on both sides of the tree if hardscapes are present there.

4.1003-B For large trees with an aggressive root system, such as the monkeypod, deeper root barriers, or root barriers installed along the entire inside edge of the planter, will encourage root containment.

4.1003-C Root barrier top edges should protrude above the soil to prevent being covered over by the soil. This prevents surface roots from growing over the root barrier and then causing hardscape damage.

4.1003-D Construction plans shall show where root barriers are to be installed and length required.

4.1004 Apply a 2-4 inch thick layer of aged coarse organic mulch in the area around the tree for soil moisture retention, weed control, and improvement of soil microflora. Keep it away from the trunk by 6 inches, and reapply as needed.

4.1005 Young and matured trees need a professional arborist who is currently certified by the International Society of Arboriculture (ISA) and who uses ISA standards to train them to grow tall and form a canopy for shade. Not desired are crowns that are topped, cropped like lollipops, or excessively raised to resemble parachutes. All pruning should be performed with an overall goal of providing maximum tree canopy. Consult with the Maui County Arborist or Arborist Committee for more information.

4.1006 Turfgrass and ground cover planted in tree planters need to be kept away from trees by a 2-foot radius for the first two years to avoid root competition. After two years, the grass can then grow into the area but should be kept away from tree trunks by hand clipping or the use of selective herbicides. Avoid string trimmer damage to trunks; trunk guards

work well. Turfgrass and ground cover recommendations can be found in Chapter Ten, "Turfgrass and Ground Covers: Types, Planting, and Care".

4.11 IRRIGATION

4.1101 All parking lot shade trees shall receive an adequate amount of water to wet their entire root ball, and a little beyond, to encourage deep rooting. The usage of irrigation bubblers in tree wells, or a drip system that is on for a sufficient amount of time to deliver the necessary amount of water, will suffice. Surface drip tubes, compared with underground pipes, are exposed and subject to vandalism. If turfgrass or other living ground covers are included, proper irrigation design becomes more critical. See Chapter Twelve, "Irrigation and Water Conservation; Drought Tolerant Plants" for more information.

4.1102 Large shade trees require large planters. These trees may need more than two (2) bubblers, depending on the size of the root ball. Stream heads are a consideration for applying water to large areas that include bigger trees as well as other plants. Deep watering, as opposed to shallow watering, is a must to encourage deep rooting to avoid hardscape root damage.

4.12 FOLLOW-UP TO INSTALLATION

4.1201 The landscape architect, or the designer of record, shall be responsible for periodically inspecting and approving the installation of all landscape elements as to plan specifications.

4.1202 Maui County personnel will inspect parking lot shade trees regarding their progress towards reaching the goal of a minimum 25% parking lot shade in 15 years. When needed, inspectors will work with parking lot owners to achieve this percent of shade. Please see Figure 4-3: Parking Lot Tree Inspection Sheet, Figure 4-4: Parking Lot Tree Corrective Actions Descriptions and Figure 4-5: Parking Lot Tree Inspection Summary Sheet on pages 79, 80 and 81. These parking lot guidelines and inspection forms are used with verbal permission from the California cities of Sacramento and Davis. They have been slightly modified for use in the MCPP.

4.13 LITERATURE CITED

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FIGURE 4-1: PARKING LOT PLAN

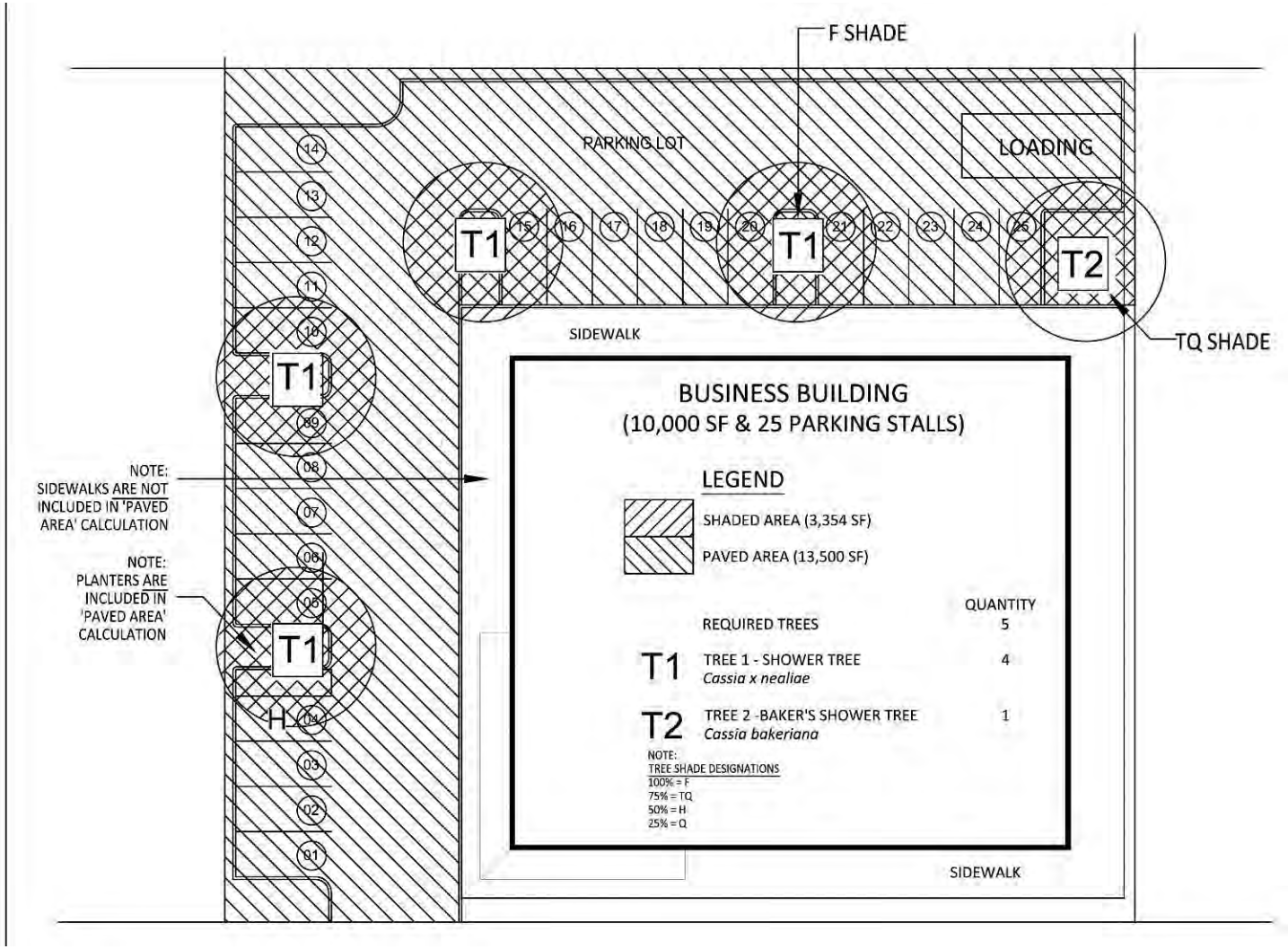

FIGURE 4-2: CALCULATING PERCENTAGE OF PARKING LOT SHADE

PROJECT NAME & LOCATION	EXAMPLE PARKING LOT - 1234 ANYWHERE ST., MAUI, HI							TMK: (2)1-1-001:01	
TREE NUMBER OR GRAPHIC SYMBOL	COMMON NAME	BOTANICAL NAME	100% FULL TREE SHADE*	TREE SHADE INVENTORY				TREE COUNT	TREE SHADE AREA
			SQUARE FEET	1/4	1/2	3/4	FULL		SQUARE FEET
T1	RAINBOW SHOWER TREE	*Cassia x nealiae*	706				4	4	2824
T2	BAKER'S SHOWER TREE	*Cassia bakeriana*	706			1		1	530

* FROM "PARKING LOT TREES" TABLES

TOTAL TREE SHADE AREA (S.F.)	3354	A
TOTAL PAVED AREA (S.F.)	13,500	B
TOTAL NUMBER OF PARKING STALLS	25	C

REQUIRED TREE COUNT ('C' DIVIDED BY 5 - ROUNDED UP)	5
PROPOSED TREE COUNT	5
REQUIRED TREE GENERA COUNT	1
PROPOSED TREE GENERA COUNT	1
REQUIRED % IN SHADE	25%
PROPOSED % IN SHADE ('A' DIVIDED BY 'B' MULTIPLY BY 100)	25%

FIGURE 4-3: PARKING LOT TREE INSPECTION SHEET

PARKING LOT TREE INSPECTION SHEET

COUNTY OF MAUI

Page _____ of _____

Project Name/Title: _____

Project Address: _____

_____

Landscape Plan Ref. No. _____

Starting point and route for inspection: _____

Inspector's Name: _____

Date of Inspection: _____

Original Planting Date: _____

Years after Planting: _____

		SIZE AND GROWTH			GROUND		TRUNK		CROWN			
Tree Site No.	Species	Crown Radius (ft.)	Class Size (1, 2, or 3)	Acceptable Growth Rate (Y or N)	Irrigation	Roots	Staking	Trunk Damage	Pruning	Foliage Condition	Remove/ Replace	"Others" & Comments

Irrigation
IM/D – Missing/damage
IW – Too wet
ID – Too dry
AM – Add mulch
BR – Basin repair
IO – Other

Roots
RP – Paving/curb damage
RW – Weakly anchored
RO – Other

Staking
SR – Remove stakes
SA – Add stakes
SS – Adjust stakes
SL – Adjust lean
ST – Adjust ties
SO – Other

Trunk Damage
TW – Add wheel stop
TS – Add stakes (protect)
TT – String trimmer
TO - Other

Pruning
PL – Lift prune
PT – Thin prune
PH – Hazard prune
PC – Conflict prune
PS – Structural prune
PR – Restorative prune
PO – Other

Foliage Condition
FS – Sparse foliage
FD – Discolored foliage
FO – Other

Remove/Replace
RF – Fatal flaw
RM – Missing tree
RD – Dead/dying tree
RS – Hist stunted tree
RO – Other

Use a checkmark if "OK" and no corrective action is required for Ground, Trunk, and Crown categories.
See back page for details of corrective actions.

Minimum Acceptable Growth Rate. Units are average crown diameter in feet.

Years After Planting	1 yr.	2 yrs.	3 yrs.	5 yrs.	7 yrs.	9 yrs.	12 yrs.	15 yrs.
Class 1 – Small Trees (15-20 ft. spread)	3 ft.	4 ft.	6 ft.	8 ft.	11 ft.	14 ft.	17 ft.	20 ft.
Class 2 – Medium Trees (25-30 ft. spread)	3 ft.	5 ft.	7 ft.	12 ft.	16 ft.	20 ft.	25 ft.	30 ft.
Class 3 – Large Trees (35 ft. and larger spread)	3 ft.	5 ft.	9 ft.	14 ft.	20 ft.	25 ft.	34 ft.	40 ft.

FIGURE 4-4: PARKING LOT TREE CORRECTIVE ACTIONS DESCRIPTIONS

Irrigation	IM/D – Missing/Damaged	Consult with a maintenance company to repair/replace irrigation fittings.
	IW – Too wet	Consult with a maintenance company to check for possible leak, flow or timing problems.
	ID – Too dry	Same as above.
	AM – Add mulch	Remove weeds and add mulch to reduce water loss.
	BR – Basin Repair	Repair tree basin or tree well to avoid water run-off.
	IO – Other	(See "Comments" section of tree's evaluation.)
Roots	RP – Paving/curb damage	Consult with a certified arborist to determine if roots can be pruned. Prune roots and repair hardscape. Leave space for root growth.
	RW – Weakly anchored	Girdling roots are typically the cause of instability. Consult with a certified arborist. If there is no corrective action, replace tree. See RF.
	RO – Other	(See "Comments" section of tree's evaluation.)
Staking	SR – Remove stakes	Remove nursery stake that is normally removed at time of planting, or remove support stakes if the trunk can support the crown alone.
	SA – Add stakes	Add stakes to improve stability of tree.
	SS – Adjust stakes	Move the stakes away from the tree trunk so that they do not touch or rub against it.
	SL – Adjust lean	Adjust ties to maintain the tree in a vertical orientation. Allow for some swaying motion of the trunk within the ties.
	ST – Adjust ties	Remove all ties except those at height where the trunk begins to bend from the weight of the tree crown. Allow for some swaying.
	SO – Other	(See "Comments" section of tree's evaluation.)
Trunk Damage	TW – Add wheel stop	Add wheel-stop to reduce further trunk damage caused by motorist pulling too far forward and striking the tree trunk.
	TS – Add stakes (protect)	Add stakes to protect the tree trunk from autos and people.
	TT – String trimmer	Pull grass away from trunk. Add trunk guard.
	TO – Other	(See "Comments" section of tree's evaluation.)
Pruning	PL – Lift prune	Remove lower branches to avoid interference with vehicles (10 ft.?) or people (7 ft.?).
	PT – Thin prune	Remove branches that are crossing, touching, or closely spaced, to open up the canopy and reduce the load on the trunk. Avoid lion tailing.
	PH – Hazard prune	Remove branches that may cause injury if they fail (deadwood, weakly attached branches, co-dominant branches, and defected branches).
	PC – Conflict prune	Remove branches that are interfering with lighting, overhead wires, buildings, signage or vision.
	PS – Structural prune	Remove branches that could cause a structural problem in the future (ex. Too closely spaced branches, branches with included bark).
	PR – Restorative prune	Remove new multiple leaders to restore crown of a tree that is too severely pruned or pollarded.
	PO – Other	(See "Comments" section of tree's evaluation.)
Foliage Cond.	FS – Sparse foliage	Consult a certified arborist to address possible wide ranging causes and corrective actions to take
	FD – Discolored foliage	Consult a certified arborist to address possible wide ranging causes and corrective actions to take.
	FO – Other	(See "Comments" section of tree's evaluation.)
Remove/ Replace	RF – Fatal flaw	Remove and replace tree. Appears healthy but contains a problem that can't be corrected (ex. weakly anchored roots, untreatable disease.
	RM – Missing tree	Replace tree that has been removed.
	RD – Dead/dying tree	Remove and replace tree which is beyond saving.
	RS – Historically Stunted tree	Remove and replace tree that has never attained the minimum growth rate expected for this location and under these conditions.
	RO – Other	(See "Comments" section of tree's evaluation.)

FIGURE 4-5: PARKING LOT TREE INSPECTION SUMMARY SHEET

County of Maui

Project Name/Title:_____ Inspector's Name: _____

Project Address: _____ Date of Inspection:_____

_____ Original Planting Date: _____

Landscape Plan – Ref. No: _____ Years after Planting:_____

Site Summary

A. Total Tree Sites _____

B. No. of Stunted Trees
(Unacceptable Growth Rate)
(RS) _____

C. No. of Trees to Remove
(RF + RD + RO) _____

D. No. of Missing Trees
(RM) _____

E. No. of Replacement Trees: (B + C + D) _____

F. No. of Remaining Trees in Need of Attention
(See "Others" and comments section) _____

G. No. of Trees with no Action Required: A-(E+F) _____

PARKING LOT TREES - 15' SPREAD

Percent shade in square feet: 100%=180 sq. ft.; 75%=135 sq. ft.; 50%=90 sq. ft.; 25%=45 sq. ft.

These trees require a minimum planter space of 16 sq. ft. with a minimum 2 ft. planter width.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Bauhinia hookeri (Fabaceae) alibangbang	20	15	med; upright: round	slow; poor	good	mod	no	white/red SpSuWn	(dry) med	fruit/nuts; nondecid.	no rubbish; low maint.	med	1,2,(3), 4,(5)
Tabebuia impetiginosa (Bignoniaceae) lavender trumpet	15	15	med; round	med; med	med	sens	no	purple (dark) SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4
Stemmadenia littoralis (Apocynaceae) lecheso, lechoso	15	15	med; round	med; good	med	sens	no	white SpSuFaWn	(dry) med-wet poisonous	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Magnolia grandiflora 'Little Gem' (Magnoliaceae) magnolia little gem	25	15	dense; upright: round	med; med	med	sens	no	white SpSu	med-wet	none; nondecd.	mod (lvs); med maint.	low-med	1,2,(3), 4
Bolusanthus speciosus (Fabaceae) Rhodesian wisteria	15	15	med; round	med; med	med	sens	no	blue/violet SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med-high	2
Schotia brachypetala (Fabaceae) tree fuchsia, schotia	20	15	med; upright	slow; med	good	mod	no	red SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4, (5)
Bauhinia tomentosa (Fabaceae) yellow bauhinia	20	15	med; upright: round	med; poor	med	sens	no	yellow SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Cordia lutea (Boraginaceae) yellow geiger, Peruvian cordia	20	15	**med; upright: round**	**med; poor**	**good**	**mod**	**no**	**yellow SpSuFaWn**	**dry-med**	**none; nondecid.**	**no rubbish; low maint.**	**low-med**	**3,4,(5)**

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 20' SPREAD

Percent shade in square feet: 100%=315 sq. ft.; 75%=235 sq. ft.; 50%=160 sq. ft.; 25%=80 sq. ft.

These trees require a minimum planter space of 64 sq. ft. with a minimum 8 ft. planter width.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Brachychiton acerifolius (Sterculiaceae) Australian flame tree	30	20	med; upright: round	med; poor	good	mod	no	red SuFa	med	none; fa	low (lvs); low maint.	med	1,2,4
Conocarpus erectus (Combretaceae) buttonwood, silver buttonwood	20	20	dense; round	med; poor	good	tol	no	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Ceratonia siliqua (Fabaceae) carob	20	20	med; upright: round	med; poor	good	mod	no	inconspic.	dry-med	fruit/nuts; nondecid.	low (fruit); low maint.	low-med	2,3,4
Tabebuia berteroi (Bignoniaceae) Hispaniolan rosy trumpet tree	30	20	med; upright: round	fast; poor	med	sens	no	light pink SpSuFa	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4, (5)
Heritiera littoralis (Sterculiaceae) looking glass tree	20	20	med; spreading	slow; poor	med	tol	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Gliricidia sepium (Fabaceae) madre de cacao	20	20	open; round	fast; poor	good	tol	no	violet SpWn	dry-med	fruit/nuts; nondecid.	mod (lvs); med maint.	low-med	3,4,5
Majidea zanquebarica (Sapindaceae) mgambo, velvet seed, black pearl	20	20	dense; round	fast; poor	good	sens	no	chartruse SuFa	(dry) med	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4
Reynoldsia sandwicensis (Araliaceae) ohe makai NATIVE (ENDEMIC)	25	20	med; round	med; poor	good	sens	no	inconspic.	dry	none; su	low (lvs); low maint.	low-med	2,3,4

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Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 20' SPREAD

Percent shade in square feet: 100%=315 sq. ft.; 75%=235 sq. ft.; 50%=160 sq. ft.; 25%=80 sq. ft.

These trees require a minimum planter space of 64 sq. ft. with a minimum 8 ft. planter width.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Cheirodendron trigynum (Araliaceae) olapa NATIVE (ENDEMIC)	20	20	med; round	med; good	med	sens	no	inconspic.	med-wet	none; nondecid.	no rubbish; low maint.	med-high	1,2,4
Tabebuia aurea (Bignoniaceae) silver trumpet	20	20	med; upright: round	fast; poor	med	mod	no	yellow SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Eucalyptus kruseana (Myrtaceae) tidy blue	20	20	med; upright: spreading	med; med	good	mod	no	yellow FaWn	dry-med	none; nondecid.	no rubbish; low maint.	low	2,3,4, (5)
Harpullia pendula (Sapindaceae) tulipwood	25	20	med; upright: round	fast; med	med	sens	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4

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Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 25' SPREAD

Percent shade in square feet: 100%=490 sq. ft.; 75%=370 sq. ft.; 50%=245 sq. ft.; 25%=125 sq. ft.

These trees require a minimum planter space of 64 sq. ft. with a minimum 8 ft. planter width.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Clusia rosea* (Clusiaceae) autograph tree, copey	20	25	med; round	med; med	good	tol	yes	white SpWn	(dry) med-wet	fruit/nuts; nondecid.	mod (fruit); med maint.	low-med	1,(3), 4,5
Eucalyptus gardneri (Myrtaceae) blue mallet	25	25	dense; upright	fast; med	good	mod	no	yellow Fa	dry-med	none; su-fa	no rubbish; low maint.	low	1,2,3,4, (5)
Colvillea racemosa (Fabaceae) colvillea	30	25	med; upright: round	med; med	good	mod	no	orange SuFa	dry-med-wet	fruit/nuts; wn-sp	no rubbish; low maint.	low-med	1,2,3,4, (5)
Cochlospermum vitifolium 'Pena' (Bixaceae) double buttercup tree	30	25	med; upright: round	med; poor	med	mod	no	yellow Wn	dry-med-wet	none; wn	no rubbish; low maint.	low-med	1,(3),4, (5)
Elaeodendron orientale (Celastraceae) false olive	30	25	dense; upright: round	med; med	med	mod	no	inconspic.	(dry) med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Bucida buceras (Combretaceae) geometry tree	25	25	med; upright: round	med; med	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Lagerstroemia speciosa (Lythraceae) giant crape myrtle	30	25	med; upright: round	med; poor	med	sens	no	lavender SpSu	(dry) med-wet	none; wn	no rubbish; low maint.	low-med	1,2,(3), 4
Cassia fistula (Fabaceae) golden shower tree	30	25	open; spreading	fast; poor	med	sens	yes	yellow SuFa	(dry) med-wet	fruit/nuts; wn	mod (lvs, pods); med maint.	low-med	1,(3),4

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Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 25' SPREAD

Percent shade in square feet: 100%=490 sq. ft.; 75%=370 sq. ft.; 50%=245 sq. ft.; 25%=125 sq. ft.

These trees require a minimum planter space of 64 sq. ft. with a minimum 8 ft. planter width.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Bauhinia x blakeana (Fabaceae) Hong Kong orchid tree	25	25	open; round	fast; good	med	sens	no	purple SpSuFa	(dry) med-wet	none; nondecid.	mod (flwrs); med maint.	low-med	1,2,(3), 4,(5)
Cordia subcordata (Boraginaceae) kou NATIVE	30	25	dense; upright: round	fast; poor	med	tol	no	orange SpSuFaWn	(dry) med-wet	fruit/nuts; nondecid.	low (fruit); med maint.	low	1,(3), 4,5
Hernandia nymphaeifolia (Hernandiaceae) lantern tree, jack in the box, bing-a-bing	30	25	dense; upright: round	med; med	med	tol	no	white SpSuFaWn	med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low	(3),(5)
Thespesia grandiflora (Malvaceae) maga	30	25	dense; upright: round	fast; med	med	sens	yes	red SuFa	dry-med-wet	fruit/nuts; nondecid.	no rubbish; low maint.	low-med	1,3,4
Swietenia mahagoni (Meliaceae) mahogany	35	25	dense; round	slow; poor	good	tol	no	inconspic.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Thespesia populnea** (Malvaceae) milo NATIVE	25	25	dense; round	fast; med	good	tol	no	yellow SpSuFa	(dry) med-wet	fruit/nuts; nondecid.	mod (lvs, fruit); med maint.	low-med	1,2,(3), 4,5
Michelia champaca (Magnoliaceae) mulang, orange champak	35	25	dense; upright: round	med; med	med	sens	no	yellow/ orange SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	med	1,2,(3), 4

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Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 25' SPREAD

Percent shade in square feet: 100%=490 sq. ft.; 75%=370 sq. ft.; 50%=245 sq. ft.; 25%=125 sq. ft.

These trees require a minimum planter space of 64 sq. ft. with a minimum 8 ft. planter width.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Michelia x alba (Magnoliaceae) paklan, white champak	30	25	dense; upright: round	med; med	med	sens	no	white SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,2,(3), 4
Tabebuia heterophylla (Bignoniaceae) pink tecoma	35	25	dense; upright: round	med; med	med	mod	no	pink SpSuFa	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4, (5)
Tabebuia rosea* (Bignoniaceae) pink trumpet tree	30	25	med; round	fast; med	med	sens	no	pink SpSu	(dry) med-wet	none; wn	mod(lvs); med maint.	low-med	1,2,(3), 4
Pongamia pinnata (Fabaceae) pongamia	25	25	dense; round	fast; med	good	tol	no	pink/white SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Amherstia nobilis (Fabaceae) pride of Burma, amherstia	30	25	med; upright: round	slow; good	poor	sens	no	pink/ yellow Sp	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4
Saraca declinata (Fabaceae) red saraca	25	25	med; upright: spreading	med; med	poor	sens	no	red/ orange SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Brownea macrophylla (Fabaceae) rouge puff	30	25	dense; upright: round	med; med	poor	sens	no	orange SpWn	med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4

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Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 25' SPREAD

Percent shade in square feet: 100%=490 sq. ft.; 75%=370 sq. ft.; 50%=245 sq. ft.; 25%=125 sq. ft.

These trees require a minimum planter space of 64 sq. ft. with a minimum 8 ft. planter width.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Saraca indica (Fabaceae) shasoka tree	25	25	med; upright: spreading	med; med	poor	sens	no	yellow/ red/ orange SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Eucalyptus cinerea (Myrtaceae) silver dollar eucalyptus	35	25	dense; upright: round	fast; med	good	mod	yes	inconspic.	dry-med	none; nondecid.	mod (lvs); med maint.	low-med-high	2,(3),4
Saraca asoca (Fabaceae) sorrowless tree, asoka	25	25	med; upright: spreading	med; med	poor	sens	no	yellow/red/ orange SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Tipuana tipu (Fabaceae) tipa	30	25	open; spreading	med; poor	good	tol	no	yellow SpSu	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Bauhinia variegata 'Candida' (Fabaceae) white orchid tree	30	25	med; round	fast; med	med	sens	no	white SpWn	(dry) med	fruit/nuts; nondecid.	mod (lvs); low maint.	low-med	2,(3),4
Saraca thaipingensis (Fabaceae) yellow saraca	25	25	med; upright: spreading	med; med	poor	sens	no	yellow SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(2), (3),4, (5)
Catalpa longissima (Bignoniaceae) yokewood	35	25	dense; upright	med; med	good	mod	no	wnite SpSu	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	(3),4

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Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 30' SPREAD

Percent shade in square feet: 100%=706 sq. ft.; 75%=530 sq. ft.; 50%=350 sq. ft.; 25%=175 sq. ft.

These trees require a minimum planter space of 64 sq. ft. with a minimum 8 ft. planter width.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Cassia bakeriana (Fabaceae) Baker's shower tree	35	30	med; upright: round	fast; med	med	mod	no	pink/white SpSu	(dry) med-wet	fruit/nuts; wn	mod (lvs, pods); med maint.	low-med	1,2,(3), 4
Guettarda speciosa (Rubiaceae) beach gardenia, pua pua, wut	40	30	dense; upright: spreading	med; poor	med	tol	no	white SpSuFaWn	(dry) med	fruit/nuts; nondecid.	low, lvs, fruit; med maint.	low-med	3,4,5
Cochlospermum vitifolium (Bixaceae) buttercup tree	35	30	med; upright: round	fast; poor	med	mod	no	yellow Wn	dry-med-wet	none; wn	no rubbish; low maint.	low-med	1,(3),4, (5)
Eucalyptus torquata (Myrtaceae) coral gum	35	30	dense; upright: round	fast; med	good	mod	no	pink/ yellow, pink/ white Fa	dry-med	none; nondecid.	no rubbish; low maint.	low	1,2,3,4, (5)
Tabebuia donnell-smithii (Bignoniaceae) gold tree, prima vera	75	30	med; upright	med; poor	poor	mod	no	yellow SpSu	dry-med-wet	none; fa-wn	mod (lvs, flwrs); low maint.	low-med	1,3,4, (5)
Calophyllum inophyllum* (Clusiaceae) kamani POLYN. INTRO	40	30	dense; upright: round	med; poor	good	tol	yes	white SpSuFa	(dry) med-wet	fruit/nuts; nondecid.	mod (nuts); med maint.	low-med	1,(3), 4,5
Cassia x nealiae (Fabaceae) rainbow shower tree	35	30	med; upright: round	fast; poor	med	sens	yes	pink/ yellow SpSu	(dry) med-wet	none; wn	mod (lvs, flws); med maint.	low-med	1,(3),4

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 30' SPREAD

Percent shade in square feet: 100%=706 sq. ft.; 75%=530 sq. ft.; 50%=350 sq. ft.; 25%=175 sq. ft.

These trees require a minimum planter space of 64 sq. ft. with a minimum 8 ft. planter width.

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Tabebuia ochracea (Bignoniaceae) yellow trumpet tree	35	30	med; upright: round	med; poor	med	sens	no	yellow SpSu	dry-med-wet	none; wn	mod (lvs); low maint.	low-med	1,3,4

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 35' SPREAD

Percent shade**** in square feet: 100%=615 sq. ft.; 75%=460 sq. ft.; 50%=310 sq. ft.; 25%=155 sq. ft.

These trees require a minimum planter space of 144 sq. ft. with a minimum 8 ft. planter width.
******Percent shade is based on 80% mature spread, or 28 ft., in 15 yrs.**

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Ficus lyrata (Moraceae) fiddle leaf fig	35	35	dense; upright: round	med; med	good	tol	no	inconspic. SpSuFaWn	(dry) med	none; nondecid.	mod (lvs); med maint.	low-med	1,2,3,4,5
Pseudobombax ellipticum (Bombaceae) shaving brush tree	40	35	med; upright: round	med; poor	med	mod	no	pink, white SpWn	dry-med	none; wn	mod (lvs, flwrs); med maint.	low	1,3,4
Peltophorum pterocarpum (Fabaceae) yellow poinciana	40	35	med; upright: round	med; med	good	sens	yes	yellow SpSu	dry-med-wet	fruit/nuts; nondecid.	mod (pods); low maint.	low-med	1,3,4,5

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 40' SPREAD

Percent shade**** in square feet: 100%=805 sq. ft.; 75%=600 sq. ft.; 50%=400 sq. ft.; 25%=200 sq. ft.

These trees require a minimum planter space of 144 sq. ft. with a minimum 8 ft. planter width.
******Percent shade is based on 80% mature spread, or 32 ft., in 15 yrs.**

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Jacaranda mimosifolia (Bignoniaceae) jacaranda	45	40	med; upright: spreading	fast; poor	med	sens	yes	blue SpSu	med-wet	fruit/nuts; sp	mod:lvs, flwrs, pods; med maint.	low-med	1,2,(3), 4
Senna siamea (Fabaceae) pheasant wood, kassod tree	50	40	med; upright: round	fast; med	good	mod	no	yellow SuFa	(dry) med	fruit/nuts; wn	no rubbish; med maint.	low-med	1,(3),4
Delonix regia (Fabaceae) royal poinciana	30	40	med; spreading	fast; poor	good	sens	yes	red, orange SpSu	dry-med-wet	fruit/nuts; wn	mod (pods); med maint.	low-med	1,2,3,4

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

PARKING LOT TREES - 70'+ SPREAD

Percent shade****in square feet: 100%=1260 sq. ft.; 75%=945 sq. ft.; 50%=630 sq. ft.; 25%=315 sq. ft.

These trees require a minimum planter space of 400 sq. ft. Best in a continuous planter 50 ft. long by 8 ft wide at a minimum, or a 25 ft. minimum diameter circle.
******Percent shade is based on 50% mature spread, or 40 ft., in 15 yrs.**

Species	Mature height (ft)	Mature spread (ft)	Crown density; Growth habit	Growth Rate; Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color; Time of flwr	Water requirements; Poisonous	Fruit or nuts; Deciduous	Rubbish; Maintenance	Elevation	Planting zone(s)
Samanea saman (Fabaceae) monkeypod tree	50	80	dense; spreading	fast; poor	med	sens	yes	pink SpSu	(dry) med-wet	fruit/nuts; wn	mod (lvs, fruit); med maint.	low-med	1,(3), 4,5
Ficus benjamina* (Moraceae) weeping banyan	50	70	dense; spreading	fast; good	good	tol	yes	inconspic.	dry-med-wet	none; nondecid.	low (lvs, fruit); low maint.	low	1,2,3,4, 5

*HPWRA designation "EVALUATE" **HPWRA designation OVERRIDE (only kukui, noni, and milo) (see chapter 13) ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

CHAPTER 5. EXCEPTIONAL TREE PROGRAM

5.1 POLICIES, PROCEDURES FOR NOMINATION AND DESIGNATION, AND OWNER RESPONSIBILITIES

5.101 Policies

5.101-A The "Exceptional Tree" designation is a result of Chapter 58, HRS, and is mandated at the Maui County level by Ordinance 12.24A, which provides for the protection of trees designated exceptional from destruction due to land development or abusive activities. Once a tree is designated as Exceptional, it is recorded with the Bureau of Conveyance. Pruning, removal, and anything that would change the surroundings of the tree to its detriment requires a permit from the Director of Parks and Recreation, with review by the Maui County Arborist Committee. See Appendix C for a copy of Chapter 58, HRS on page 225.

5.101-B The list of Exceptional Trees is included in this document in Appendix D and filed with the Arborist Committee, the Bureau of Conveyances, and the Maui County departments of Planning, Public Works, and Parks and Recreation. (See Appendix D, page 226, for a listing of the Exceptional Trees of Maui County at the time of this printing.)

5.101-C The Hawaii State Legislature passed a bill that allows for a tax deduction for Exceptional Tree maintenance. Consult with your tax preparer, or the Hawaii Department of Taxation, for current information.

5.102 Procedures for nomination and designation of Exceptional Trees:

5.102-A An individual or organization nominates a tree, stand, or grove of trees to the Arborist Committee for consideration as "Exceptional". Included with the nomination should be the scientific and common name of the tree(s), the location of the tree(s) with Tax Map Key number, recent photographs, and reason why the tree(s) should be considered for the Exceptional Tree status.

5.102-B The Arborist Committee reviews the application. If the tree(s) has historic or cultural value; or represents an important community resource; or is exceptional by reason of age, rarity, location, size, esthetic quality; or is endemic: such a tree(s) can be considered an Exceptional Tree.

5.102-C The Arborist Committee communicates with the owner of the property regarding the Exceptional Tree(s) nomination (see form on page 98).

5.102-D The owner signs an "Acceptance Form for Exceptional Tree Status" and returns it to the Arborist Committee (see form on page 99).

5.102-E The Arborist Committee forwards the nomination through the Mayor to the County Council for acceptance and protection by County ordinance.

5.103 Should the owner(s) of an exceptional tree(s) wish to prune, spray, or otherwise remove the tree(s), said owner must first apply for a permit from the Director of Parks and Recreation. The applicant needs to include the location of the tree(s), the action(s) to be taken, and the reason for such action. The Director of Parks and Recreation will request the Arborist Committee to make an on-site evaluation of the Exceptional Tree(s) and recommend a course of action. Approval shall be granted subject to Arborist Committee concurrence.

5.104 Only in very rare occasions will the owner of an Exceptional Tree(s) be granted approval to remove said tree(s) unless the tree(s) is dead, diseased, irretrievably damaged, or is a hazard to public safety or welfare. If an Exceptional Tree is approved for removal, the Arborist Committee will recommend to the Director of Parks and Recreation that the owner plant an appropriate replacement(s) or relocate the Exceptional Tree. If replacement or relocation is not possible, the Committee should identify another tree of the kind for Exceptional Tree classification.

5.105 Owner Responsibilities

5.105-A It is the responsibility of Exceptional Tree owner(s) to provide the required care to maintain the good health of the tree(s).

5.105-B Owners shall:

- Ensure adequate irrigation and fertilization.
- Minimize overcrowding by other trees, plants, and weeds.
- Minimize overcrowding by manmade objects (buildings, etc.).
- For tree pruning, after obtaining a permit from the Department of Parks and Recreation and with the Arborist Committee's approval, utilize the services of an arborist, who is currently certified by the International Society of Arboriculture, who will be onsite overseeing or doing the pruning. Pruning of the

tree(s) must be in accordance with International Society of Arboriculture standards.

- Keep the surrounding area free of litter.
- Not permit anyone to climb an Exceptional Tree except for pruning purposes.
- Not permit anyone to climb an Exceptional Tree with spikes.
- Not permit anyone to post a sign or attach any item with or without nails, wires, etc., to an Exceptional Tree.
- Not permit foreign matter to be applied to the surface of an Exceptional Tree (paint, sealers, oil, etc.).
- Not apply or store toxic or harmful materials (such as oil, ice, paint, etc.) under the canopy of Exceptional Trees.
- Limit activities that occur under the tree's canopy to avoid soil compaction and root damage.

5.106 The Arborist Committee has final approval on any actions that might negatively affect the health of Exceptional Trees.

FORM 5-1: MAUI COUNTY ARBORIST COMMITTEE REQUEST FOR EXCEPTIONAL TREE CONSIDERATION

TO: (Owner of tree considered for Exceptional Tree status)

From: Maui County Arborist Committee Date: _____

Dear _____:

The Maui County Arborist Committee is considering a tree*, a stand, or grove of trees that is presently growing on a parcel of your land (TMK _____) for designation as an Exceptional Tree(s) pursuant to the Exceptional Tree Law (HRS 58 - 1 through 5).

Chapter 58, HRS (see page 225) was enacted in 1975. It provides for the protection of trees designated exceptional by the Arborist Committee from destruction due to land development or abusive activities. A tree or grove of trees may be deemed exceptional by reason of historic or cultural value, age, rarity, location, size, esthetic quality, endemic status, or representing an important community resource. A tree so designated will receive special County review prior to any action that may destroy it or negatively impact its health and vigor.

For your consideration, we are including a copy of Chapter Five, "Exceptional Tree Program", of the Maui County Planting Plan. In it, you will find responsibilities of Exceptional Tree owners as well as information on a State Tax deduction for expenses incurred in the maintenance of each Exceptional Tree. Once a tree(s) is declared Exceptional, only the County Council can remove it from that list.

We are seeking your approval to designate this tree(s) as Exceptional. Please respond by completing the enclosed form. If you have any questions, please write to us at:
Maui County Arborist Committee; 275 Uhu St.; Kahului, HI; 96732.

Sincerely,

_____

Maui County Arborist Committee Chair
Enclosures: HRS, Chapter 58, Chapter Five of the Maui County Planting Plan, Acceptance Form for Exceptional Tree Status.

*Description of Tree, Stand, or Grove of Trees here:

FORM 5-2: ACCEPTANCE FOR EXCEPTIONAL TREE STATUS

I, _____, recognize that a tree(s)*, stand, or grove

of trees growing on my property, TMK_____,

situated at _____ is (are) exceptional under the criteria of the Exceptional Tree Law (HRS 58 - 1 through 5). I am aware of my responsibilities as an Exceptional Tree owner having read Chapter Five of the Maui County Planting Plan and HRS Chapter 58 paragraphs 1-5, I agree to designate my tree(s) as Exceptional and that the tree(s) be listed with the Exceptional Trees of Maui County. I understand that this list will be filed with the Bureau of Conveyances, the Maui County Arborist Committee, and the Departments of Planning, Public Works, and Parks and Recreation. I understand that only the County Council can remove a tree from the Exceptional Tree list.

I agree that I will not destroy this tree(s) or affect its immediate surroundings in such a way that its health and vigor is negatively impacted without first consulting the Maui County Arborist Committee through the Maui County Department of Parks and Recreation.

I understand that the County of Maui will assume no liability with reference to this tree(s) and will not be responsible for its care and maintenance.

In the event that the property ownership is transferred, I will notify the Maui County Arborist Committee within thirty (30) days.

Signed: _____

Dated: _____

Please mail to: Maui County Arborist Committee, 275 Uhu St; Kahului, HI; 96732

*Description of Tree, Stand, or Grove of Trees here:

CHAPTER 6. POLICIES, PROCEDURES, AND STANDARDS FOR PLANTING, PRUNING, AND MAINTAINING TREES

6.1 POLICIES FOR DEVELOPERS AND PROPERTY OWNERS

6.101 It is the responsibility of developers and property owners to plant appropriate trees, turfgrass, and ground covers in planting strips in accordance with provisions of this document, in order to provide shade, reduce heat, cleanse air, and obtain other tree benefits. Consideration must be given to the site's planting space, wind conditions, ocean spray, soil type, above and below ground utilities, etc. that affect tree performance.

6.102 It is the responsibility of abutting property owners to provide water, fertilizer, and weed control to trees, turfgrass, and ground covers growing in the planting strips between their property line and the road. Mowing and raking of clippings (when excessive) are the responsibility of abutting property owners. Nylon string trimmers and mowers should not be used in a way that tree bark injury occurs. Such injuries cause trees to decline and may eventually die.

6.103 An abutting property owner may conduct proper pruning and spraying of street trees with permission from the Director of Parks and Recreation or his/her designee.

6.104 Abutting property owners without a 2" PVC pipe sleeve under existing sidewalks are encouraged to obtain a "Work to Perform on County Highway" permit from the Director of Public Works to install one to facilitate installation of a permanent irrigation system in the planting strip.

6.105 The transplanting or removal of trees necessitated by widening or relocation of a driveway or any other construction by the adjoining property shall be done at the abutting property owner's expense. If a tree is too large to transplant, it shall be removed and a young tree shall be provided and planted in accordance with this document's guidelines. The size of the new tree shall have a caliper not less than 2 inches when measured 12 inches above ground and shall have a height of not less than 6 feet from the ground after planting. The tree should have strong roots without excessive kinking or circling to avoid restricting growth. It shall have a single dominant leader. Field stock trees with crushed or shattered roots shall have them cleanly cut off (with a saw, loppers, etc.) to reduce

decay. A permit from the Department of Public Works, with concurrence from the Department of Parks and Recreation, will be required. Such a permit will be granted only if the tree removal, planting, and subsequent care are in conformance with all standards and guidelines in this document.

6.106 In-ground or field stock tree diameters are measured at 54 inches above ground, diameter at breast height (DBH).

6.107 If trees are to be impacted because of construction, it may be necessary to relocate and then replant them on-site. If the trees are to remain in place during construction, protect them from construction damage. (See Chapter 8, "Construction Project Tree Protection and Replacement Program" for guidelines). Consult with a knowledgeable arborist currently certified by the International Society of Arboriculture (ISA) for additional information.

6.108 If tree root cutting is unavoidable consult with a knowledgeable arborist currently certified by the ISA for guidelines and precautions.

6.109 Some trees are killed by root suffocation when more than 4 inches of soil is placed above the original grade. The tree's age, health, and species will influence its tolerance or sensitivity to raising the grade and how rapidly its decline and ultimate death will occur.

6.2 POLICIES FOR PUBLIC UTILITY FIRMS

6.201 Public utility firms that maintain poles and wires in the streets and parks shall keep all such trees and shrubs near wires and poles properly trimmed (thinning cuts without stubbing), subject to the supervision of the County Arborist so that minimal injury and no permanent damage occur.

6.3 POLICIES FOR MAUI COUNTY

6.301 It is the responsibility of the Director of Parks and Recreation, or his/her designee, to prune and spray street trees on designated major county streets. However, with permission from the Director of Parks and Recreation, or his/her designee, the abutting property owner may conduct proper pruning and spraying of street trees. The Director must be assured that pruning techniques and procedures are correct according to ISA standards and will not lead to topping, stubbing, torn bark, damaged and misshapen trees, and ultimate decline of plant health and aesthetics.

6.302 When the Director of Public Works observes or is notified of unsafe conditions caused by street trees that affect public works or traffic on roads designated for maintenance by the Department of Parks and Recreation, he/she shall inform the Director of Parks and Recreation of the condition. The Department of Parks and Recreation shall be responsible for taking appropriate steps to remedy the situation(s).

6.303 The Department of Parks and Recreation is responsible to perform, or contract out, all maintenance of County park trees.

6.304 It is the responsibility of the Director of Planning, or his/her designee to work with developers to ensure that trees and other landscape plants destined to become County property meet the selection, planting methods, and post planting care to be in conformance with this publication prior to the County's acceptance.

6.4 PROCEDURES AND STANDARDS FOR PLANTING TREES

6.401 Park trees shall be planted in accordance with street tree planting standards including, but not limited to, using guys and stakes, trunk guards, and mulch. Approved root barriers may not be necessary if surface roots will not interfere with walkways, curbs, road pavement and mowing. If surface roots will be a problem, approved root barriers must be used in compliance with 6.402-G-6.402-I.

6.402 Street tree planting shall conform to the following guidelines:

6.402-A No street tree shall be planted closer than the following horizontal distances:

- 30 feet from property line intersection at street intersection
- 5 feet from a storm drain
- 15 feet from a utility pole
- 10 feet from a fire hydrant
- 20 feet from overhead street light
- 10 feet from a pedestrian crosswalk
- 10 feet from a driveway
- 30 feet from end of median

These distances serve as guidelines and may be revised in accordance with site conditions. Department of Public Works current standards take precedence.

6.402-B No street tree will be planted over sewer, water, or other utility lateral.

6.402-C When selecting trees they shall be healthy, showing vigorous growth, and being free from insect pests. The trees shall be free of diseases, sun scalds, bark abrasions, and other physical disfigurements. Trees shall have a single dominant leader with well-developed lateral branches. Trees shall have a vigorous root system that is not pot bound and without girdling roots (roots that wrap around the trunk).

6.402-D If unprotected and in the sun, trees laying on their side waiting to be transplanted may develop trunk and root sunburn.

6.402-E Planting pits should be dug with level bottoms and with a minimum width 3 times the root ball's diameter. If the soil is compacted or heavy clay, the planting pit's diameter should be 5 times the root ball's diameter. The depth shall be same as the root ball's depth. Soil returned to the planting hole to adjust planting depth should be firmed, but not overly compacted (see planting details on page 114 and page 115). Palm trees require a smaller planting pit for stability (see palm planting details on page 116). These three planting graphics can be used as a reference for this entire section of Chapter Six.

6.402-F Trees planted in holes deeper than the root ball tend to sink further as irrigation and organic matter decomposition compact the soil beneath the tree. As the tree sinks, trunk bark is exposed to wet soils and various soil borne diseases. Trees and palms planted too deeply never recover and will always look stressed. They will be prone to insect and disease problems and be a detriment, rather than an asset, to the landscape.

6.402-G When street and park tree roots will impact with hardscapes, they shall be planted with a minimum 24 inch wide approved root barrier (Biobarrier, Deep Root, or approved equivalent). The root barrier must be approved by the Directors of Public Works and Planning and installed in accordance with manufacturer's guidelines. Trees planted along open highways 30 feet or more from the road may not need root barriers.

6.402-H When planting in a single tree well, or in multiple tree wells, root barriers shall be placed along the inner edges of the hardscape in accordance with manufacturer's recommendations. They are not to be installed immediately around the root ball, mimicking a planting pot, because the tree will become unstable.

6.402-I When planting in long continuous strips, such as along roads, or on the property side of sidewalks that abut the road, place root barriers along hardscape edges in 20-foot lengths - ten feet on either side of the tree. Root barriers may eventually need to be replaced as they age or roots undermine.

6.402-J The tree shall be removed from its container. The root ball shall be cut or opened slightly (without excessive trauma) to correct circling roots caused by the container to encourage root growth beyond the original confines. The tree shall be placed in the center of the pit on top of firmed soil. Trees, including coconuts and other palms, shall bear the same relation to soil grade when planted as they did when in the container or field. Planting them deeper guarantees poor performance and failure.

6.402-K When transplanting field stock broadleaf trees, smashed and fractured roots must be cut clean. Air pockets should be removed and soil moved to fill the voids. Use a water pipe wand and/or hand tools to do the job. The finished grade must be the same as when the tree grew in the field (see detail at end of this chapter).

6.402-L When transplanting field stock palms, sand is often used as a backfill. Air pockets are removed and sand moved to fill the voids with a water pipe wand. An amended soil might be too soft and allow movement of the root ball. The finished grade must be the same as when the palm grew in the field. See detail at end of this chapter.

6.402-M Pit Backfill: A sudden change of soil particle size (layering soil over sand or vice a versa) creates a sudden change of soil particle size that will inhibit downward movement of water. Therefore back fill with on-site soil. If on-site soil is not available, good imported soil of the same kind can be used. The final combination should be thoroughly mixed to avoid layering. Layering impedes water infiltration. Organic amendments in backfill do not necessarily improve tree growth. They may even reduce shoot and root growth due to locking up of micronutrients.

6.402-N Slow release fertilizer tablets or briquettes (Agriform 21 gram 20-10-5 tablets or equivalent) should be used in the planting hole in accordance with the manufacture's recommendations.

6.402-O For containerized specimen trees, build a 6-inch high by 4-foot wide berm around the tree to hold water. The berm's rim shall be above the surrounding grade. Water trees immediately after planting. Increase water basin widths for field stock trees.

6.402-P Staking: All trees not able to withstand strong winds by themselves shall be double-staked as per the Tree Planting Detail at the end of this chapter. At a minimum, stakes shall be a 2-inch diameter pole or a 2"x2"x8' rough construction grade hardwood. Stakes shall be pointed on one end and free of knots and splits. Poles are preferred because they do not split or break as easily as sawn stakes while in use or while being driven. Stakes shall be placed in firm soil. The height of the stake will be 3 inches above the highest tie so as not to cause branch abrasions. The prevailing wind should blow perpendicular to an imaginary line between the stakes and cause some trunk flexing. Trunk flexing makes for an increase in trunk diameter and enhances root growth.

6.402-Q Tree ties shall contact the trunk with a broad, smooth surface and have enough elasticity to minimize trunk abrasion and girdling. Common tie material includes elastic webbing, belting, and cinch ties. Wire covered with garden hose is too abrasive for plant trunks. Ties should contact the tree at the lowest place possible and still keep the tree upright. This location should permit the tree to flex and bend in the wind and return to a vertical position without being injured by the tie or stakes.

6.402-R Very windy areas may require ties to be moved higher. A second and lower tie should be used only for very spindly trees. The tie(s) will form a figure-eight loop between the trunk and the stakes. Two ties, one from each stake going around the tree and back to the original stake and making contact with the tree at, or nearly at, the same point. Ties must be checked periodically for making adjustments and to ensure that they are intact and serving their purpose without injuring the tree. See Figure 6-1: Staking Young Trees Detail at the end of this chapter.

6.402-S Field-grown and large containerized trees with branches shall be guyed (three of them equally spaced) as per Figure 6-2: Tree Planting Detail with Guying and Figure 6-3: Palm Planting Detail at the end of this chapter if they are not able to withstand strong winds. Wire guys covered with garden hose, or strong webbing, may be used provided that there is no movement of the tree to cause bark abrasion. Palm tree guying is necessary only when support is needed. This decision is left to the landscape contractor. Guys shall remain in place until the tree is well rooted and able to withstand wind. At this time, guys should be removed. Guys must be checked periodically for making adjustments to ensure that trunks are not being girdled or abraded.

6.402-T Stakes, ties, and guys shall remain in place for at the most one year, or until the tree is able to withstand strong winds.

6.402-U Use a 2-4 inch layer of a coarse mulch (wood chips preferably) within the water basin. Keep it away from the tree's trunk by 6 inches. Replace mulch as needed for two years.

6.402-V Saturate the soil immediately after planting. (For subsequent water requirements, see Chapter 12, "Irrigation and Water Conservation; Drought Tolerant Plants".

6.402-W Maintain a turf free zone around the tree within the tree well for two years.

6.402-X When grass is permitted to grow into the tree well, keep it away from the tree trunk. Trunk guards are recommended to avoid girdling by sting trimmers.

6.5 PROCEDURES AND STANDARDS FOR PRUNING TREES

6.501 Pruning should not be taken lightly; if done improperly it may have long lasting undesirable effects. It is not possible to fully discuss tree pruning in this publication. However, there are many references on the subject, such as Gilman, E. F., *An Illustrated Guide to Pruning*, 2nd ed. Delmar Publishers, 2002. ISBN: 0-7668-2271-0. Another good reference is *ANSI (Part 1) – 2008 Pruning*. "Tree Shrub and Other Woody Plant Management – Standard Practices (Pruning)"; obtainable from the International Society of Arboriculture, **isa@isa-arbor.com**. Both references have many pictures along with text to make it easy to follow.

6.502 Broad Leaf Tree Pruning.

6.502-A Young Transplanted Trees:

- It is no longer recommended that young trees be pruned at the time of transplanting to "balance off" the above ground portion with the below ground portion because of a root loss that occurred in transplanting. Leaves and branches with green contain the factories where plant foods and essential hormones and chemicals are produced and stored. From storage, food is sent to sites where needed. Removing too many above ground parts of a young tree may contribute to "transplant shock" and slow down its establishment. Of course, field stock material may require a reduction of canopy and roots for transportation reasons. These trees are generally bigger and have larger amounts of stored food, and thus are able to generate new shoots and roots after replanting.

- Initially all branches should be kept on newly transplanted young trees since green branches and leaves produce essential foods and hormones that the sapling needs to grow. After the young tree has become established, vigorous upright branches that compete for dominance with the main leader should be "tipped back" to curtail their aggressive growth. It is best to have a single dominant leader because multi trunked trees have weaker unions that may lead to problems in the future. As the tree grows stronger and the leader establishes its dominance, the competing tipped leaders could be removed if there are a sufficient number of other branches to provide the energy required by the tree.

6.502-B Juvenile and Medium Aged Trees:

- The rule is not to remove more than 25% of a tree's canopy in any one year; so topping, or "hat racking", is out.
- Pruning should remove dead and diseased branches, rubbing branches, and branches that interfere with people and traffic.
- Lion tailing should be avoided. This condition results when an excessive number of lateral branches are removed from a primary branch, leaving mostly terminal foliage. The branch becomes long and small in diameter and is more likely to break off in inclement weather.

6.502-C Mature trees:

- Avoid removing large branches because the tree may not be able to callus over the wounds. Such large wounds can then become entry points for disease, borers, and other pests. If at all possible, living wood should not be removed from overly matured trees because they contain "old age benefits". Excessive branch removal may cause many water sprouts (vigorous upright sprouts that arise from dormant nodes on remaining branches) to compensate for the loss of food production and reserves. An old tree's flush of water sprouts, without excessive pruning, may be an indication of its "last hurrah".

6.503 Tree Topping vs. Tree Thinning.

6.503-A Tree Topping (alias: hat racking, stubbing, cutting back, rounding over, shearing, tipping) is unnecessary. People have it done because:

- Topping reduces tree height. Consider: Drop crotching instead. This is when the height of a tree is reduced to a lateral (side) branch large enough to assume the leadership role. This branch should be about one third the diameter of the one being removed. This same type of reduction can be used to decrease the horizontal spread of a tree; pulling it in to a lateral branch.
- Topping is fast and cheap. Fact: Yes, it is fast, but it is not cheap. The tree responds with a flush of fast growing sprouts and the tree quickly reaches, or surpasses, its original height. This requires a quicker return visit by the so called “pruner”, who then makes more money.
- Trees need to be cut back periodically. Fact: Definitely not. Topping weakens trees by removing valuable food and chemical reserves, making them more vulnerable to insects and diseases. Sunburn, resulting from loss of leaf shade, kills tree bark and underlying wood. Topped trees can be hazardous because the long sprouts that grow from cut ends are poorly attached and can break off causing injury to people and damage to property.

6.503-B A Few Alternatives to Tree Topping.

- If a tree needs to be lowered in height, use drop crotching as described above.
- Consider thinning out and removing rubbing and diseased branches to permit more light, air, and views through the canopy. Avoid lion tailing (described above).
- When selecting a tree species, consider below and above ground limitations to avoid future space issues that require topping.
- If a tree is too large for the area, remove it and replace it with a smaller type or a dwarfed form.

- Hire an arborist who is currently certified by the International Society of Arboriculture and uses their pruning standards to do your pruning. It takes knowledge, training, and skill to properly prune a tree, but little to no knowledge, training, or skill to top a tree. Besides, topped trees look ugly.
- See Figure 6-4: Detailed Pruning Graphic on page 117 as an alternative to tree topping.

6.504 Coconut Palm Tree Pruning.

6.504-A To ensure people and property safety, it is common practice to remove coconut palm fronds and fruit two, three, and even four times a year. At times overzealous pruners remove so many fronds that the crown resembles a "feather duster".

6.504-B A "feather duster" crown, like root cutting at transplanting, reduces water absorption by the roots and its upward movement. Without sufficient water, the trunk does not fully expand at the site where the fronds are attached. When the crown is full and roots grow and function normally, the trunk returns to its normal diameter, thus creating a condition called "hour glass".

6.504-C An "hour glass" trunk may have safety implications, especially in very tall trees. The best practice is to remove only those fronds whose tips fall below a horizontal plane drawn at the base of frond attachments (See page 120 for the coconut frond removal graphic).

6.504-D It is recommended that about 12 inches of palm frond bases be left to fall off by themselves, or left on at least until the next pruning. If these bases are shaved off at the time of frond removal, soft trunk tissue is exposed to insects, such as the banana moth, *Opogona sacchari*. If present in the area, the moth will lay its eggs on frond removal sites, the eggs hatch, and larvae enter the wounds to eat the inside of the upper trunk just below the crown. The crown shows no signs of the invaders within until it suddenly falls to the ground.

6.504-E For coconut tree owners and pruners a document on coconut tree pruning, and a few safety measures, is included at the end of this chapter (See pages 119-121). This material is published by the Aloha Arborist Association, in consultation with the International Society of Arboriculture, dated August 19, 2009.

6.6 PROCEDURES AND STANDARDS FOR POST PLANT TREE MAINTENANCE FOR DEVELOPERS AND ABUTTING PROPERTY OWNERS

6.601 Post plant tree care, including maintaining, replacing, and removing tree stakes and guys, is the responsibility of the developer for the first year after planting. The abutting property owner must be informed by the developer at the time of the sale regarding the owner's obligation to maintain the tree(s) and plantings abutting the property after the initial year. Trees and landscape plantings in front of lots that have not sold after the one-year period shall be the responsibility of the developer.

6.602 After the first year the abutting property owner is responsible for removing/maintaining/replacing tree stakes and guys. To avoid trunk girdling, the abutting property owner must remove the stakes/guys when they are not needed for tree support. Stake and guy attachments to trees should not interfere with trunk expansion.

6.602-A It is the responsibility of the Director of Planning, or his/her designee, to ensure that stakes and guys are removed prior to causing tree damage to protect publicly owned trees.

6.603 Maintenance of trees and landscape plantings (turf and/or ground cover) includes watering, fertilizing, mowing the lawn, and raking leaves and rubbish when they are excessive.

6.604 Maintain a weed and turfgrass free zone within the tree's water basin. Restore the water basin berm as needed. Basins should be maintained for at least 2 years.

6.605 It is recommended that the 2-4 inch layer of coarse organic mulch, preferably wood chips, be maintained. Keep it away from tree trunks by 6 inches. Such mulches improve the population of soil microbes, conserve soil moisture, maintain soil porosity, and improve soil structure. Research has shown that trees produce many times the amount of feeder roots when mulched with coarse tree chips than with no mulch at all. Using tree chip material promotes soil microbes more compatible with the tree.

6.606 If trees are growing in grassed planters, do not girdle tree trunks with string trimmers and other machinery. Trunk damage guarantees poor performance and maybe even death. Trunk guards will protect tree trunks from string trimmer damage, but must be monitored and replaced periodically.

6.607 After initial soil saturating irrigation at planting, keep the soil moist for the first two weeks. After this, reduce water frequency to permit some surface drying. Replace water loss as needed. The amount of water applied will depend on time of year, soil type, environmental conditions such as wind and temperature, size of the plant, and the availability and thickness of mulch.

6.608 Too much or too little water is the primary cause for tree death in the first year after planting. Important: Check the root ball's moisture underneath the mulch the day after irrigating and if necessary adjust the amount of water applied.

6.609 In order to provide fertilization during the first year, tablets or briquettes should be incorporated into the planting pit. However, the tree will benefit from additional fertilizer the second half of the first year and then on. Use a general fertilizer and follow the manufacturer's guidelines. Use a fertilizer with as many trace elements as possible. Broadcast the fertilizer from the trunk out to the drip line and beyond even if there is a lawn. Water it thoroughly. The amount of fertilizer applied may need to be adjusted depending on soil type and fertility, fertilizer analysis, and amount of water applied. Palms should be provided with a Palm Special fertilizer. Follow manufacture's recommendations.

6.610 Fertilizers with an organic source of nitrogen such as 4-4-4 or one such as 8-4-5 with an organic and an inorganic source of nitrogen are slow release and promote root growth. If using an organic fertilizer, more will be required because of a low analysis of nutrients. Consult the manufacturer's guidelines.

6.611 The abutting property owner should inform the County Arborist if the tree planted along the public right of way is not doing well. The Department of Parks and Recreation is responsible for spraying trees for insects.

6.612 Abutting property owners are responsible for providing water and fertilizer to trees to help them ward off insect pests.

6.613 If a street tree dies due to abuse or neglect by the abutting property owner, tree replacement, with Parks and Recreation approval, is the responsibility of the abutting property owner. See section 7.4 on page 124 for penalties. Otherwise, tree replacement is the responsibility of Parks and Recreation.

FIGURE 6-1: STAKING YOUNG TREES DETAIL

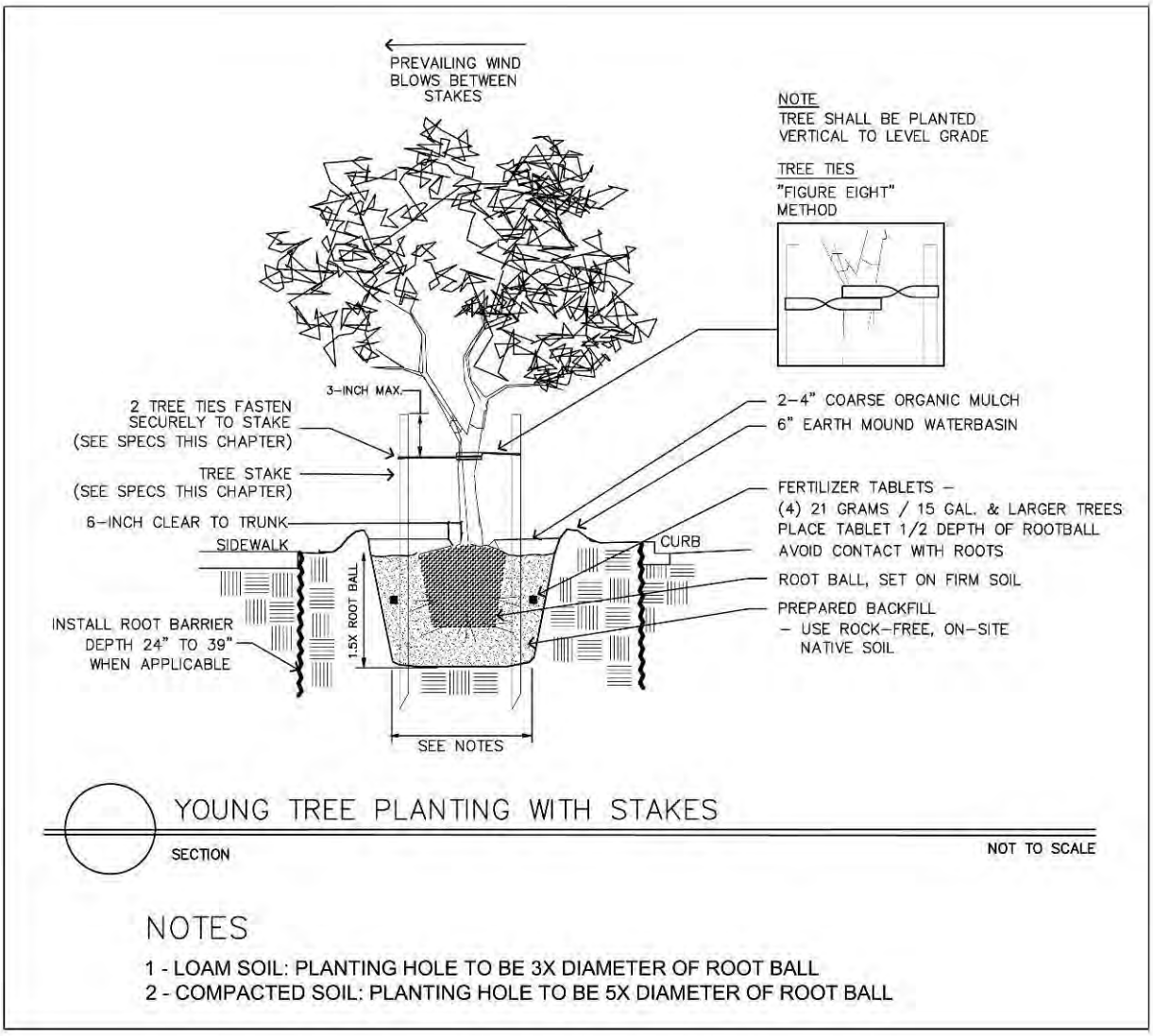
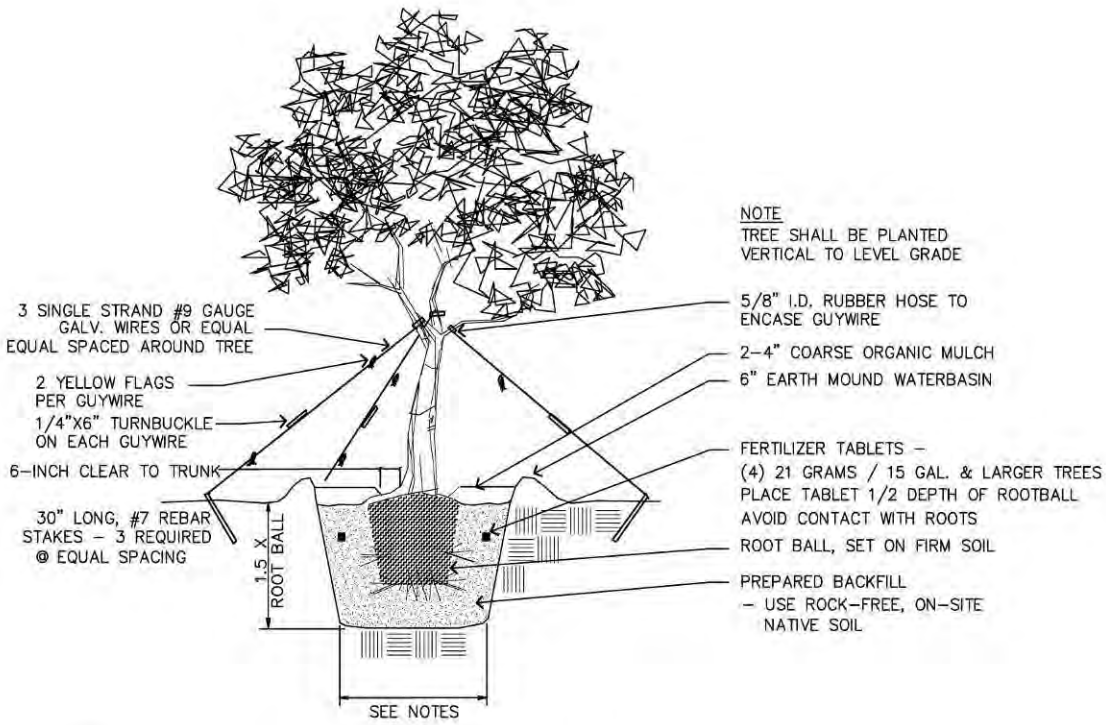


FIGURE 6-2: TREE PLANTING DETAIL WITH GUYING



NOTES

1 - LOAM SOIL: PLANTING HOLE TO BE 3X DIAMETER OF ROOT BALL
2 - COMPACTED SOIL: PLANTING HOLE TO BE 5X DIAMETER OF ROOT BALL

FIGURE 6-3: PALM PLANTING DETAIL

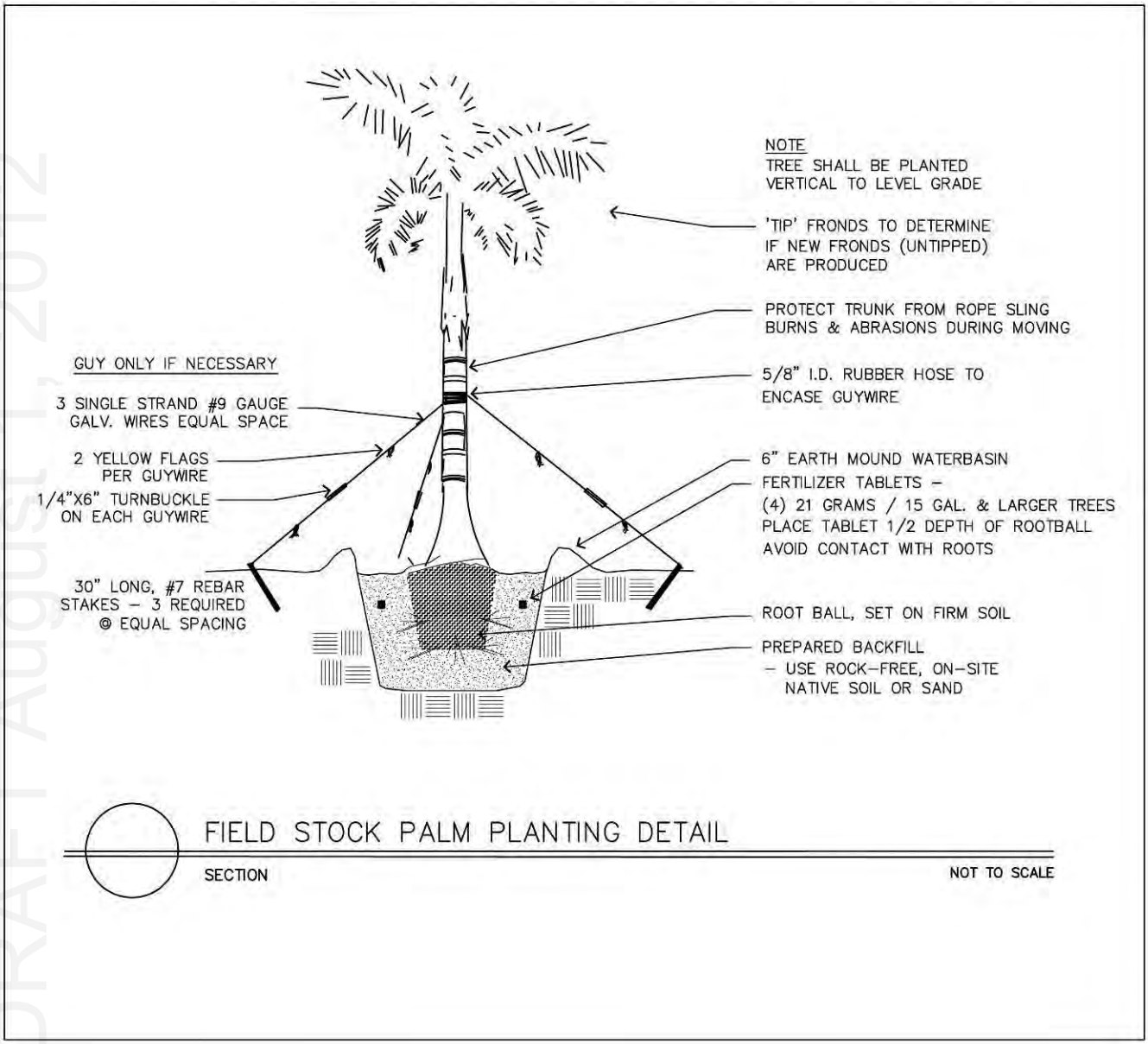


FIGURE 6-4: DETAILED PRUNING GRAPHIC

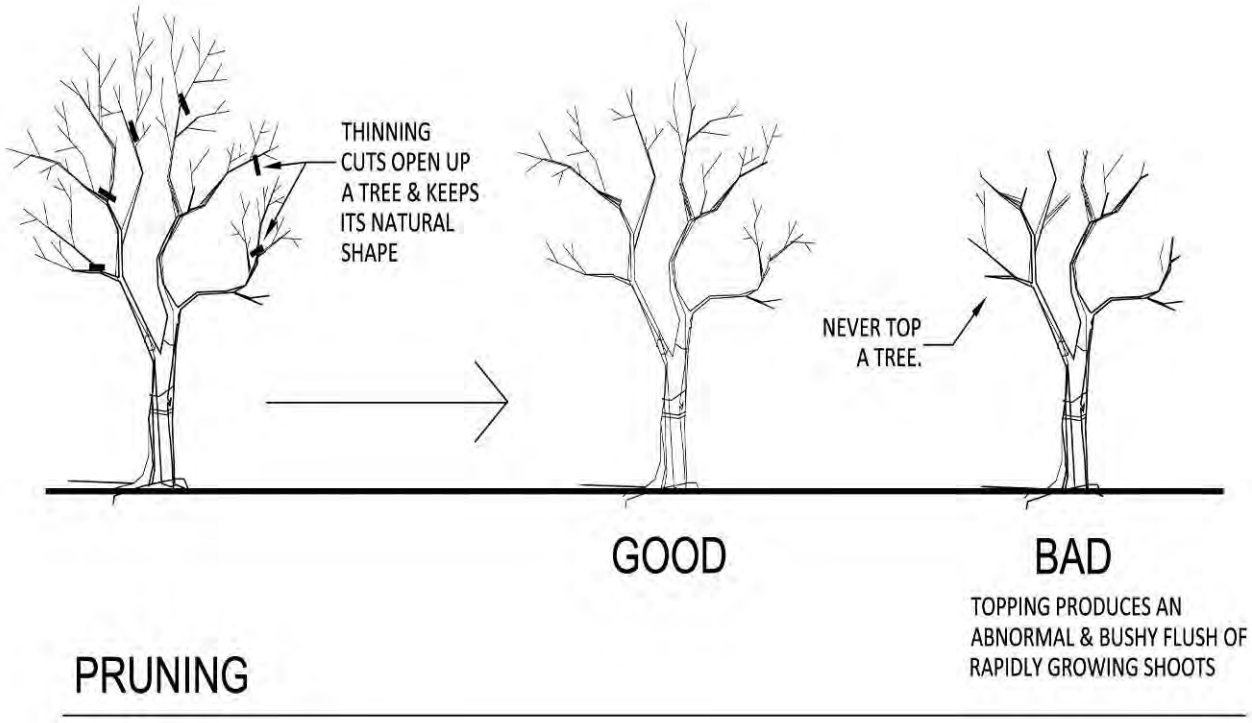


EXHIBIT 6-1: HAWAI'I GUIDELINES FOR THE MANAGEMENT OF COCONUT PALMS

Aloha Arborist Association, approved August 19, 2009

Coconut palms, *Cocos nucifera,* are a significant palm throughout Hawaii and tropical regions around the world. These palms can reach over 100' in height and may live over 100 years. They regularly shed coconuts and large fronds, which may expose people and property to injury and damage. To minimize this risk, coconuts and fronds must be regularly removed prior to their fall. In certain instances, coconut palms may possess structural defects that increase the risk of failure of a portion or the entire palm.

This brochure is designed to provide guidance for arborists, tree workers and property owners/managers in the proper pruning and general assessment of coconut palms. When caring for coconut palms, the safety of people and property is our greatest priority.

Pruning is recommended a minimum of two times per year within developed areas to manage the hazards of falling coconuts and fronds and to minimize risk to persons and property within the fall zone.

In order to ensure safe, healthy, and attractive palms that can achieve a maximum life-span within a specific site, we recommend that the tree worker who is pruning the palm:

1. Report abnormal conditions in the crown, trunk, or base of the palm.
2. Remove fronds, fruit, seedpods, and fruit stalks carefully without damaging the trunk or fronds that are to be retained.
3. Remove lower fronds where any part of the frond hangs below a horizontal plane if desired. (see Figure 1)
4. Not remove live, healthy fronds above horizontal except where encroaching on utilities or structures. (see Figure 2)
5. Not embed the cutting tool into the trunk or fronds that will remain on the coconut palm.
6. Avoid the use of spikes where practical. In most instances, damage from repeated spike use is primarily cosmetic, but structural defects may develop over time.

Figure 1 – Before Trimming

Figure 2 – After Trimming

Listed below are some of the potentially serious defects or conditions that should be inspected by a Qualified Arborist:

1. Large wounds, cracks and cavities in the trunk (over 25% of the trunk circumference or cross section affected).
2. Penciling (abrupt tapering of the upper trunk immediately below the crown).
3. Significant hour-glassing (narrowing and enlargement of the trunk in an hour-glass form that exceeds 30% reduction of the diameter at the site of the hourglass).
4. Excessive root damage near the base of the palm (more than 25% of the roots within two feet of the trunk).
5. Trunk flare restrictions (less than 1' radius of open space around trunk).
6. Excessive dead areas within the root initiation zone (more than 25%).
7. Termite damage.
8. Discolored, stunted, or deformed fronds or leaning or missing crown shaft.
9. Excessive trunk lean (over 35 degrees).
10. Growing under, over, or into utility lines.
11. Palms with trunk heights over 70 feet.

As coconut palms age, replacement planting programs should be implemented. This brochure has been prepared by the Aloha Arborist Association (AAA), a professional association of arborists, tree care services, and arboricultural consultants with experience and knowledge of the growth and management of coconut palms in Hawaii. AAA advocates proper tree and palm care in conformance with the standards and practices set forth within the most current versions of the ANSI A300 pruning standards and ANSI Z133.1 safety standards. A Qualified Arborist is a professional experienced in the type of

work to be performed who has maintained an International Society of Arboriculture (ISA) Certified Arborist certificate continuously for at least 5 years, and can demonstrate technical knowledge and skill through conformance with internationally accepted arboricultural standards and practices. The advice contained herein is of necessity general in nature and is intended as a guide. Each palm is subject to unique conditions that cannot reasonably be anticipated within this publication. The final determination for proper care and treatment of an individual coconut palm should be according to the recommendations of a Qualified Arborist who has conducted an inspection and assessment of the subject palm.

CHAPTER 7. PERMITS AND ABUSE OR MUTILATION OF STREET, PARK, AND EXCEPTIONAL TREES

7.1 PURPOSE

7.101 The purpose of this section is to protect and preserve trees for public enjoyment and beautification of Maui County, while providing shade, heat reduction, air filtration, oxygen, protection from wind, and other benefits.

7.2 PROCEDURES

7.201 All trees planted in Maui County planting strips and parks belong to Maui County. Exceptional Trees are classified as such because of their uniqueness and should be preserved for public enjoyment. Trees on designated major county roads will be pruned and sprayed by the Department of Parks and Recreation. Watering, weeding, and fertilizing will be done by the abutting property owners.

7.3 PERMIT REQUIREMENTS

7.301 Removal or cutting down street trees: No person other than the Director of Parks and Recreation or his/her designee are authorized to remove or cut down trees growing in Maui County planting strips without first obtaining a permit from the Director of Parks and Recreation. In emergencies, the Director of Parks and Recreation and Director of Public Works are authorized to remove trees at their discretion.

7.302 Prune, spray, or removal of Exceptional Trees: Should the owner(s) of an Exceptional Tree(s) wish to prune, spray, or otherwise remove the tree(s), said owner must first apply for a permit from the Director of Parks and Recreation. Approval shall be granted subject to Arborist Committee concurrence. See Chapter Five, "Exceptional Tree Program" section 5.103 on page 96, for details.

7.303 Only in very rare occasions will the owner of an Exceptional Tree(s) be granted approval to remove said tree(s) unless the tree(s) is dead, diseased, irretrievably damaged, or is a hazard to public safety or welfare.

7.304 Plant trees: No person shall plant street trees in County rights-of-way without first obtaining a permit from the Department of Public Works with concurrence from the Department of Parks and Recreation. No person shall plant trees in County parks without first obtaining a permit from the Director of Parks and Recreation.

7.304-A An application to plant street trees shall be filed with the Department of Public Works with concurrence of the Department of Parks and Recreation. It shall state the number, size, spacing, and kind of trees to be planted; their location; and the method of planting, including the supplying of suitable soil and source of irrigation. The Director or his/her designee may request additional information in determining whether a permit should be issued and if the planting is in conformance with the Maui County Planting Plan.

7.304-B A park tree planting permit may be issued if the Director of Parks and Recreation finds that the proposed planting conforms to the Maui County Planting Plan (MCPP) and other application requirements.

7.305 A permit from the County's Land Use and Codes Plumbing Section is required to install an irrigation system in the planting strip. The permit requires a reduced-pressure-backflow-preventer and a licensed plumber or landscape contractor to do the work. This installation can be done when the house is being plumbed because the permit to plumb or replumb is all-inclusive.

7.306 A permit from the County's Land Use and Codes Electrical Section is required to install an electrical valve(s) to automate irrigation of the planting strip. The permit requires a licensed electrician to do the work. This installation can be done when the house is being wired because the permit to wire or rewire is all inclusive.

7.4 ABUSE OR MUTILATION OF STREET, PARK, AND EXCEPTIONAL TREES

7.401 Maui County Code establishes that no person shall injure or destroy street, park, or Exceptional trees in any manner or by any means, including but not limited to:

7.401-A Constructing a concrete, asphalt, brick, or gravel sidewalk or otherwise filling in the ground area around any tree so as to shut off air or water to the roots.

7.401-B Piling building materials, equipment, or other substances around any tree so as to cause injury.

7.401-C Pouring any deleterious or poisonous matter on the ground, sidewalk, or any lawn or ground cover.

7.401-D Posting any sign, advertisement, or notice on any tree, tree stake, or guard, or fastening any guy wire, cable, or rope to any tree, tree stake, or guard.

7.401-E Damaging any tree, tree stake, or guard with a vehicle or animal, or in any other manner (including burning coals or wood) causing injury to any tree.

7.401-F Road and other public signs shall be placed, whenever possible, so as not to interfere with the growth of existing or newly planted trees and shall never be fastened to street, park, or Exceptional Trees.

7.402 When the Director of Parks and Recreation or Public Works observes or has knowledge that a park or street tree has been abused or mutilated, he/she shall take appropriate steps to prevent the recurrence of such acts. The Director will file a criminal complaint with the Prosecutor and/or submit the case to the Corporation Counsel for civil action whenever the circumstances justify the aforementioned.

7.403 When injury or damage has been done to a tree, the Prosecutor or Corporation Counsel shall request that the Director of Finance bill and collect from the offending or responsible party all damages sustained by the County, which shall include the cost of repair or replacement and other incidental expenses. The guilty party may be fined an amount not to exceed $1,000.

7.404 When the Director of Parks and Recreation observes or has knowledge that an Exceptional Tree(s) has been abused or mutilated by any action, including but not restricted to construction, vehicles, animals, or pruning, he/she will file a complaint with the police department and ask the Arborist Committee to make an on-site evaluation. The Committee will then make a report to the Director of Parks and Recreation. The Director of Parks and Recreation will consider the Committee's report and transmit the file and a recommendation to the Mayor. After evaluation, the Mayor may direct the County Prosecutor or Corporation Counsel to effect a reasonable solution including injunctive relief for removal or destruction of the Exceptional Tree(s) with fines of up to $1,000 per tree. However, reasonable consideration should be given to the property owner if the Exceptional Tree(s) is causing severe health, safety, and financial problems and especially if other similar trees are available in the County for the "Exceptional Tree" status.

7.405 Consult local landscape contractors and nurseries or use the International Society of Arboriculture appraisal methods for determining tree value and replacement costs.

CHAPTER 8. CONSTRUCTION PROJECT TREE PROTECTION AND REPLACEMENT PROGRAM

8.1 OBJECTIVES

8.101 The goal of this chapter is to protect mature trees at a construction site, or making up for their loss by planting replacement trees that provide equivalent environmental benefits on-site or at some other agreed upon site.

8.2 TREE PROTECTION AT A CONSTRUCTION SITE

8.201 When a project area includes trees selected to be included in the finished landscaping, they need to be protected during construction to avoid being damaged.

8.202 It is suggested that a developer utilize the services of a certified arborist who is currently a member of the International Society of Arboriculture (ISA). The certified arborist should be knowledgeable about proper procedures to be used regarding protecting trees during construction and the necessary follow-up maintenance.

8.203 Typically, tree roots are found in the top three to four feet of soil. However, most of the small absorbing roots are found in the top six inches of soil. Root mycorrhizae, beneficial fungi that associate with roots to enhance absorption of water and minerals, are found just beneath the soil's surface. Heavy equipment and automobile travel, equipment repair, and storage of supplies under a tree's canopy, all compress the soil and damage mycorrhizae and tree roots. Tree roots provide tree anchorage and protect against tree "blow over".

8.204 To protect trees, construction fences need to be erected around each tree or group of trees that are to remain and be included as part of the final landscape. These fences will form a tree protection zone (TPZ) where no activity should occur above as well as below ground.

8.204-A For young, mature and over mature trees tolerant of construction damage, the TPZ's radius should be one foot per inch of tree trunk diameter.

8.204-B For young, mature and over mature trees not tolerant of construction damage, the TPZ's radius should be 1.5 feet per inch of tree trunk diameter.

8.204-C For columnar trees such as the Cook pine, *Araucaria columnaris*, or the columnar Italian cypress, *Cupressus sempervirens*, with a disproportionately small canopy spread, the TPZ's radius should be 1.5 feet per inch of trunk diameter.

8.204-D The above TPZ's can be adjusted downward depending on tree species, age, health, and post plant care. Using the services of a knowledgeable currently certified arborist with the ISA is recommended.

8.205 Trunk diameters are measured at 54 inches above ground for all planted trees. Young containerized tree trunk diameters are measured at 12 inches above container soil.

8.206 If travel under the canopy of a tree destined to be saved is unavoidable, limit travel to a single route and as far away from the trunk as possible. It is recommended that the soil be temporarily covered with a 6 to 12 inch layer of coarse tree chips and overlaid with sheets of thick plywood or steel. It would benefit the tree being protected to cease travel under its canopy and remove the sheets of plywood or steel as soon as possible to avoid root suffocation. In addition, spread out the mulch under the tree's canopy to between 2-4 inches thick.

8.207 Water and fertilize beneath the tree's canopy, during and after construction, to help reduce tree root stress. Fertilizers with an organic form of nitrogen are best for root growth. Applying fertilizers prior to the mulch is even more beneficial to the tree.

8.208 Some of the above statements were taken from Lily, 2010 and from Fite and Smiley, 2008.

8.3 MATURE TREE REPLACEMENT AT A CONSTRUCTION SITE

8.301 Even though this part of Chapter Eight is an optional consideration for developers at this time, it provides an opportunity for those who want to "go green" to maintain or exceed the environmental benefits that large trees on their property provided prior to development.

8.302 Mature trees are an important asset in Maui County. Retaining them at a construction site provides a continuation of their environmental and economic benefits to the community.

8.302-A In this planting plan, a "mature tree" is one with a trunk diameter of eight inches or more (excluding its bark) measured at 54 inches above ground, diameter at breast height (DBH).

8.303 Mature trees to be retained at a construction site should be protected by a TPZ during construction. They could also be transplanted elsewhere for safekeeping, then returned to the original site at the time landscaping is installed, providing they will tolerate such a move. To avoid root decay, damaged roots two inches or larger need to be cut "clean" with a saw.

8.304 If a mature tree's retention or movement is not warranted due to its poor health, high costs, or is an invasive species, then it should be replaced. Replacement trees should be used to restore the lost environmental benefits the mature tree(s) provided. Replacement trees must be of a species found in this document.

8.305 Tree environmental benefits, converted to dollar values, can be obtained by visiting the **itreetools.org** website and searching for "*design*" or by simply searching the web for "*i-tree design*" and clicking on the resulting link (**http://itreetools.org/design.php**).

8.306 Using this webpage, the developer, or an ISA currently certified arborist, or the landscape architect, can calculate the approximate annual environmental dollar value for mature trees being removed as well as for the trees replacing them. Needed is the property's address, the tree's common name (its scientific name is not necessary but helpful for making a positive identification), its DBH, and its condition of health: Excellent, Good, Fair, Poor, Dead or Dying. If a tree species is not found on the web site, one can still estimate dollar values by using the appropriate "other" category given in the tree species listing. See an example using the calculator in section 8.4 below.

8.307 The maximum tree diameter this program accepts is 45 inches excluding thickness of bark. Any tree larger than this is therefore to be considered as being just 45 inches.

8.308 The environmental dollar value of a tree does not consider costs associated with its long-term care and maintenance. The dollar value estimates represent the overall benefits a healthy tree of that type and trunk diameter growing in that area will provide to the community.

8.308-A Some tree benefits considered in determining these tree annual environmental dollar values are:

- Interception of storm water runoff.
- Carbon dioxide reduction.
- Conservation of energy resulting from direct shading of surfaces.
- Wind speed reduction.
- Cooling the air by transpiration (loss of water vapor via leaf pores).
- Shading ability to reduce light/heat reflection off surfaces.
- Shading of paved surfaces to reduce the "heat island" effect.
- Reduction of ozone production resulting in cooler atmospheres.
- Intercepting particulate matter like dust, ash, and smoke.
- Production of oxygen required for breathing.

8.309 Should the above web site not be available in the future, then the Maui County Arborist Committee and the Department of Planning will be responsible for selecting some other web site or means for determining tree values.

8.4 EXAMPLE: TREE VALUATION AND REPLACEMENT AT A CONSTRUCTION SITE

8.401 The following background scenario demonstrates the process of calculating the environmental dollar value of trees: An open field located at 600 Haleakala Highway is used as the site for this example. The property is being cleared to build a proposed residential subdivision of 30 house lots and a small park. An ISA certified arborist was hired to conduct a survey to determine the number and kind of trees that are 8 inches and larger in diameter growing on the site prior to land clearing. The certified arborist found one Chinese banyan, *Ficus microcarpa,* seven opiuma, *Pithecellobium dulce* and four kiawe, *Prosopis pallida*, trees plus many smaller trees and brush.

8.402 Searching the web for the words **"i-tree design"** yields a link (**http://www.itreetools.org/design.php)** to a national tree benefits calculator developed by the USDA Forest Service in cooperative partnership with numerous other entities. The following estimated tree benefits (Environmental Dollar Values) were obtained for the trees with

trunk diameters of eight inches or larger destined to be removed due to the fictitious land development in the above scenario.

i-Tree Design Benefits Calculator Results for Existing Large Trees				
Tree	**Quantity**	**Condition**	**DBH (inches)**	**Annual Tree Benefits (Environmental Dollar Values)**
Chinese banyan, *Ficus microcarpa* (found as Banyan, Chinese)	1	Good	15	1 x $32 = $32.
Opiuma, *Pithecellobium dulce* (found as Opiuma)	4	Fair	8	4 x $8 = $32.
	1	Poor	10	1 x $9 = $9.
	1	Dead/Dying	15	1 x $9 = $ 9.
	1	Good	10	1 x $15 = $ 15.
Kiawe, *Prosopis pallida* (found as Kiawe)	4	Good	9	4 x $11 = $44.
Total Annual Tree Benefits (Environmental Dollar Values) lost due to removal of large trees				**$141.**

8.403 None of the above trees were to be incorporated into the landscape plan because all are invasive species.

8.404 In keeping with the "street tree mix" for subdivisions of four or more lots found in Chapter Two, and fulfilling the requirement of "one tree per lot", the landscape architect selected the following street and park trees for this fictitious 30 lot residential subdivision. All 30 selected street trees have trunk diameters of two inches measured at 12 inches above ground but one inch DBH.

Street trees:

60% of 30 = 18 colvillea trees, *Colvillea racemosa*, "theme genus"
20% of 30 = 6 pink tecoma trees, *Tabebuia heterophylla*
20% of 30 = 6 rainbow shower trees, *Cassia x nealiae*

Park trees:

5 monkeypod trees, *Samanea saman*, twelve inches DBH.

3 royal poinciana tree, *Delonix regia*, eight inches DBH.

8.405 The following Dollar Value for Replacement Trees was calculated using the same scenario for a fictitious housing development at 600 Haleakala Highway and employing the **itree tools.org** tree benefits calculator.

i-Tree Design Benefits Calculator Results for Replacement Trees				
Street Trees				
Tree	**Quantity**	**Condition**	**DBH (inches)**	**Annual Tree Benefits (Environmental Dollar Values)**
Colvillea, *Colvillea racemosa* (found as Glory, Colville's)	18	Excellent	1	1 x $0 = $0.
Pink tecoma, *Tabebuia heterophylla* (found as Tecoma, Pink)	6	Excellent	1	6 x $0 = $0.
Rainbow shower, *Cassia x nealiae* (found as Tree, Rainbow Shower)	6	Excellent	1	6 x $1 = $6.
Park Trees				
Monkeypod, *Samanea saman* (found as Monkeypod)	5	Excellent	12	5 x $14 = $ 70.
Royal poinciana, *Delonix regia* (found as Poinciana, Royal)	3	Excellent	8	3 x $6 = $ 18.
Total Annual Tree Benefits (Environmental Dollar Values) replaced at planting				**$94.**
Note: If a tree's common name is not found, use the appropriate "other" category. Needed are: tree size (small, medium, large) and tree type (deciduous, evergreen or is a palm of a specific size). This information is best found in Chapter Three "Park, Greenway, and Open Space Tree Program" tables beginning on page 35.				

8.406 Removal of trees with diameters eight inches or larger lost $141 in annual tree benefits. Replacement trees provided $94 in annual tree benefits, making for a net loss of $47. This example confirms the environmental value that large canopy mature trees provide when part of the urban forest. The typical street tree specimen measuring two inches at 12 inches above ground with a one inch DBH contributes very little (if any) to the benefits listed in paragraph 8.308-A. If trees are grown to benefit the community, rather than just meeting requirements of a County ordinance, then large canopies are necessary. Trees resembling "lollipops" and periodically stubbed to being leafless are counter to being a community asset.

8.407 If the project area does not have a sufficient number of planting places to accommodate all the required number of replacement trees, then trees can be planted in County parks, along County roads, or in other agreed upon places. Prior approval from the Directors of Public Works and Parks and Recreation is required. In addition, some form of irrigation to maintain the trees will be necessary. If the trees are planted in residential areas along County owned roads as street trees, it is essential that the abutting property owners are made aware that County ordinance requires that they water, weed, and fertilize, but not prune or spray, the publicly owned tree(s) abutting their property. Documentation acknowledging this is advisable.

8.408 As replacement trees grow larger, their environmental value increases. Hopefully this increase will make up for the loss of benefits from the trees and shrubs that were less than eight inches in diameter and not considered for planting replacements.

Literature Cited

Permission was granted by the ISA to use information from the following publications:

Lily, S.J. 2010. "Arborists' Certification Study Guide." 352 pp. ISBN 978-1-881956-69-3, an International Society of Arboriculture publication.

Fite, K. and E. Thomas Smiley. 2008. "BMP, Managing Trees During Construction." 35 pp. ISBN 1-881956-67-9, an International Society of Arboriculture publication.

CHAPTER 9. SOUND, WIND AND VISUAL BARRIER PROGRAM

9.1 GENERAL

9.101 These plants can be used as barriers to provide sound, wind, and visual screening. Users should keep in mind people and traffic safety when selecting and placing barrier plants in the landscape.

9.102 Plants taller than 3 feet cannot be planted closer than 30 feet from intersections. If they are, then height control will be necessary for maintaining a line of sight for safety purposes.

9.103 Some of the following plants may be appropriate for use as specimen, as well as group plantings, in public and private landscaping.

9.104 For clarification of plant characteristics and planting zones in Table 9-1: Sound/Wind/Visual Barriers at the end of this chapter, please see the Chapter One topic "Tree and Other Plant Characteristics Defined" on page 8.

9.105 Plants with an asterisk (*) next to their scientific name are currently being evaluated by the Hawaii/Pacific Weed Risk Assessment protocol (*See explanation of HPWRA on page 209)*. If they are found to be invasive at a later date, they will be removed from this list of plants appropriate for planting in Maui County.

SOUND/WIND/VISUAL BARRIERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color Time of flwr Fragrance	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elevation	Planting zone(s)
Dodonaea viscosa (Sapindaceae) aalii **NATIVE**	6	8	med; spreading; 8 ft	med; poor	good	tol	no	n/a not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-high	2,3,4,5
Acalypha godseffiana (Euphorbiaceae) acalypha	8	5	dense; upright: round; 2 ft	med; poor	good	mod	no	inconspic. not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4,(5)
Wikstroemia uva-ursi (Thymelaeaceae) akia **NATIVE (ENDEMIC)**	4	3	dense; spreading; 2 ft	med; poor	good	tol	no	yellow SpWn not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Psydrax odorata (Rubiaceae) alahee **NATIVE**	15	8	dense; upright: round; 4 ft	slow; med	good	sens	no	white SpWn fragrant	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Dypsis lutescens (Arecaceae) areca, golden-fruited palm	20	15	open; upright; 4 ft	slow; med	good	mod	no	yellow SpSuFaWr not fragr.	(dry) med-wet	none; nondecid.	low (lvs); low maint.	low-med	1,2,(3),4,(5)
Rhapis excelsa (Arecaceae) bamboo palm, lady palm	10	4	dense; upright; 2 ft	slow; good	good	mod	no	inconspic. not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4,(5)
Thunbergia erecta (Acanthaceae) bush thunbergia	6	5	dense; upright: round; 3 ft	med; med	med	sens	no	blue/purple SpSuFaWr not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-high	1,2,3,4,(5)

*HPWRA designation "EVALUATE" ***Endangered

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

SOUND/WIND/VISUAL BARRIERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color Time of flwr Fragrance	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elevation	Planting zone(s)
Graptophyllum pictum (Acanthaceae) caricature plant	10	5	med; upright: round; 2 ft	fast; good	good	mod	no	purple SpSuFaWr not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4, (5)
Acalypha hispida (Euphorbiaceae) chenille plant	8	8	med; upright; 4 ft	med; med	med	sens	no	red SpSuFaWr not fragr.	(dry) med-wet	none; nondecid.	low (lvs); low maint.	low-med-high	1,2,(3),4
Aglaia odorata (Meliaceae) Chinese rice flower, mock lime	20	10	med; upright: round; 4 ft	med; good	med	sens	no	creamy white SpSuFa fragrant	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4
Bambusa vulgaris (Poaceae) common bamboo, feathery bamboo	35	25	dense; upright: clump; 10 ft	fast; med	med	sens	no	n/a not fragr.	(dry) med-wet	none; nondecid.	high (lvs); med maint.	low-med	1,(3),4,(5)
Acalypha wilkesiana (Euphorbiaceae) copper leaf, beef steak, Jacob's coat	10	5	dense; upright: round; 2 ft	fast; poor	good	mod	no	inconspic. Su not fragr.	(dry) med	none; nondecid.	mod (lvs); low maint.	low-med	1,2,(3),4, (5)
Hibiscus schizopetalus (Malvaceae) coral hibiscus	10	5	med; upright: round; 3 ft	med; poor	good	mod	no	red SpSuFaWr not fragr.	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4, (5)

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Tabernaemontana divaricata (Apocynaceae) crepe jasmine, paper gardenia	15	6	med; upright: round; 3 ft	med; med	med	sens	no	white/yellov SpSuFaWr fragrant	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-high	1,2,3,4
Codiaeum variegatum (Euphorbiaceae) croton	12	6	dense; upright: round; 2 ft	fast; med	good	mod	no	white Su not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4, (5)
Holmskioldia sanguinea (Verbenaceae) cup and saucer, Chinese hat	15	12	med; upright: spreading; 4 ft	fast; poor	good	mod	no	orange,red SpSuFaWr not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4, (5)
Mussaenda philippica 'Dona Aurora' (Rubiaceae) Dona Aurora mussaenda	10	6	med; upright: round; 4 ft	med; poor	poor	sens	no	cream SpSuFa not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4
Mussaenda x 'Dona Luz' (Rubiaceae) Dona Luz mussaenda	10	6	med; upright: round; 4 ft	med; poor	poor	sens	no	pink SpSuFa not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4
Mussaenda erythrophylla 'Dona Trining' (Rubiaceae) Dona Trining mussaenda	10	6	med; upright: round; 4 ft	med; poor	poor	sens	no	red SpSuFa not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4

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SOUND/WIND/VISUAL BARRIERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color Time of flwr Fragrance	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elevation	Planting zone(s)
Dracaena marginata 'Tricolor' (Liliaceae) dracaena tricolor	10	5	open; upright: round; 3 ft	slow; med	med	sens	no	n/a not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-high	1,2,3,4,(5)
Bambusa multiplex* (Poaceae) dwarf bamboo, hedge bamboo	15	5	dense; upright: clump; 4 ft	fast; med	med	sens	no	n/a not fragr.	(dry) med-wet	none; nondecid.	high (lvs); med maint.	low-med	1,(3),4,(5)
Schefflera arboricola* (Araliaceae) dwarf brassaia, dwarf umbrella	15	8	dense; upright: round; 3 ft	fast; good	good	mod	no	white Sp not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,2,(3),4,5
Caesalpinia pulcherrima (Fabaceae) dwarf poinciana	15	15	open; round; 3 ft	fast; poor	good	tol	no	red/yellow SpSuFaWr not fragr.	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4,5
Pseuderanthemum carruthersii* (Acanthaceae) false eranthemum	8	4	med; upright; 2 ft	fast; med	med	mod	no	white/red SpSuFaWr not fragr.	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4,(5)
Gardenia jasminoides (Rubiaceae) gardenia, Cape jasmine	6	4	med; upright: round; 3 ft	med; med	good	sens	no	white SpSu fragrant	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4,(5)
Taliparitiliaceum (Malvaceae) hau **NATIVE**	25	35	dense; spreading; 6 ft	fast; med	good	tol	yes	yellow SpSuWn not fragr.	(dry) med-wet	none; nondecid.	high (lvs, flws); high maint.	low	1,(3),(5)

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Hibiscus rosa-sinensis (Malvaceae) hibiscus	10	5	med; upright: round; 2 ft	med; poor	good	mod	no	red, orange, yellow, pinl SpSuFaWr not fragr.	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4, (5)
Abutilon eremitopetalum*** (Malvaceae) hidden petal abutilon **NATIVE (ENDEMIC)**	5	8	med; round; 3 ft	fast; poor	good	sens	no	green SpWn not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Juniperus chinensis ssp. torulosa (Cupressaceae) Hollywood twisted juniper	35	8	dense; upright; 7 ft	med; med	good	mod	no	n/a not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Ligustrum japonicum* (Oleaceae) Japanese privet	15	10	dense; upright; 3 ft	fast; med	good	tol	no	white Sp fragrant	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4,5
Cordyline fruticosa (Agavaceae) ki, ti **POLYN. INTRO**	6	2	dense; upright; 2 ft	fast; good	med	sens	no	white SpSu fragrant	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Saccharum officinarum (Poaceae) ko, sugar cane **POLYN. INTRO**	15	5	dense; upright; 3 ft	fast; poor	good	mod	no	white SpWn not fragr.	(dry) med	none; nondecid.	mod (lvs); med maint.	low	1,(3),4
Hibiscus waimeae*** (Malvaceae) kokio keokeo (Kauai) **NATIVE (ENDEMIC)**	15	10	dense; round; 4 ft	fast; mod	med	sens	no	white/red SpSuWn fragrant	(dry) med	none; fa	mod (lvs); low maint.	med	2,(3),4

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Hibiscus immaculatus (Malvaceae) kokio keokeo (Maui & Molokai) **NATIVE (ENDEMIC)**	15	10	dense; upright: round; 4 ft	fast; med	med	sens	no	white SpSuWn fragrant	(dry) med-wet	none; fa	mod (lvs); low maint.	low-med	1,(3),4
Hibiscus kokio (Malvaceae) kokio ula ula **NATIVE (ENDEMIC)**	10-12	5	open; upright; 3 ft	fast; med	med	sens	no	red, orange SpSuFa not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4,(5)
Senna gaudichaudii (Fabaceae) kolomona **NATIVE**	5	5	med; round; 3 ft	slow; poor	good	sens	no	green SpWn fragrant	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4,5
Senna surattensis* (Fabaceae) kolomona, scrambled eggs	15	10	med; round	fast; med	good	mod	no	yellow SpSuFaWr not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	1,3,4,5
Abutilon menziesii*** (Malvaceae) kooloa ula **NATIVE (ENDEMIC)**	5	8	dense; round; 3 ft	fast; poor	good	sens	no	maroon SpWn not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Ipomoea horsfalliae (Convolvulaceae) Kuhio vine	20	5	med; vine; 8 ft	fast; med	good	sens	no	red Su not fragr.	med	none; sp	no rubbish; low maint.	low-med	1,2,3,4
Nototrichium sandwicense (Amaranthaceae) kului **NATIVE (ENDEMIC)**	8	8	med; round; 4 ft	med; poor	good	sens	no	silver SpWn not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4

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Brunfelsia americana (Solanaceae) lady of the night	10	5	med; upright: round; 3 ft	med; poor	med	sens	no	green FaWn fragrant	dry-med poisonous	none; nondecid.	no rubbish; low maint.	low-med	1,3,4
Calliandra haematocephala (Fabaceae) lehua haole	8	10	dense; round; 6 ft	fast; poor	good	mod	no	red, pink, white FaWn not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4
Gossypium tomentosum (Malvaceae) mao, Hawaiian cotton **NATIVE (ENDEMIC)**	5	8	dense; spreading; 3 ft	med; poor	good	sens	no	yellow SpWn not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,5
Polyalthia longifolia (Annonaceae) mast tree	35	8	dense; upright; 6 ft	fast; poor	good	mod	no	inconspic. Su not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4
Otatea acuminata (Poaceae) Mexican weeping bamboo	20	20	dense; upright: clump; 10 ft	fast; med	med	sens	no	n/a not fragr.	(dry) med-wet	none; nondecid.	mod (lvs); med maint.	low-med	1,(3),4,(5)
Murraya paniculata* (Rutaceae) mock orange	20	5	dense; upright: round; 2 ft	slow; med	good	mod	no	white SpSuFaWr fragrant	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4,(5)
Dracaena marginata (Liliaceae) money tree	15	5	open; upright: round; 4 ft	slow; med	med	mod	no	n/a not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-high	1,2,3,4,(5)

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Myoporum sandwicense (Myoporaceae) naio **NATIVE**	10	10	med; round; 10 ft	med; poor	good	tol	no	white SpSuWn not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-high	2,3,4,5
Carissa macrocarpa (Apocynaceae) natal plum	10	5	med; upright: round; 2 ft	med; med	good	tol	no	white SpSuFaWr fragrant	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,3,4,5
Scaevola chamissoniana (Goodeniaceae) naupaka kuahiwi **NATIVE (ENDEMIC)**	8	8	med; round; 3 ft	med; med	med	sens	no	white SpSuWn not fragr.	med-wet	none; nondecid.	no rubbish; med maint.	med	1,2,4
Scaevola sericea (Goodeniaceae) naupaka kahakai, beach naupaka **NATIVE**	6	8	dense; spreading; 3 ft	fast; poor	good	tol	no	white SpSuWn not fragr.	(dry) med	none; nondecid.	no rubbish; low maint.	low	(3),4,5
Schizostachyum glaucifolium (Poaceae) ohe, Hawaiian bamboo **POLYN. INTRO**	30	20	dense; upright; 10 ft	fast; good	poor	sens	no	n/a not fragr.	(dry) med-wet	none; nondecid.	mod (lvs); med maint.	low	1,(3),4,(5)
Nerium oleander (Apocynaceae) oleander	20	15	dense; round; 3 ft	fast; med	good	tol	no	red, pink, white SpSuFaWr fragrant	dry-med-wet poisonous	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4,5
Polyscias guilfoylei (Araliaceae) panax	20	4	dense; upright; 2 ft	fast; poor	good	tol	no	inconspic. not fragr.	(dry) med-wet	none; nondecid.	mod (lvs); low maint.	low-med	1,2,(3),4,5

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Polyscias fructicosa (Araliaceae) parsley panax	10	4	dense; upright; 2 ft	slow; poor	good	tol	no	inconspic. not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4,5
Pittosporum tobira* (Pittosporaceae) pittosporum	15	10	dense; upright: round; 3 ft	fast; good	good	tol	no	white Su fragrant	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4,5
Plumbago auriculata (Plumbaginaceae) plumbago	6	6	dense; upright: round; 2.5 ft	fast; poor	good	mod	no	blue, white SpSuFaWr not fragr.	(dry) med	none; nondecid.	no rubbish; med maint.	low-med	1,2,(3),4, (5)
Afrocarpus falcatus (Podocarpaceae) podocarpus, African fern pine	30	20	dense; upright: round; 7 ft	slow; good	good	mod	no	inconspic. not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4
Vitex rotundifolia (Verbenaceae) pohinahina, beach vitex **NATIVE**	3	4	med; spreading; 2 ft	fast; poor	good	tol	no	purple SpSuWn not fragr.	(dry) med	none; nondecid.	no rubbish; low maint.	low	(3),5
Hibiscus kokio subsp. saintjohnianus (Malvaceae) pualoalo, kokio ulaula **NATIVE (ENDEMIC)**	10-12	5	open; upright; 3 ft	fast; med	med	sens	no	orange SpSuFa not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4,(5)
Galphimia gracilis (Malpighiaceae) rain of gold	5	3	med; upright; 2 ft	med; poor	good	sens	no	yellow SpSuFaWr not fragr.	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4

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Alpinia purpurata* (Zingiberaceae) red ginger	5	5	open; upright; 3 ft	med; med	good	sens	no	red SpSuFaWr not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Ixora coccinea* (Rubiaceae) red ixora	10	6	med; upright; 2.5 ft	med; poor	med	mod	no	red, yellow, pink SpSuFaWr not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4,(5)
Rondeletia odorata (Rubiaceae) rondeletia	6	5	dense; upright: round; 3 ft	fast; poor	good	sens	no	yellow/ orange SpSuFaWr not fragr.	dry-med	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4,(5)
Hibiscus syriacus* (Malvaceae) rose of sharon	10	5	med; upright: round; 3 ft	slow; poor	good	sens	no	white, rose, pink, lavender SpSuFaWr not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4,5
Coccoloba uvifera (Polygonaceae) sea grape	20	20	dense; round; 4 ft	med; med	good	tol	no	white Sp fragrant	dry-med	none; nondecid.	low (lvs, fruit); low maint.	low	(3),4,5
Breynia disticha (Euphorbiaceae) snowbush	10	3	dense; upright: round; 2 ft	med; poor	good	sens	no	inconspic. not fragr.	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Crinum asiaticum (Liliaceae) spider lily	4	4	open; upright; 4 ft	med; med	good	tol	no	white, maroon SpSuFaWr not fragr.	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4,5

*HPWRA designation "EVALUATE" ***Endangered

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

SOUND/WIND/VISUAL BARRIERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color Time of flwr Fragrance	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elevation	Planting zone(s)
Gardenia taitensis (Rubiaceae) tiare, Tahitian gardenia	15	15	med; round; 5 ft	med; med	med	sens	no	white SpSuFaWr fragrant	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Erythrina variegata 'Tropic Coral' (Fabaceae) tropic coral	30	8	dense; upright; 3 ft	fast; poor	good	sens	no	orange Wn not fragr.	(dry) med	none; nondecid.	mod (lvs); low maint.	low	1,(3),4
Malvaviscus penduliflorus (Malvaceae) turk's cap	10	5	dense; upright: spreading; 2 ft	med; poor	good	mod	no	red, pink, white SpSuFaWr not fragr.	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4, (5)
Osteomeles anthyllidifolia (Rosaceae ulei **NATIVE**	4	6	dense; spreading; 3 ft	med; poor	good	mod	no	white SpSuWn fragrant	dry-med	none; nondecid.	no rubbish; low maint.	low-high	2,3,4
Taliparitiliaceum f. variegata (Malvaceae) variegated hau	18	10	dense; spreading; 5 ft	fast; med	good	tol	yes	yellow SpSuWn not fragr.	(dry) med-wet	none; nondecid.	high (lvs, flws); high maint.	low	1,(3),(5)
Pandanus tectorius 'Baptistii' (Pandanaceae) variegated pandanus	25	20	dense; upright; 7 ft	med; med	good	tol	no	white SpSuFaWr not fragr.	(dry) med-wet	none; nondecid.	high (lvs); high maint.	low-med	1,2,(3),4,5
Broussonetia papyrifera (Moraceae) wauke **POLYN. INTRO**	8	6	med; upright; 2 ft	fast; poor	good	sens	yes	inconspic. not fragr.	(dry) med	none; nondecid.	no rubbish; low maint.	low	(3),4
Jasminum humile 'Mesnyi' (Oleaceae) yellow jasmine	10	5	dense; round; 3 ft	med; good	good	sens	no	yellow SpSu fragrant	med-wet	none; nondecid.	no rubbish; low maint.	med-high	2,4

*HPWRA designation "EVALUATE" ***Endangered

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

SOUND/WIND/VISUAL BARRIERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Intrusive roots	Flower color Time of flwr Fragrance	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elevation	Planting zone(s)
Brunfelsia australis (Solanaceae) yesterday, today, and tomorrow	12	8	dense; upright: round; 4 ft	med; good	med	sens	no	purple, white SpWn fragrant	med-wet	none; nondecid.	no rubbish; low maint.	low-high	1,2,(3),4

*HPWRA designation "EVALUATE" ***Endangered

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

CHAPTER 10. TURFGRASS AND GROUND COVERS: TYPES, PLANTING, AND CARE

10.1 TURFGRASS AND GROUND COVER GENERAL INFORMATION

10.101 Well established and maintained turfgrass and ground cover contribute to the esthetics of an area, protect it from soil erosion, and provide dust control. To achieve such results, the following should be considered:

10.101-A Good soil preparation and grading.

10.101-B Selection of appropriate plant materials for the area.

10.101-C Good maintenance - proper fertilizing, mowing, trimming back, watering, and controlling weeds, diseases, and insects.

10.102 The decision to use ground cover rather than turfgrass in residential roadside planting strips needs to consider that the former may not permit foot traffic.

10.103 Site Preparation Measures

10.103-A If possible, move 6 inches of top soil to one side until construction and subsoil grading operations are completed. This top soil will be returned prior to planting. Do not mix poor soils that may be "trucked in" or sub soils accumulated when installing a septic system or doing other on-site diggings, with this top soil that will be used for planting turfgrass and ground covers.

10.103-B If additional soil is brought in for planting, it should be similar to what is onsite. Mix it with the existing top soil to a depth of 12 inches to avoid "layering" and the water movement problems it produces. Do not introduce rocky fill material to serve as top soil for planting.

10.103-C Remove debris, branches, rocks, construction materials, etc. prior to planting.

10.103-D A test of on-site soil, with backfill material mixed in if used, should be conducted to determine nutrient, pH, and salinity levels for making appropriate adjustments prior to planting.

10.2 PREPARING THE SOIL FOR TURFGRASS AND GROUND COVER PLANTING

10.201 Soil preparation prior to planting.

10.201-A All types of grass and ground cover planting methods require the same bed preparation.

10.201-B After moving six inches of top soil to one side, loosen the subsoil so that it can be worked. It is recommended that the soil be at field capacity moisture (two days after irrigation) rather than at saturation point (all pores filled with moisture). Saturated and very dry soil will be difficult to work and may form large clumps.

10.201-C Slope the subsoil away from buildings if possible. A 25% grade will be adequate for good drainage.

10.201-D Based on a soil analysis and fertilizer recommendations, a phosphate fertilizer (such as 10-30-10) and any required lime products should be incorporated into the top six inches of subsoil and mixed in thoroughly prior to planting. (See 10.202-A below.)

10.201-E In addition, organic matter should be added as well. This is especially true for sandy and heavy clay soils where 25%-33% organic matter by volume would make an ideal soil mixture and 10%-15% organic matter would be considered minimal. For loam soils a 5%-10% addition of organic matter by volume is sufficient.

10.201-F Uniformly spread the six inches of topsoil you saved (See 10.103-A.) or brought in, over the subsoil and grade. If topsoil needs to be purchased, be sure that it is free of rocks, toxic salts and chemicals, debris, and undesirable plants and seeds. The other half of the phosphate fertilizer and lime products, and additional organic matter, should be added and mixed into the topsoil at planting.

10.202 Fertilizer Incorporation.

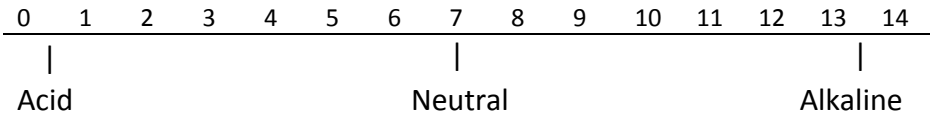
10.202-A A fertilizer that has a combination of nitrogen, phosphorus, potassium, and some trace elements, is incorporated into the soil, usually at 2 lbs. nitrogen per thousand square feet of surface, six inches deep. Typically, a fertilizer such as 10-30-10 with trace elements is used. A soil test should be conducted therefore the fertilizer percentages may change but the calculation method remains the same. The amount to be applied can be determined as follows:

Example Problem: *The hypothetical fertilizer has an analysis of 10-30-10 (10% N, 30% P_2O_5, 10% K_2O). It is to be applied to an area of 650 sq. ft. at the rate of 2 lb. nitrogen per thousand square feet.*

$$\frac{\text{2 lbs. N x 650 sq. ft.}}{\text{1000 ft. x 0.10 N}}$$ = 13 pounds of fertilizer to be incorporated in the top 6" of soil and another 13 pounds to the lower 6” of soil in the 650 sq. ft. area.

10.203 Understanding Soil pH

10.203-A Soil pH Scale.



- Every number is 10 times more acid or more alkaline than number 7 (a neutral pH). For example, 6 is ten times more acidic than 7 and 5 is 10 times more acidic than 6. Thus, 5 is 10 x 10, or 100 times, more acidic than 7. Four is 10 x 10 x 10, or 1000 times, more acidic than 7. The same goes for numbers above 7: 8 is 10 times more alkaline than 7 and 9 is 10 x 10, or 100 times, more alkaline than 7, etc.
- Turfgrass and ground covers prefer a soil pH in the range of 6.3 to 6.8 because various plant nutrients become less available for root uptake above and below this pH range. However, as Table 10-1 indicates, they tolerate pHs a little above and below this preferred range. For pHs above 7.0, iron, manganese, boron, copper, and zinc are limited in availability. For pHs below 6.3, phosphorous, magnesium, and molybdenum are limited. Correcting soil pH before planting is advantageous.
- Consult a professional for advice and recommendations for ways to correct soil pH to promote good plant growth.

10.204 Chemical Use

10.204-A If pesticides are applied, all label directions must be adhered to. Pesticides and herbicides should be used as a last resort for benefit of the environment. Consult a professional.

10.205 WEED CONTROL

10.205-A Until good turfgrass/ground cover coverage is achieved, hand pulling, pre-emergent herbicides, mulches, mechanical barriers, or some other means of controlling weeds is recommended. Weeds compete with desired plants for water, fertilizer, and light.

10.3 TURFGRASS PLANTING

10.301 Turfgrass selection consideration:

10.301-A Select high quality planting material that is free of weeds, insects, and diseases.

10.301-B Select turfgrass types that are adapted to anticipated traffic, soil, salinity, rainfall, elevation, shade, and other conditions of the area.

10.301-C Select the type of turfgrass that available time and resources will provide the required maintenance.

10.301-D Some of the warm season grasses will turn yellow, thin out, and grow more slowly during the cold months at higher elevations.

- Kikuyugrass is an exception; it thrives when it is cooler.

10.301-E Avoid planting grass stolons and seed under shade.

10.302 Planting Turfgrass

10.302-A Seeding: Grasses for which seeds are available can be planted by hand or with a mechanical seeder. Divide the seeds in half, spreading half in one direction, and the other half crosswise to the first sowing. Cover the seeds by raking lightly or with organic matter or soil. Roll the seeded area with a light roller.

10.302-B Plugging is planting clumps of grass plants with intact roots and soil in preformed holes at given intervals, usually 1 foot apart. Closer intervals will result in quicker coverage.

10.302-C Sodding is good when a contractor has a 90 day maintenance contract after installation or immediate and complete coverage is required. The seedbed should be firmed with a roller. Sod should be cut with one inch of soil (a turfgrass producer international specification). Thickness will therefore vary depending on the mowing height. Lay the sod in the planting bed and tightly "butt-up" the strips with each other; alternate the end seams. To avoid tramping on sod and seedbed, use a board to kneel on. “Roll” the sod with a weighted roller to increase its soil contact, eliminate air pockets, and smooth out its surface. Clean topsoil may be used to fill-in seams and holes.

10.302-D Strip Sodding is planting sod in strips, end to end, with parallel strips spaced about one foot apart.

10.302-E Sprigging is planting individual plants, runners, or cuttings at spaced intervals. Sprigs or runners are obtained by tearing apart or shredding solid pieces of established grass. The spacing should be governed by how fast coverage is desired and the amount of planting material available.

10.302-F Stolonizing is evenly spreading shredded stolons (turfgrass clippings with short stems) over an area followed by top dressing, and rolling.

10.302-G Hydromulching is a method of applying propagation material by spraying a mixture of water, wood fiber mulch, and seeds, sprigs, or stolons onto a planting area. Specialized equipment is required. Hydromulching provides the additional benefits of holding planting material in place and enhancing moisture retention. Avoid introducing seeds of invasive species when hydromulching.

10.4 TURFGRASS MAINTENANCE

10.401 Fertilizing post plant.

10.401-A Slow release fertilizers should be used in post plant grass care because losses due to leaching are minimized and longer intervals between applications are possible. Apply fertilizers with a ratio of major nutrients of 4:1:2 or 3:1:2. Avoid picking up the fertilizer granules with the mower's grass catcher.

10.401-B Using a hypothetical fertilizer of 28:7:14 on El Toro zoysiagrass growing in an area of 650 sq. ft. and at 0.5 lb. N per 1000sq. ft. per month (as found in Table 10-1: TURFGRASS on page 163). The amount of fertilizer to apply can be determined as follows:

$$\frac{0.5 \text{ lb. N} \times 650 \text{ sq. ft.}}{1000 \text{ sq. ft.} \times 0.28 \text{ N}} = 1.16 \text{ or } 1.2 \text{ pounds of this fertilizer per month}$$

10.401-C In general, you need to determine the nitrogen requirement of your grass from Table 10-1: TURFGRASS in this chapter. Then determine how much fertilizer needs to be applied to provide this amount of nitrogen according to the calculation in the above paragraph or from the fertilizer bag's directions.

10.401-D Besides nitrogen (nitrate, ammonium, and urea), other important elements for greening grass are: Iron, Magnesium, Sulfur, and Manganese. Fertilizers with these additional nutrients are considered better than those without.

10.401-E Do not apply fertilizers when grass leaves are wet. Water the turfgrass immediately after applying fertilizer to wash it off the leaves and prevent burning of the grass plant.

10.401-F At some sites, kikuyugrass may not need to be fertilized once it is established. Water alone may be sufficient.

10.401-G Be concerned about polluting the environment and ocean. Avoid water runoff from the land, especially when it contains fertilizers and chemicals used in landscape planting and maintenance.

10.402 Watering

10.402-A Newly planted turfgrass needs to be lightly watered at least three to four times a day for the first 10 days, two times a day for the next 14 days, and one time a day until matured growth is reached. When reaching maturity, watering every other day may be sufficient. On-site adjustments may be necessary.

10.402-B The watering program for an established turfgrass will depend on soil texture and environmental conditions. Sandy soils will require more frequent watering while clay soils will require less. Apply water before the grass wilts (enough water to moisten the soil six (6) inches deep or more). Use a "cycle and soak" scheduling to avoid applying water faster than it infiltrates the soil's surface to avoid water runoff. Avoid watering lightly and frequently because this will cause shallow rooting and promotes weed growth. The deeper the roots, the greater will be the grass's resistance to drought.

10.402-C Seasonal irrigation adjustments will also be needed: more applied during the summer months and less during the winter months.

10.402-D For water conservation, automatic irrigation systems must be governed by a rain shut off valve. The irrigation industry has controllers with soil moisture sensors and evapotranspiration (ET) stations to make for more conservative applications of water. These and other systems designed for conserving water are recommended because water is a limited commodity. See Chapter Twelve, "Irrigation and Water Conservation; Drought Tolerant Plants" for some water conservation recommendations.

10.402-E Subsurface watering may be appropriate for irrigating turfgrass. When used, fertilizer injection into the irrigation system may be appropriate because wetting fertilizers applied to the soil's surface will be difficult. Use irrigation materials designed for subsurface use, consider repair and root issues.

10.402-F Irrigation with saline water must be on long enough to have the layer of accumulated salt below the root zone. The soil must not be permitted to dry out. If soil dries, the lower salts will rise up and may reach the root zone and increase its salinity. A soil's salinity (electrical conductivity, E.C.) can be 2-10 times the water's E.C. with shallow watering and inadequate leaching.

10.402-G Turfgrass will do better without salts. If a soil's electrical conductivity is greater than 3.0, it will hinder the growth of most grasses. Irrigation water should preferably have an EC of less than 1.5. Matured grasses are more tolerant of salts. Seashore paspalum, *Paspalum vaginatum,* is tolerant of being temporarily covered with sea water.

10.402-H When irrigating with recycled water, it should be tested for pH, electrical conductivity, and mineral content to make adjustments in plant types selected, soil amendments, depth of wetting, and fertilizers used.

10.403 Mowing

10.403-A Mowing height will depend on the type of turfgrass grown and its intended use. In general, higher cuts will reduce weed seed germination. Mowers should be sharp enough to cut the grass cleanly without bruising or tearing the leaves. Reel mowers give a better quality cut than rotary mowers but may not be practical except for highly manicured turfgrass. Flail mowers are safer to use in parks and along roadsides.

10.404 Renovating Turfgrass

10.404-A Grass may decline after establishment. Determine the cause(s) for decline and implement corrective measures. At times poor drainage due to the nature of the soil itself may be causing the decline in turfgrass health. In that case, follow suggestions made in "Preparing the Soil for Turfgrass and Ground Cover Planting". Drain pipes can be installed to carry excessive water away.

10.404-B Faults such as poor plant nutrition, low soil pH, improper or inadequate irrigation, soil compaction, weeds, excessive shading from trees, and general neglect can usually be corrected during renovation.

10.404-C Steps in lawn renovation:

- For the elimination of weeds and undesirable grasses: Mow closely and remove clippings and debris. Water and fertilize the area. When the grass and weeds are growing better, apply selective herbicides to eliminate the weeds. Consult a professional for advice.

- For compact soils: Aerate or loosen surface soil by using an aerator. A grid system (e.g. grasscrete, geotec, or equivalent) filled with soil and planted with grass will tolerate vehicular and foot traffic.
- For nutrient and pH problems: Apply fertilizer and lime products in accordance with soil test recommendations.
- Replant turfgrass in areas where it is poorly established. Provide walkways where foot traffic limits growing turfgrass.

10.405 Turfgrass Problems

10.405-A Weeds

- Pulling, mowing prior to weed seeding, and growing a strong healthy competitive grass will provide some weed control. Stressed grass is not able to compete with weeds.
- Barren soil invites weeds.
- Even with a good turfgrass management program, weeds may become established and some means of control may be required. If herbicides are used, follow directions and precautions listed on the container label. For assistance call the chemical companies or contact the local dealers, garden shops, or the Cooperative Extension Service.

10.405-B Diseases

- Certain environmental and turfgrass conditions need to be present before plant diseases are established. Poor turfgrass management due to inadequate soil aeration or drainage, over watering, over fertilizing, excessive shading, excessive thatch, and incorrect mowing practices may cause the grass to become more prone to disease organisms. Environmental conditions such as excessive rain, warm temperature, and high humidity can also cause disease problems. Diseases are more of a problem in highly manicured grasses rich in nitrogen and moisture.
- If disease is a problem, consult a professional.

10.405-C Insects

- There are many kinds of insects and insect-like pests that damage turfgrass. Some of these are turfgrass caterpillars, Hunting Billbugs, Rhodesgrass Mealy Bugs, mites, and aphids. The organic material Dipel, *Bacillus thuringiensis*, is effective against caterpillars when applied according to the label. Birds also control caterpillars

effectively. Other insecticides are available and if used label directions and precautions should be followed.

10.5 TURFGRASS TABLE CHARACTERISTICS DEFINED

10.501 Turfgrass characteristics that appear in Table 10-1: TURFGRASS are defined below.

10.501-A Color: Shades of green, as listed in Turfgrass Table.

10.501-B Disease Susceptibility: These diseases are listed by number in the Turfgrass Table. The grasses are particularly sensitive to these diseases when specific environmental and cultural conditions exist. Other diseases could affect the grass plant as well. If this should occur, consult a professional.

- 0 - not susceptible to any serious disease
- 1 – Helminthosporium like diseases, fungal diseases.
- 2 - rust, a fungal disease
- 3 - gray leaf spot, a fungal disease
- 4 - Rhizoctonia, a fungal disease (more common in poorly drained soils)
- 5 - Pythium, a fungal disease (more common in poorly drained soils)

10.501-C Drought Tolerance: The ability to survive or recover after periods without water. Grasses with underground stems (rhizomes) are more drought tolerant.

- Poor
- Good
- Excellent

10.501-D Insect Susceptibility: These insects are listed by number in the Turfgrass Table. The list is limited to major problems only. If necessary consult a professional.

- 0 - insect pests of minor significance
- 1 - lawn armyworm
- 2 - sod webworm
- 3 - hunting billbug
- 4 - black cutworm - usually a minor pest.
- 5 - yellow sugarcane aphid

- 6 - firey skipper
- 7 - bermudagrass mite
- 8 – southern chinch bug
- 9 - rhodesgrass mealy bug

10.501-E Leaf Stiffness: Indicates relative softness of leaf blades.

- Soft
- Medium
- Stiff

10.501-F Leaf Texture: Indicates relative width of leaf.

- Fine: < 2 mm wide
- Medium: 2-3 mm wide
- Coarse: > 3 mm wide

10.501-G Maintenance: Grasses differ greatly in their maintenance requirements (including fertilizer needs, susceptibility to pests, mowing frequency, irrigation requirements, and thatch control). As a general rule fine textured grasses require a higher level of maintenance. The level of maintenance of the grass should be one of the first considerations in selection of a turfgrass for a given area.

- High – require high maintenance; generally fine textured grasses.
- Medium – require less maintenance.
- Low – require even less maintenance; generally coarse textured grasses mowed higher.

10.501-H Mower Height/Frequency: The recommendations made will provide optimum growth and aesthetics.

- Height of mowing: as listed in Table 10-1: TURFGRASS.
- Frequency is as follows:
  - Frequent – once a week is best.
  - Intermediate – once every two or three weeks may be all right.
    - Minimal – mowing intervals greater than three weeks may be all right.

10.501-I Nitrogen Requirement: These recommendations are for optimum growth of turfgrass. Environmental factors, such as temperature and sunlight, may alter these rates. Use rates shown as a guideline only.

10.501-J Planting Method: Grass is propagated either by seed or vegetative pieces. Some grasses are propagated only by vegetative means because they are hybrids and/or sterile and produce no seeds.

- Plugs: The amount of material needed for planting plugs will depend on the distance between plugs and the size of the plug.
- Sprigs and Stolons: The amount of material needed for planting sprigs and stolons will depend on the turfgrass density desired for competition with weeds and the selected species' rate of growth.
- Seed: The pounds of seed per 1,000 sq. ft. of soil surface are shown in Table 10-1: TURFGRASS.

10.501-K Planting Rate: Suggested planting rates are shown in the Table 10-1: TURFGRASS. One bushel equals eight gallons by volume.

10.501-L Salt Tolerance: Indicates the ability to be grown in salty soil, to be irrigated with saline water, or to be exposed to ocean sprays.

- Sensitive - not recommended for salty areas.
- Moderate - will do all right in salty areas. Some loss in vigor or salt damage may occur.
- Tolerant - tolerant of salt sprays.

10.501-M Seed Head Development: Indicates the abundance of seed heads produced by the turfgrass. These tend to be unsightly and it is usually a problem in the summertime.

- Minimal - negligible amount of heads.
- Medium - sometimes a problem; usually in low numbers.
- High - more frequently a problem and numerous.

10.501-N Shade Tolerance: This characteristic is the ability to grow in varying degrees of shade. Grasses will do better when grown in full sunlight. Shading a sun loving grass produces poor growth and weediness.

- Poor
- Fair
- Good
- Excellent

10.501-O Shoot Density: Indicates the number of plants per square inch.

- Low - few plants per square inch.
- Medium
- High - many plants per square inch. Lower mowing height possible.

10.501-P Soil pH: The listed pH represents the range of acidity that turfgrass prefers (see page 151 for general discussion of pH).

10.501-Q Thatching: Thatch is a layer of dead and living stems, leaves, and roots between the growing turfgrass and soil surface. It can cause disease problems and slow growth due to the accumulation of grass roots in the thatch and related grass plant stresses. Dethatching is recommended for those grasses prone to thatch build-up. The following indicates relative rates at which turfgrass tends to produce thatch. An annual dethatching is recommended for those grasses prone to thatch build up.

- Low
- Medium
- High

10.501-R Water Requirement: Water required for optimum growth. Temperature, wind, rainfall, cloud cover, soil type, etc. will vary requirements throughout the year.

- Low - approximately 1" per week
- Medium - in between low and high
- High - approximately 2.5" per week

10.501-S Wear Resistance/Wear Recovery:

- Wear resistance is the ability to withstand traffic and other abuse without sustaining excessive damage.
  - Poor
  - Fair
  - Good
  - Very good

- Wear recovery is the rate at which turfgrass will grow back after damage has occurred. Grasses with underground stems (rhizomes) recover faster. As an exception, even though Zoysia grasses have rhizomes, most are listed as being slow to recover from damage because of their slow growth.
  - Slow
  - Medium
  - Rapid

10.501-T Zones: See Chapter One for the Maui County map with planting zones on page 12.

TURFGRASS

Species	Leaf color; Leaf texture	Shoot density; Shade tolerance	Seed head dev; Leaf stiffness	Wear resistance; Recovery	Water req.; Soil pH; Drought tolerance	Salt tol.; Insect susceptibility	Thatching; Disease susceptibility	Mowing height (inches); Frequency; Maintenance	Seeds (lbs/1000sqft); Sprigs (bu/1000sqft)	Plugs (sq yds/ 1000sqft); Stolons (bu/1000sqf	Nitrogen (lbs. per 1000sqft per mo.); Planting zone
Pennisetum clandestinum 'AZ-1' (Poaceae) AZ-1 Kikuyugrass	green medium	med fair	minimal medium	very good rapid	med 5.5-7.5 excellent	mod 2, 5	High 2	0.3-0.5 frequent high	0.5-1 10-20	5-10 5-10	0.3-0.5 1,2,3,4,5
Cynodon dactylon (Poaceae Bermudagrass, manienie	gray/green medium	med poor	high medium	very good rapid	low 5.5-7.5 excellent	mod 1,2,4,6,7	High 1,4,5	0.25-1.0 intermediate med	1-2 1-2	8-10 5-10	1.0 1,2,3,4,5
Cynodon dactylon 'Black Jack' (Poaceae) Black Jack Bermudagrass	dark green fine	high good	high soft	very good rapid	low 5.5-7.5 excellent	mod 1,2,4,6,7	High 1,4,5	0.25-1.0 intermediate med	1-2 1-2	8-10 5-10	1.0 1,2,3,4,5
Eremochloa ophiuroides (Poaceae) centipedegrass	medium green coarse	med fair	minimal medium	poor med	med 4.5-5.5 poor	sens 0	Medium 0	1.0-2.0 minimal low	4-6 4-5	5-10 5-10	0.3-0.5 1,2,3,4
Zoysia japonica 'El Toro' (Poaceae) El Toro zoysiagrass	deep green coarse	high good	minimal stiff	very good med	low 5.8-8.0 excellent	mod 3,9	Low 4	0.5-1.0 frequent med	0.0 2-4	5-10 5-10	0.5 1,2,3,4,5
Zoysia japonica x Z. tenuifolia 'Emerald' (Poaceae) Emerald zoysiagrass	deep green medium	high good	minimal stiff	very good slow	low 5.8-8.0 excellent	mod 3	Medium-high 2,4	0.5-1.0 frequent med	0.0 2-4	5-10 5-10	1.0 1,2,3,4,5
Paspalum conjugatum (Poaceae) Hilograss	light green coarse	low good	minimal soft	poor slow	wet 4.5-5.5 poor	sens 0	Low 0	1.0-1.5 frequent low	0.0 4-5	5-10 5-10	0.3-0.5 1,4
Zoysia matrella (Poaceae) Manilagrass	deep green medium	high good	minimal stiff	very good slow	low 5.8-8.0 excellent	sens 3	Medium-high 2,4	0.5-1.0 frequent med	0.0 2-4	5-10 5-10	0.33-1.0 1,2,3,4,5
Zoysia tenuifolia (Poaceae) Mascarenegrass, Japanese templegrass	deep green medium	high good	minimal stiff	very good slow	low 5.8-8.0 excellent	mod 3	Medium-high 2,4	0.5-1.0 frequent med	0.0 2-4	5-10 5-10	0.33 1,2,3,4,5
Zoysia japonica 'Meyer' (Poaceae) Meyer zoysiagrass	deep green medium	high good	minimal stiff	very good slow	low 5.8-8.0 excellent	mod 3	Medium-high 2,4	0.5-1.0 frequent med	0.0 2-4	5-10 5-10	0.5 1,2,3,4,5
Paspalum vaginatum 'Sea Spray' (Poaceae) Sea Spray seashore paspalum	dark green medium	high fair	medium soft	good rapid	med 4.5-9.0 excellent	tol 1,2,4,6	High 1	0.5-1.5 frequent med	1.0 1-2	8-10 5-10	0.25 1,2,3,4,5

1 bushel = 8 gallons by volume

TURFGRASS

Species	Leaf color; Leaf texture	Shoot density; Shade tolerance	Seed head dev; Leaf stiffness	Wear resistance; Recovery	Water req.; Soil pH; Drought tolerance	Salt tol.; Insect susceptibility	Thatching; Disease susceptibility	Mowing height (inches); Frequency; Maintenance	Seeds (lbs/1000sqft); Sprigs (bu/1000sqft)	Plugs (sq yds/ 1000sqft); Stolons (bu/1000sqf	Nitrogen (lbs. per 1000sqft per mo.); Planting zone
Paspalum vaginatum (Poaceae) seashore paspalum	light green medium	high fair	medium soft	good rapid	med 5.5-7.5 good	tol 1,2,4,6	High 1	0.5-2.0 frequent med	1.0 1-2	8-10 5-10	0.5-1.0 1,2,3,4,5
Stenotaphrum secundatum (Poaceae) St. Augustinegrass	blue green coarse	low excellent	minimal medium	fair medium	med 6.5-7.5 good	mod 8	High 3	1.5-2.5 frequent low	0.0 2-4	5-10 5-10	0.5-1 1,3,4,5
Cynodon dactylon x C. transvaalensis 'Tifdwarf' (Poaceae) Tifdwarf Bermudagrass	dark green fine	high poor	medium soft	very good rapid	med 5.5-7.5 excellent	mod 1,2,3,4,6	High 1,4,5	0.25-1.0 frequent high	0.0 1-2	8-10 5-10	1-2 1,2,3,4,5
Cynodon dactylon x C. transvaalensis 'Tifgreen' (Poaceae) Tifgreen Bermudagrass, Tifton 328	dark green fine	high poor	medium soft	very good rapid	med 5.5-7.5 excellent	mod 1,2,3,4,6	High 1,4,5	0.25-1.0 frequent high	0.0 1-2	5-10 5-10	1-2 1,2,3,4,5
Cynodon dactylon x C. transvaalensis 'Tifway' (Poaceae) Tifway Bermudagrass, tifton 419	dark green fine	high poor	medium soft	very good rapid	med 5.5-7.5 excellent	mod 1,3,4,6	High 1,4,5	0.25-1.0 frequent high	0.0 1-2	5-10 5-10	1.0 1,2,3,4,5
Pennisetum clandestinum 'Whittet' (Poaceae) Whittet Kikuyugrass	yellow green medium	med fair	minimal medium	very good rapid	med 5.5-7.5 excellent	mod 2, 5	High 2	0.5-1.5 frequent high	1-2 10-20	5-10 5-10	0.3-0.5 1,2,3,4,5
Zoysia japonica x Z. matrella 'Z-3' (Poaceae) Z-3 zoysiagrass	medium green medium/fine	high good	minimal soft	very good slow	low 5.8-8.0 excellent	mod 3	Medium-high 2,4	0.5-1.0 frequent high	0.0 2-4	5-10 5-10	0.5 1,2,3,4,5

1 bushel = 8 gallons by volume

10.6 GROUND COVER PLANTING AND MAINTENANCE GUIDE

10.601 Ground covers play an important part in any planting scheme. They serve many purposes such as: weed control, prevent soil erosion, and provide dust control. They also protect soil from temperature extremes, are area fillers, and are plantings in hard-to-maintain areas like sloping, rocky, and shady sites. They complement landscape features.

10.602 The selection of ground cover plants will depend on: site climatic and soil conditions, plant moisture requirements, ultimate size, and maintenance requirements. Generally speaking most ground covers require minimal maintenance. This is not to say that they will require "no" maintenance.

10.603 Soil preparation is usually the same as for turfgrass. The soil should be loosened, organic matter incorporated, and a balanced fertilizer applied evenly. Refer to Sections 10.1 and 10.2 pages 149 - 151in this chapter for details.

10.604 Irrigation is most crucial during establishment. Water is necessary to maintain plant vigor even after the plants have become established. For water conservation, automatic irrigation systems must be governed by a rain shut off valve. The irrigation industry has controllers with soil moisture sensors and evapotranspiration (ET) stations to make for more conservative applications of water. These and other systems designed for conserving water are recommended because water is a limited commodity. Established ground cover uses less water than turfgrass and can be irrigated by means of a drip system. See Chapter Twelve, “Irrigation and Water Conservation; Drought Tolerant Plants” for pipe irrigation system recommendations and plant suggestions. (Some of the above material is repeated for the convenience of the reader.)

10.605 A good fertilizer for the lawn can be used on a ground cover. Fertilizers with a ratio of about 3-1-2, applied after rooting is established, are recommended. Plants should be fertilized during the spring and fall as needed.

10.606 Some ground covers should be cut back or pruned once a year to encourage new growth and to prevent “leggyness”.

10.607 Ground covers are not pest free. Mealy bugs, scales, white flies, and mites are their worst pests. Consult a professional for advice on pest control.

10.608 This list of ground covers is in no way complete. Developers and home owners wanting to use ground covers not listed here should request for approval in writing to the Maui County Arborist Committee.

10.609 Plant characteristics should be used as a guide when selecting a particular ground cover. Some of the following ground cover characteristic definitions are repeated for the convenience of the reader; others may be new. See the

Chapter One topic "Tree and Other Plant Characteristics Defined" on page 8 for more information.

- Propagation: How plants can be multiplied.
  - Division - separation of mother plant into smaller clumps.
  - Stolons - use of soil surface stems.
  - Layers - air or ground layering for stem rooting.
  - Cuttings - use of stem or root pieces.
  - Seeds - self-explanatory.
- Shade Tolerance:
  - Poor: Very low tolerance of shade.
  - Medium: Somewhat tolerant of shade
  - Good: Tolerant of shade.
  - High: Very tolerant of shade. However, will probably grow better with more light.
- Spacing: The center to center distance between plants.
- Water Requirements: Plants need the amount of rainfall indicated. When they are grown in areas providing less than their required rainfall, supplemental irrigation will be necessary. For plant species where this is possible, the designated water requirement is extended to a drier category and is indicated within parentheses, e.g., (dry) med-wet.
  - Dry: Less than 20 inches of rain per year. Plants will need more than 20 inches of rain per year until they become well established. Matured plantings with this characteristic will tolerate this low rainfall.
  - Medium: 20-40 inches of rain per year.
  - Wet: More than 40 inches of rain per year.

10.610 The following tables (Table 10-2 and Table 10-3) separate ground covers into two categories:

- Introduced Ground Covers – Post Captain Cook, and
- Native and Polynesian-Introduced Ground Covers.

10.611 Planting Zones: See Chapter One for the Maui County maps with planting zones on page 12.

GROUND COVERS

INTRODUCED GROUND COVERS - POST CAPTAIN COOK

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Aglaonema commutatum (Araceae) aglaonema	2	1.5	med; upright: round; 1 ft	med; good	med	sens	green, gray/green; cuttings, div.	white; SpSuFa	(dry) med-wet poisonous	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Hibiscus calyphyllus (Malvaceae) aloalo	3	2	med; spreading; 1.5 ft	med; poor	good	mod	green; cuttings	yellow/ red; SpSuFaWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	2,(3),4,5
Hippeastrum puniceum (Liliaceae) amaryllis	2	1	med; upright; 1 ft	fast; med	good	sens	green; division	orange; SpSuFa	dry-med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,3,4
Pilea microphylla* (Urticaceae) artillery plant	1	1	dense; upright; 1 ft	fast; good	med	sens	green; cuttings	white; SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Peperomia obtusifolia (Piperaceae) baby rubber plant	1	1	med; upright; 1 ft	med; good	med	sens	dark green; cuttings	white; Su	(dry) med	none; nondecid.	no rubbish; low maint.	low-med-high	2,(3),4
Evolvulus glomeratus subsp. grandiflorus (Convolvulaceae) blue daze	1	1	dense; upright: round; 0.5 ft	med; med	good	sens	green; cuttings, division	blue; SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Trachelospermum jasminoides (Apocynaceae) Confederate jasmine,	3	30	dense; vine; 2 ft	fast; med	good	mod	green; cuttings	white; SpSu; fragrant	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4,(5)

* HPWRA designation "EVALUATE" ***Endangered species

Water requirements: Categories in parentheses are too dry for plant natural survival. Additional water is required to satisfy plant needs.
Zones: Numbers in parentheses need site modification for good plant growth.

GROUND COVERS

INTRODUCED GROUND COVERS - POST CAPTAIN COOK

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Plectranthus australis (Lamiaceae) creeping Charlie, Swedish ivy	0.5	2	dense; spreading; 1 ft	med; good	poor	sens	light green; cuttings	blue/white; Fa	wet	none; nondecid.	no rubbish; low maint.	med	1,4
Hemerocallis aurantiaca (Liliaceae) daylily	1.5	1.5	dense; upright; 1 ft	med; poor	good	mod	green; seed, division	yellow, brown, orange; SpSuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Cuphea hyssopifolia (Lythraceae) false heather, Mexican heather	1	1	dense; upright: round; 0.75 ft	fast; med	good	sens	green; cuttings, division	purple, white; SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Russelia equisetifolia (Scrophulariaceae) firecracker plant, coral plant	4	3	dense; upright: round; 2 ft	fast; poor	good	mod	green; cuttings	red; SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; med maint.	low-med	1,2,(3),4
Arachis pintoi (Fabaceae) golden glory, perennial peanut, pinto peanut	0.5	1.0	dense; spreading; 0.75 ft	fast; poor	good	sens	green; cuttings, division	yellow; SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Pelargonium peltatum (Geraniaceae) ivy-leaf geranium	1	1.5	med; spreading; 1 ft	med; poor	good	mod	green; cuttings	pink, red, lavender; SpSuFaWn	med	none; nondecid.	no rubbish; low maint.	low-med	1,2,4
Hemerocallis thunbergii (Liliaceae) late yellow daylily	1.5	1.5	dense; upright; 1 ft	med; poor	good	mod	green; seed, division	yellow; SuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5

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GROUND COVERS

INTRODUCED GROUND COVERS - POST CAPTAIN COOK

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Phymatosorus scolopendria* (Polypodiaceae) lauae fern	2	2	dense; spreading; 1 ft	slow; good	med	sens	dark green; division	n/a	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Hemerocallis lilioasphodelus (Liliaceae) lemon lily	1.5	1.5	dense; upright; 1 ft	med; poor	good	mod	green; seed, division	yellow; SpSuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Liriope muscari (Liliaceae) liriope, lilyturf	1	0.75	dense; upright; 0.5 ft	slow; med	good	mod	green; division	white, lavender, blue; SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Hemerocallis citrina (Liliaceae) long yellow daylily	2.0	1.5	dense; upright; 1 ft	med; poor	good	mod	green; seed, division	yellow; SpSuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Catharanthus roseus (Apocynaceae) Madagascar periwinkle	2	1.5	med; upright; 1 ft	fast; med	good	mod	dark green; seed	rose, white; SpSuFaWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4,5
Hemigraphis alternata (Acanthaceae) metallic plant	0.5	1.5	dense; spreading; 1 ft	fast; med	good	mod	maroon; cuttings	white; SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3), 4,5
Ophiopogon japonicus (Liliaceae) mondo grass	0.5	0.5	dense; upright; 0.5 ft	slow; good	good	mod	dark green; division	n/a	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,5

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Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Lotus berthelotii (Fabaceae) parrot's-beak, coral gem	2	3	dense; spreading; 2 ft	med; poor	med	sens	gray green; cuttings	bronze/red	dry	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Lonicera x heckrottii (Caprifoliaceae) pink honeysuckle	3	12	med; spreading; 3 ft	fast; poor	good	mod	green; cuttings	pink; SpSu; fragrant	(dry) med	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4
Gardenia jasminoides 'Radicans' (Rubiaceae) prostrate gardenia	1	1.5	med; upright; 1 ft	med; poor	good	sens	dark green; cuttings	white; SpSu; fragrant	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,(5)
Carissa macrocarpa 'Prostrata' (Apocynaceae) prostrate natal plum	2	1.5	dense; upright: round; 1 ft	med; poor	good	tol	green; cuttings, seeds	white; SpSuFaWn; fragrant	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,5
Ruellia caroliniensis (Acanthaceae) ruellia	1.5	2	dense; upright: spreading; 1 ft	fast; med	good	mod	light green; cuttings	blue/white; SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Justicia brandegeana (Acanthaceae) shrimp plant	3	1.5	dense; upright: round; 1 ft	fast; med	good	sens	green; cuttings	orange/ white SpSuFaWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Spathiphyllum wallisii (Araceae) spathiphyllum, white flag	2	2	dense; upright: round; 1.5 ft	med; good	med	sens	shiny green; division	white; SpSuFaWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4

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GROUND COVERS

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Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Chlorophytum comosum (Liliaceae) spider plant	1	1	med; spreading; 0.75 ft	slow; good	med	sens	green/white; division, layer	white; Su	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4
Potentilla verna (Rosaceae) spring cinquefoil	0.5	1.5	med; spreading; 1 ft	fast; med	med	sens	green; division, cuttings	yellow; SpSu	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4
Jasminum multiflorum (Oleaceae) star jasmine	4	4	dense; round; 2 ft	fast; med	good	sens	green; cuttings	white; SpSu; fragrant	(dry) med	none; nondecid.	no rubbish; low maint.	low-med-high	1,2,(3),4
Saxifraga sarmentosa (Saxifragaceae) strawberry geranium	1	1.5	med; spreading; 1 ft	fast; poor	good	sens	green; runners	white; Wn	med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,4
Osteospermum fruticosum (Asteraceae) trailing African daisy	1.5	1.5	dense; spreading; 1 ft	fast; poor	good	tol	light green; cuttings	white, lavender; SuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,5
Gazania rigens var. leucoleana* (Asteraceae) trailing gazania	0.5	1.5	dense; spreading; 1 ft	fast; poor	good	tol	silvery gray; cuttings	yellow; SpSuFaWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,5
Ficus tikoua (Moraceae) Waipahu fig	0.5	1	med; spreading; 0.5 ft	fast; med	good	sens	dark green; cuttings	inconspic.	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	(3),4

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GROUND COVERS

NATIVE AND POLYNESIAN-INTRODUCED GROUND COVERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Artemisia australis (Asteraceae) ahinahina **NATIVE (ENDEMIC)**	2	3	med; spreading; 2 ft	med; med	good	tol	silvery green; seed, cutting	n/a	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3), 4,5
Artemisia mauiensis (Asteraceae) ahinahina **NATIVE (ENDEMIC)**	2	3	dense; round; 2 ft	med; poor	good	mod	silver; seed, cutting	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	med-high	2,4
Wikstroemia uva-ursi (Thymelaeaceae) akia **NATIVE (ENDEMIC)**	4	3	dense; spreading; 2 ft	med; poor	good	tol	gray green; seed, cuttings	yellow; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Sporobolus virginicus (Poaceae) akiaki **NATIVE**	1	2	dense; creeping grass; 1 ft	med; poor	good	tol	gray/green; cuttings	no	(dry) med	none; nondecid.	no rubbish; low maint.	low	(3),5
Chamaesyce celastroides (Euphorbiaceae) akoko **NATIVE (ENDEMIC)**	2	3	med; spreading; 2 ft	med; poor	good	tol	blue green; seed	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	low	3,4,5
Chamaesyce skottsbergii var. skottsbergii*** (Euphorbiaceae) akoko **[illegible]**	0.5	2	med; spreading; 1 ft	med; poor	good	tol	green; seed	inconspic.	dry-med	none; nondecid.	no rubbish; low maint.	low	3,5
Sesuvium portulacastrum (Aizoaceae) akulikuli, sea purslane **NATIVE**	0.5	2	dense; prostrate; 1 ft	slow; poor	good	tol	green; cuttings	pink; SpWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),5

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GROUND COVERS

NATIVE AND POLYNESIAN-INTRODUCED GROUND COVERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Peperomia leptostachya (Piperaceae) alaala wai nui, Hawaiian peperomia	1	1	dense; round; 0.75 ft	fast; med	good	mod	gray green; cuttings	n/a	dry-med	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Boerhavia repens (Nyctaginaceae) alena **NATIVE**	0.5	4	open; spreading; 2 ft	fast; poor	good	tol	green; seed, cuttings	pink/white; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low	3,5
Colubrina asiatica (Rhamnaceae) anapanapa **NATIVE**	20 climber	20	open; spreading; 10 ft	fast; med	good	tol	shiny green; seed, cuttings	n/a	(dry) med-wet poisonous	none; nondecid.	no rubbish; low maint.	low	1,(3), 4,5
Alocasia macrorrhiza (Araceae) ape **POLYN. INTRO**	8	6	med; upright: round; 6 ft	med; good	med	sens	bright green; division	white/ green; Sp	med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,4
Hedyotis centranthoides (Rubiaceae) au, pilo **NATIVE (ENDEMIC)**	3	2	med; low shrub; 2 ft	slow; med	med	sens	green; seed	green; SpSuWn	med	none; nondecid.	no rubbish; med maint.	med	2,4
Hedyotis littoralis (Rubiaceae) au, pilo **NATIVE (ENDEMIC)**	2	1	med; clustered; 1 ft	slow; med	good	tol	green; seed	white; SpSuWn; fragrant	(dry) med-wet	none; nondecid.	no rubbish; med maint.	low	1,(3),5
Zingiber zerumbet (Zingiberaceae) awapuhi, shampoo ginger **POLYN. INTRO**	3	2	med; upright; 2 ft	fast; good	poor	sens	green; division	white; SuFa; fragrant	(dry) med-wet	none; wn-sp	mod (lvs); med maint.	low	1,(3),4

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GROUND COVERS

NATIVE AND POLYNESIAN-INTRODUCED GROUND COVERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Canavalia molokaiensis*** (Fabaceae) awikiwiki **NATIVE (ENDEMIC)**	20 climber	20	med; vine; 10 ft	fast; poor	good	sens	green; seed	purple; SpSuWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	2,(3),4
Canavalia pubescens (Fabaceae) awikiwiki **NATIVE (ENDEMIC)**	20 climber	20	med; vine; 10 ft	fast; poor	good	sens	gray green; seed	purple; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Bacopa monnieri (Scrophulariaceae) bacopa, aeae **NATIVE**	0.5	2	dense; spreading; 1.5 ft	fast; med	good	sens	bright green; cuttings	white; SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),5
Bonamia menziesii*** (Convolvulaceae) bonamia menziesii **NATIVE (ENDEMIC)**	20 climber	20	dense; vine; 10 ft	med; poor	good	mod	silvery; seed, cuttings	white; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4,5
Scaevola coriacea*** (Goodeniaceae) creeping naupaka **NATIVE (ENDEMIC)**	1	6	med; spreading; 3 ft	med; poor	good	tol	silvery green; seed	white; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Cressa truxillensis (Convolvulaceae) cressa **NATIVE**	0.5	1	med; round; 0.5 ft	med; poor	good	tol	blue green; seed	white	dry-med	none; nondecid.	no rubbish; low maint.	low	3,5
Asplenium nidus (Aspleniaceae) ekaha, bird's nest fern **NATIVE**	2	5	dense; upright; 3 ft	med; good	med	sens	green; spores	n/a	med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),(4)

* HPWRA designation "EVALUATE" ***Endangered species

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Zones: Numbers in parentheses need site modification for good plant growth.

GROUND COVERS

NATIVE AND POLYNESIAN-INTRODUCED GROUND COVERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Ipomoea tuboides (Convolvulaceae) Hawaiian moon flower **NATIVE (ENDEMIC)**	1	10	dense; vine; 5 ft	fast; poor	good	sens	green; seed, cuttings	white; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Abutilon eremitopetalum*** (Malvaceae) hidden petal abutilon **NATIVE (ENDEMIC)**	5	8	med; round; 3 ft	fast; poor	good	sens	green; seed, cuttings	green; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Heliotropium anomalum var. argenteum (Boraginaceae) hinahina ku kahakai	1	2	dense; spreading; 1 ft	med; poor	good	tol	silver; cutting	white; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low	(3),5
Dioscorea bulbifera (Dioscoreaceae) hoi, yam **POLYN. INTRO**	0.5	30	open; vine; 20 ft	fast; good	poor	sens	green; roots, tubers	n/a	(dry) med-wet poisonous	none; wn	mod (lvs); med maint.	low	1,(3),4
Portulaca lutea (Portulacaceae) ihi **NATIVE**	0.5	3	dense; spreading; 1.5 ft	fast; poor	good	tol	green; cuttings	yellow; SpSuFaWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),5
Portulaca molokiniensis (Portulacaceae) ihi **NATIVE (ENDEMIC)**	1	2	med; round; 1 ft	fast; poor	good	tol	green; cuttings	yellow; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low	3,5
Santalum ellipticum (Santalaceae) iliahi **NATIVE (ENDEMIC)**	8	8	med; round; 4 ft	slow; poor	good	sens	gray green; seed	green; SpWn; fragrant	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4

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Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Plumbago zeylanica (Plumbaginaceae) iliee **NATIVE**	1	4	open; spreading; 2 ft	fast; med	good	tol	green; seed, cuttings	white; SpSuWn	dry-med	none; su-fa	no rubbish; low maint.	low-med	2,3,4
Sida fallax (Malvaceae) ilima papa **NATIVE**	0.5	3	med; spreading; 1.5 ft	med; poor	good	tol	gray green; seed	orange; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low	3,4,5
Lagenaria siceraria (Cucurbitaceae) ipu, gourd **POLYN. INTRO**	1	50	med; vine; 30 ft	fast; poor	med	mod	green; seed	white; SpWn	(dry) med	none; fa	mod (lvs); med maint.	low	1,(3), 4,5
Eragrostis monticola (Poaceae) kalamalo **NATIVE (ENDEMIC)**	1	2	dense; spreading; 1 ft	fast; poor	good	mod	light green; division	straw; Wn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Colocasia esculenta (Araceae) kalo, taro **POLYN. INTRO**	3	2	med; upright: round; 2 ft	fast; med	med	sens	gray green; division	n/a	wet	none; nondecid.	no rubbish; med maint.	low	1,4
Cordyline fruticosa (Agavaceae) ki, ti **POLYN. INTRO**	6	2	dense; upright; 2 ft	fast; good	med	sens	green; cuttings	white; SpSu; fragrant	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3),4
Bidens hillebrandiana ssp. hillebrandiana (Asteraceae) kookoolau **NATIVE (ENDEMIC)**	1	2	med; spreading; 1 ft	fast; med	good	tol	bright green; seed, cutting	yellow; SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),5

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Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Bidens mauiensis (Asteraceae) kookoolau **NATIVE (ENDEMIC)**	1	3	dense; spreading; 1 ft	fast; poor	good	tol	green; seed, cutting	yellow; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low	3,5
Senna gaudichaudii (Fabaceae) kolomona **NATIVE**	5	5	med; round; 3 ft	slow; poor	good	sens	green; seed	green; SpWn; fragrant	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4,5
Abutilon menziesii*** (Malvaceae) kooloa ula **NATIVE (ENDEMIC)**	5	8	dense; round; 3 ft	fast; poor	good	sens	silvery green; seed, cuttings	maroon; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Coprosma ernodeoides (Rubiaceae) kukaenene **NATIVE (ENDEMIC)**	1	6	med; spreading; 3 ft	med; med	good	sens	green; seed, cuttings	n/a	dry-med	none; nondecid.	no rubbish; med maint.	med-high	2
Nototrichium sandwicense (Amaranthaceae) kului **NATIVE (ENDEMIC)**	8	8	med; round; 4 ft	med; poor	good	sens	silvery green; seed	silver; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4
Nephrolepis exaltata (Nephrolepidaceae) kupukupu, native sword fern **NATIVE**	3	1	dense; upright; 1 ft	fast; med	med	sens	light green; division	n/a	(dry) med-wet	none; nondecid.	no rubbish; low maint.	med	2,(3),4
Schiedea globosa (Caryophyllaceae) maolioli **NATIVE (ENDEMIC)**	1	1	med; round; 0.5 ft	med; med	good	tol	green; seed, cuttings	green; SpSuWn	med-wet	none; nondecid.	no rubbish; med maint.	low	1,5

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GROUND COVERS

NATIVE AND POLYNESIAN-INTRODUCED GROUND COVERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Capparis sandwichiana (Capparaceae) maiapilo, native caper **NATIVE (ENDEMIC)**	4	10	med; spreading; 5 ft	med; poor	good	sens	blue green; seed	white; SpWn; fragrant	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,4,5
Cyperus laevigatus (Cyperaceae) makaloa **NATIVE**	2	1	dense; upright; 0.5 ft	med; poor	good	tol	dark green; seed, division	inconspic.	wet	none; nondecid.	no rubbish; low maint.	low	(3),5
Peucedanum sandwicense*** (Apiaceae) makou	3-4	4	med; round; 4 ft	med; med	good	tol	shiny green; seed	green; Su	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),5
Pipturus albidus (Urticaceae) mamaki, Hawaiian tea **NATIVE (ENDEMIC)**	8	8	med; round; 8 ft	fast; poor	med	sens	green; seed	n/a	med-wet	none; nondecid.	no rubbish; low maint.	low-high	1,2,4
Gossypium tomentosum (Malvaceae) mao, Hawaiian cotton **NATIVE (ENDEMIC)**	5	8	dense; spreading; 3 ft	med; poor	good	sens	gray green; seed	yellow; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	3,5
Fimbristylis cymosa ssp. spathacea (Cyperaceae) mauu aki aki, fimbristylis **NATIVE**	0.5	1	dense; round; 0.5 ft	slow; poor	good	tol	gray green; seed. division	brown; SpSuFaWn	dry-med	none; nondecid.	no rubbish; low maint.	low	3,5
Psilotum nudum (Psilotaceae) moa **NATIVE**	1	1	dense; round; 0.5 ft	slow; good	good	sens	green; spores, division	n/a	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	2,(3),4

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GROUND COVERS

NATIVE AND POLYNESIAN-INTRODUCED GROUND COVERS

Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Dubautia scabra (Asteraceae) naenae **NATIVE (ENDEMIC)**	1	2	dense; spreading; 1 ft	med; med	good	sens	green; seed, cutting	white; SpSuWn	dry-med	none; nondecid.	no rubbish; med maint.	med-high	2,4
Myoporum sandwicense (Myoporaceae) naio **NATIVE**	10	10	med; round; 10 ft	med; poor	good	tol	gray green; seed, airlayer	white; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low-high	2,3,4,5
Vigna marina (Fabaceae) nanea **NATIVE**	0.5	6	med; spreading; 5 ft	fast; poor	good	tol	light green; seed	yellow; SpSuWn	med-wet	none; nondecid.	no rubbish; low maint.	low	1,5
Scaevola chamissoniana (Goodeniaceae) naupaka kuahiwi **NATIVE (ENDEMIC)**	8	8	med; round; 3 ft	med; med	med	sens	green; seed	white; SpSuWn	med-wet	none; nondecid.	no rubbish; med maint.	med	1,2,4
Scaevola sericea (Goodeniaceae) naupaka kahakai, beach naupaka	6	8	dense; spreading; 3 ft	fast; poor	good	tol	green; cuttings, seed	white; SpSuWn	(dry) med	none; nondecid.	no rubbish; low maint.	low	(3),4,5
Lipochaeta connata var. connata (Asteraceae) nehe **NATIVE (ENDEMIC)**	2	4	med; spreading; 2 ft	fast; poor	good	mod	grayish green; seed, cutting	yellow; SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	2,(3),4
Lipochaeta rockii (Asteraceae) nehe **NATIVE (ENDEMIC)**	2	2	dense; round; 1 ft	fast; poor	good	mod	green; seed, cutting	yellow; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4

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Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Lipochaeta succulenta (Asteraceae) nehe **NATIVE (ENDEMIC)**	2	5	dense; spreading; 2.5 ft	fast; med	good	tol	green; seed, cutting	yellow; SpSuWn	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low	1,(3),4
Melanthera integrifolia (Asteraceae) nehe **NATIVE (ENDEMIC)**	1	5	dense; spreading; 2.5 ft	fast; poor	good	tol	pale green; seed, cutting	yellow; SpSuWn	(dry) med	none; nondecid.	no rubbish; low maint.	low	(3),4,5
Melanthera lavarum (Asteraceae) nehe **NATIVE (ENDEMIC)**	3	3	med; round; 1.5 ft	fast; poor	good	mod	silvery green; seed, cutting	yellow; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4,5
Sesbania tomentosa*** (Fabaceae) ohai **NATIVE (ENDEMIC)**	1	4	med; spreading; 3 ft	fast; poor	good	tol	silvery green; seed	red; SpSuWn	dry-med	none; nondecid.	no rubbish; med maint.	low-med	3,4,5
Vaccinium reticulatum (Ericaceae) ohelo **NATIVE (ENDEMIC)**	3	3	med; round; 2 ft	slow; poor	med	sens	green; seed	red; SpSuWn	dry-med	none; nondecid.	no rubbish; med maint.	high	2
Lycium sandwicense (Solanaceae) ohelo kai **NATIVE**	2	2	open; round; 1.5 ft	slow; poor	good	tol	light green; seed, cuttings	violet; SpWn	(dry) med	none; nondecid.	no rubbish; low maint.	low	(3),5
Fragaria chiloensis (Rosaceae) ohelo papa **NATIVE**	0.5	1.5	med; spreading; 1 ft	fast; med	poor	tol	dark green; division	white; SpWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	1,2,(3), 4,5

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Species	Mature height (ft)	Mature spread (ft)	Crown density Growth habit Spacing (ft)	Growth Rate Shade Tol.	Wind tol.	Salt tol.	Foliage color Propagation	Flwer color Time of flwr Fragrant flwrs?	Water requirements Poisonous	Fruit or nuts Deciduous	Rubbish Maintenance	Elev.	Planting zone(s)
Curcuma longa (Zingiberaceae) olena, tumeric **POLYN. INTRO**	3	2	dense; upright; 2 ft	fast; med	med	sens	green; division	white; Su	(dry) med-wet	none; wn	no rubbish; med maint.	low-med	1,(3),4
Microlepia strigosa (Dennstaedtiaceae) palapalai **NATIVE**	2	2	dense; upright clumps; 1 ft	fast; good	med	sens	green; division	n/a	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-high	1,2,(3),4
Phyllanthus distichus (Euphorbiaceae) pamakani mahu **NATIVE (ENDEMIC)**	1.5	2	med; spreading; 1 ft	med; med	good	mod	dark green; seed	inconspic.	med	none; nondecid.	no rubbish; low maint.	low-med	4
Jacquemontia ovalifolia ssp. sandwicensis (Convolvulaceae) pauohiiaka	0.5	6	med; spreading; 3 ft	fast; poor	good	tol	green; seed, cuttings	pale blue; SpSuWn	dry-med	none; nondecid.	no rubbish; low maint.	low	3,4,5
Tacca leontopetaloides (Taccaceae) pia, arrowroot **POLYN. INTRO**	5	2	open; upright; 2 ft	fast; med	med	mod	green; division	n/a	(dry) med	none; wn	mod (lvs); med maint.	low	1,(3), 4,5
Dioscorea pentaphylla (Dioscoreaceae) pia, yam **POLYN. INTRO**	0.5	30	open; vine; 20 ft	fast; good	poor	sens	green; roots, tubers	n/a	(dry) med-wet poisonous	none; nondecid.	mod (lvs); med maint.	low	1,(3),4
Vitex rotundifolia (Verbenaceae) pohinahina, beach vitex **NATIVE**	3	4	med; spreading; 2 ft	fast; poor	good	tol	gray/green; seed, cuttings	purple; SpSuWn	(dry) med	none; nondecid.	no rubbish; low maint.	low	(3),5

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Ipomoea pes-caprae (Convolvulaceae) pohuehue, beach morning glory	1	20	med; vine; 3 ft	fast; poor	good	tol	green; seed, cuttings	pink; SpSuFaWn	(dry) med	none; nondecid.	no rubbish; med maint.	low	5
Solanum nelsonii (Solanaceae) popolo, beach solanum **NATIVE (ENDEMIC)**	3	3	med; spreading; 2 ft	med; poor	good	tol	tawny green; seed, cuttings	white/purple; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low	3,4,5
Argemone glauca var. glauca (Papaveraceae) pua kala, Hawaiian poppy	3	2	med; upright; 2 ft	fast; poor	good	tol	blue green; seed	white; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	low-med	2,3,4,5
Hibiscus kokio subsp. saintjohnianus (Malvaceae) pualoalo, kokio ulaula	10-12	5	open; upright; 3 ft	fast; med	med	sens	green; cuttings	orange; SpSuFa	(dry) med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,(3),4, (5)
Styphelia tameiameiae (Epacridaceae) pukiawe **NATIVE**	6	6	med; round; 4 ft	slow; poor	good	sens	dark green; seed	white; SpWn	dry-med	none; nondecid.	no rubbish; low maint.	med-high	2,3,4
Ipomoea batatas (Convolvulaceae) uala, sweet potato **POLYN. INTRO**	1	15	dense; vine; 3 ft	fast; poor	good	sens	green; cuttings	pink; SpSuWn	med-wet	none; nondecid.	no rubbish; low maint.	low-med	1,2,3,4
Dioscorea alata (Dioscoreaceae) uhi,yam **POLYN. INTRO**	0.5	30	open; vine; 30 ft	fast; good	poor	sens	green; roots	green	(dry) med-wet poisonous	none; wn	mod (lvs); med maint.	low	1,(3),4

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Dianella sandwicensis (Liliaceae) ukiuki **NATIVE**	2	2	dense; round; 1 ft	med; poor	good	sens	green; seed, cuttings	pale blue to white; SpSu	(dry) med	none; nondecid.	no rubbish; low maint.	med-high	2,(3),4
Osteomeles anthyllidifolia (Rosaceae) ulei **NATIVE**	4	6	dense; spreading; 3 ft	med; poor	good	mod	dark green; seed, cutting	white; SpSuWn; fragrant	dry-med	none; nondecid.	no rubbish; low maint.	low-high	2,3,4
Scaevola gaudichaudii (Goodeniaceae) yellow naupaka **NATIVE (ENDEMIC)**	2	3	med; round; 2 ft	med; poor	good	mod	green; seed, cuttings	yellow/ orange; SpSuWn	(dry) med	none; nondecid.	no rubbish; low maint.	low-med	2,(3),4

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CHAPTER 11. NATIVE HAWAIIAN AND POLYNESIAN-INTRODUCED PLANTS

11.1 PURPOSE

11.101 To encourage the use of Native Hawaiian and Polynesian-introduced plants in landscaping for the purposes of their perpetuation and increasing the public's awareness and appreciation of local flora.

11.2 ENDANGERED SPECIES

11.201 By federal law no one should possess or propagate endangered species without a permit. A few species are included in the Maui County Planting Plan (MCPP) and are so labeled in case their propagation and use are permitted in the future. The plant's scientific name, as found Table 11-1: NATIVE & POLYNESIAN INTRODUCED PLANTS, is followed by a triple asterisk (***) and a footnote at the bottom of the page with an explanation. Some plants in this document may be placed on the endangered list at a later date. At that time, their propagation and use in landscapes may be restricted by law.

11.3 DEFINITIONS

11.301 Indigenous refers to being native of the Hawaiian Islands, but also occurring naturally elsewhere (without the aid of humans).

11.302 Endemic to the Hawaiian Islands means occurring naturally (without the aid of humans) nowhere else in the world. These plants are labeled NATIVE (ENDEMIC).

11.303 Native plants were in Hawaii before the Polynesians arrived and include plants both indigenous and endemic to our islands. The plants that are indigenous but not endemic are labeled NATIVE.

11.304 Polynesian introductions include those plants brought by Polynesian immigrants prior to the year 1778. These plants are identified by POLYN. INTRO.

11.305 Exotic plants were introduced into Hawaii after European contact in 1778.

11.4 STATE LAW

11.401 The 1992 Hawaii State Legislature passed legislation that was signed by the Governor (Act 73) encouraging the use of Hawaii's native plant species in new or renovated landscaping of State funded buildings.

11.402 The 1993 Legislature amended Act 73 to include Polynesian introduced plants along with those that are native to Hawaii. It was H.B. No. 882, H.D. 2, S. D. 1. HB 882 (Act 156).

11.5 GENERAL

11.501 In keeping with the State laws, Maui County encourages all landscapers and developers to include Native Hawaiian plants, as well as those introduced by the Polynesians, wherever and whenever feasible.

11.502 It is important that native plants not be gathered from the wild because they have enough difficulty in maintaining their populations against the invading exotic plants. Nurseries are propagating and stocking Native Hawaiian plants and can help with providing instructions for their planting and care.

11.503 Using native plants should not jeopardize these and other species growing in the wild to lose their natural habitats.

11.504 Whenever feasible, Native Hawaiian plants in the landscape should be properly labeled for identification and for the public's awareness and education.

11.505 Wherever and whenever feasible, the native plants used should belong to the island on which the species originated to maintain purity of the gene pool. Closely related plants, such as species of loulu or of nehe, should not be used within the same landscape design as cross pollination will occur and produce gene contaminated seed.

11.506 The extreme isolation of the Hawaiian Islands accounts for a high percentage of endemic species. Ninety percent of approximately 1,200 native ferns, flowering plants, and trees are found nowhere else in the world.

11.507 Approximately half of the 950 remaining species of native plants found only in Hawaii are threatened with imminent extinction. Extinction has happened because towns, agriculture, pastures, and resorts have virtually eliminated native plants from lowland areas. Thousands of foreign species imported for landscapes and crops have escaped into State forests and out-competed native plants in the wild.

11.508 A benefit of using native plants in landscaping is that they usually require less care once they are established.

11.509 The following table (Table 11-1) is a list of Native Hawaiian and Polynesian Introduced Plants. Use the chapters indicated, or the Index at the end of

this document, to discover the plant's characteristics and requirements. Use this information to locate plants in their preferred habitats.

11.510 The Hawaiian language diacritical marks appear only in Table 11-1: NATIVE & POLYNESIAN INTRODUCED PLANTS. Use this information to assist with proper pronunciation and written expression of plant common names.

11.511 Recent archeological evidence indicates that kou, *Cordia subcordata*, and hala, *Pandanus tectorius*, are a pre-Polynesian occurrence in Hawaii. Therefore, they are not Polynesian introduced but native throughout the Pacific.

TABLE 11-1: NATIVE & POLYNESIAN INTRODUCED PLANTS

STREET TREES – SMALL NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Diospyros sandwicensis	lama	dry-med	NATIVE (ENDEMIC)
Metrosideros polymorpha	ʻōhiʻa lehua	(dry) med-wet	NATIVE (ENDEMIC)
Cheirodendron trigynum	ʻōlapa	med-wet	NATIVE (ENDEMIC)
Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

STREET TREES – MEDIUM NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Cordia subcordata	kou	(dry) med-wet	NATIVE
Thespesia populnea**	milo	(dry) med-wet	NATIVE
Reynoldsia sandwicensis	ʻohe makai	dry	NATIVE (ENDEMIC)
**HPWRA designation OVERRIDE (only kukui, noni, and milo. See Chap. 13.) Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

PALMS FOR STREETS AND 10-15 FT WIDE MEDIANS NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Pritchardia hillebrandii	loulu, loulu-lelo (Molokai)	(dry) med-wet	NATIVE (ENDEMIC)
Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

PARK, GREENWAY, AND OPEN SPACE TREES – SMALL NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Dodonaea viscosa	ʻaʻaliʻi	dry-med	NATIVE
Psydrax odorata	alaheʻe	dry-med	NATIVE
Piper methysticum	ʻawa	wet	POLYN. INTRO.
Pleomele auwahiensis	hala pepe	dry-med	NATIVE (ENDEMIC)
Rauvolfia sandwicensis	hao	dry-med	NATIVE (ENDEMIC)
Hibiscadelphus giffardianus***	hau kuahiwi (Big Island)	med	NATIVE (ENDEMIC)
Pittosporum hosmeri	hōʻawa	med	NATIVE (ENDEMIC)
Nesoluma polynesicum	keahi	dry	NATIVE
Kokia drynarioides***	kokiʻo, kokia	dry-med	NATIVE (ENDEMIC)
Acacia koaia	koai'a, koaiʻe	dry-med	NATIVE (ENDEMIC)
Hibiscus waimeae***	kokiʻo keʻokeʻo (Kauai)	(dry) med	NATIVE (ENDEMIC)
Kokia drynarioides***	kokiʻo, kokia	dry-med	NATIVE (ENDEMIC)
Acacia koaia	koai'a, koaiʻe	dry-med	NATIVE (ENDEMIC)
Hibiscus waimeae***	kokiʻo keʻokeʻo (Kauai)	(dry) med	NATIVE (ENDEMIC)
Hibiscus immaculatus	kokiʻo keʻokeʻo (Maui & Molokai)	(dry) med-wet	NATIVE (ENDEMIC)
Hibiscus kokio	kokiʻo ʻulaʻula	(dry) med-wet	NATIVE (ENDEMIC)
Myrsine lessertiana	kōlea	med-wet	NATIVE (ENDEMIC)
Diospyros sandwicensis	lama	dry-med	NATIVE (ENDEMIC)
Musa acuminata	maiʻa, banana	(dry) med-wet	POLYN. INTRO.
Sophora chrysophylla	māmane	med	NATIVE (ENDEMIC)
Hibiscus brackenridgei***	maʻo hau hele (Hawaii State flower)	dry-med	NATIVE (ENDEMIC)
Gardenia brighamii***	nānū, naʻū	dry-med	NATIVE (ENDEMIC)
Morinda citrifolia**	noni, Indian mulberry	dry-med-wet	POLYN. INTRO.
Metrosideros polymorpha	ʻōhiʻa lehua	(dry) med-wet	NATIVE (ENDEMIC)
Cheirodendron trigynum	ʻōlapa	med-wet	NATIVE (ENDEMIC)
Nestegis sandwicensis	olopua	dry-med	(NATIVE ENDEMIC)
Pisonia brunoniana	pāpala kēpau	med	NATIVE
Pisonia sandwicensis	pāpala kēpau, āulu	med	NATIVE (ENDEMIC)

**HPWRA designation OVERRIDE (only kukui, noni, and milo. See Chap. 13.)
***Endangered species.
Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.

PARK, GREENWAY, AND OPEN SPACE TREES – MEDIUM NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Pandanus tectorius	hala, pandanus	(dry)med-wet	NATIVE
Cordia subcordata	kou	(dry) med-wet	NATIVE
Aleurites moluccana**	kukui	(dry) med-wet	POLYN. INTRO.
Sapindus saponaria	mānele, soapberry	med	NATIVE
Thespesia populnea**	milo	(dry) med-wet	NATIVE
Syzygium malaccense	mountain apple, *ʻōhiʻaʻai*	med-wet	POLYN. INTRO.
Reynoldsia sandwicensis	ʻohe makai	dry	NATIVE (ENDEMIC)
Pisonia umbellifera	pāpala kēpau, āulu	wet	NATIVE
Erythrina sandwicensis	wiliwili	dry-med	NATIVE (ENDEMIC)
**HPWRA designation OVERRIDE (only kukui, noni, and milo. See Chap. 13.) Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

PARK, GREENWAY, AND OPEN SPACE TREES - LARGE NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Calophyllum inophyllum	kamani	(dry) med-wet	POLYN. INTRO.
Acacia koa	koa	med-wet	NATIVE (ENDEMIC)
Artocarpus altilis	ʻulu, breadfruit	(dry) med-wet	POLYN. INTRO.
Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

PARK, GREENWAY, & OPEN SPACE PALM TREES – SMALL NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Pritchardia glabrata	dwarf-loulu (W. Maui)	(dry) med-wet	NATIVE (ENDEMIC)
Pritchardia hillebrandii	loulu, loulu lelo (Molokai)	(dry) med-wet	NATIVE (ENDEMIC)
Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

PARK, GREENWAY, & OPEN SPACE PALM TREES – MEDIUM NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Pritchardia arecina	golden loulu (E. Maui)	(dry) med-wet	NATIVE (ENDEMIC)
Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

PARK, GREENWAY, AND OPEN SPACE PALM TREES – LARGE NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Cocos nucifera	niu, coconut	dry- med-wet	POLYN. INTRO.

PARKING LOT TREES – 20’ SPREAD NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Reynoldsia sandwicensis	‘ohe makai	dry	NATIVE (ENDEMIC)
Cheirodendron trigynum	‘ōlapa	med-wet	NATIVE (ENDEMIC)

PARKING LOT TREES – 25’ SPREAD NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Cordia subcordata	kou	(dry) med-wet	NATIVE
Thespesia populnea**	milo	(dry) med-wet	NATIVE
**HPWRA designation OVERRIDE (only kukui, noni, and milo. See Chap. 13.) Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

PARKING LOT TREES – 30’ SPREAD NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Calophyllum inophyllum	kamani	(dry) med-wet	POLYN. INTRO.
Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

SOUND/WIND/VISUAL BARRIERS NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Dodonaea viscosa	ʻaʻaliʻi	dry-med	NATIVE
Wikstroemia uva-ursi	ʻākia	dry-med	NATIVE (ENDEMIC)
Psydrax odorata	alaheʻe	dry-med	NATIVE
Talipariti tiliaceum	hau	(dry) med-wet	NATIVE
Abutilon eremitopetalum***	hidden petal abutilon	dry-med	NATIVE (ENDEMIC)
Cordyline fruticosa	kī, ti	(dry) med-wet	POLYN. INTRO.
Saccharum officinarum	kō, sugar cane	(dry) med	POLYN. INTRO.
Hibiscus waimeae***	kokiʻo keʻokeʻo (Kauai)	(dry) med	NATIVE (ENDEMIC)
Hibiscus immaculatus	kokiʻo keʻokeʻo (Maui & Molokai)	(dry) med-wet	NATIVE (ENDEMIC)
Hibiscus kokio	kokiʻo ʻula ʻula	(dry) med-wet	NATIVE (ENDEMIC)
Senna gaudicaudii	kolomona	dry-med	NATIVE
Abutilon menziesii***	koʻoloa ʻula	dry-med	NATIVE (ENDEMIC)
Nototrichium sandwicense	kuluʻī	dry-med	NATIVE (ENDEMIC)
Gossypium tomentosum	maʻo, Hawaiian cotton	dry-med	NATIVE (ENDEMIC)
Scaevola chamissoniana	naupaka kuahiwi	med-wet	NATIVE (ENDEMIC)
Scaevola sericea	naupaka kahakai, beach naupaka	(dry) med	NATIVE
Schizostachyum glaucifolium	ʻohe, Hawaiian bamboo	(dry) med-wet	POLYN. INTRO.
Vitex rotundifolia	pōhinahina, beach vitex	(dry) med	NATIVE
Hibiscus kokio subsp. saintjohnianus	puaʻaloalo,kokiʻo ʻulaʻula	(dry) med-wet	NATIVE (ENDEMIC)
Osteomeles anthyllidifolia	ʻūlei	dry-med	NATIVE
Broussonetia papyrifera	wauke	(dry) med	POLYN. INTRO.
***Endangered species. Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

GROUND COVERS NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Artemisia australis	ʻāhinahina	(dry) med-wet	NATIVE (ENDEMIC)
Artemisia mauiensis	ʻāhinahina	dry-med	NATIVE (ENDEMIC)
Wikstroemia uva-ursi	ʻākia	dry-med	NATIVE (ENDEMIC)
Sporobolus virginicus	ʻakiʻaki	(dry) med	NATIVE
Chamaesyce celastroides	ʻakoko	dry-med	NATIVE (ENDEMIC)
Chamaesyce skottsbergii var. skottsbergii***	ʻakoko	dry-med	NATIVE (ENDEMIC)
Sesuvium portulacastrum	ʻākulikuli, sea purslane	(dry) med-wet	NATIVE
Peperomia leptostachya	ʻalaʻala wai nui, Hawaiian peperomia	dry-med	NATIVE
Boerhavia repens	alena	dry-med	NATIVE
Colubrina asiatica	ʻānapanapa	(dry) med-wet	NATIVE
Alocasia macrorrhiza	ʻape	med-wet	POLYN. INTRO.
Hedyotis centranthoides	au, pilo	med	NATIVE (ENDEMIC)
Hedyotis littoralis	au, pilo	(dry) med-wet	NATIVE (ENDEMIC)
Zingiber zerumbet	ʻawapuhi, shampoo ginger	(dry) med-wet	POLYN. INTRO.
Canavalia molokaiensis***	ʻāwikiwiki	(dry) med	NATIVE (ENDEMIC)
Canavalia pubescens	ʻāwikiwiki	dry-med	NATIVE (ENDEMIC)
Bacopa monnieri	bacopa, ʻaeʻae	(dry) med-wet	NATIVE
Bonamia menziesii***	bonamia menziesii	dry-med	NATIVE (ENDEMIC)
Scaevola coriacea***	creeping naupaka	dry-med	NATIVE (ENDEMIC)
Cressa truxillensis	cressa	dry-med	NATIVE
Asplenium nidus	ʻēkaha, bird's nest fern	med-wet	NATIVE
Ipomoea tuboides	Hawaiian moon flower	dry-med	NATIVE (ENDEMIC)
Abutilon eremitopetalum***	hidden petal abutilon	dry-med	NATIVE (ENDEMIC)
Heliotropium anomalum var. argenteum	hinahina kū kahakai	dry-med	NATIVE
Discorea bulbifera	hoi, yam	(dry) med-wet	POLYN. INTRO.
Portulaca lutea	ʻihi	(dry) med-wet	NATIVE
Portulaca molokiniensis	ʻihi	dry-med	NATIVE (ENDEMIC)
Santalum ellipticum	ʻiliahi	dry-med	NATIVE (ENDEMIC)
Plumbago zeylanica	ʻilieʻe	dry-med	NATIVE
Sida fallax	ʻilima papa	dry-med	NATIVE
Lagenaria siceraria	ipu, gourd	(dry) med	POLY. INTRO.
Eragrostis monticola	kalamālō	dry-med	NATIVE (ENDEMIC)

GROUND COVERS NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Calocasia esculenta	kalo, taro	wet	POLY. INTRO.
Cordyline fruticosa	ki, ti	(dry) med-wet	POLY. INTRO.
Senna gaudichaudii	kolomona	dry-med	NATIVE
Bidens hillebrandiana ssp. hillebrandiana	koʻokoʻolau,	(dry) med-wet	NATIVE (ENDEMIC)
Bidens mauiensis	koʻokoʻolau,	dry-med	NATIVE (ENDEMIC)
Abutilon menziesii***	koʻoloaʻula	dry-med	NATIVE (ENDEMIC)
Coprosma ernodeoides	kūkaenēnē	dry-med	NATIVE (ENDEMIC)
Nototrichium sandwicense	kuluʻī	dry-med	NATIVE (ENDEMIC)
Nephrolepis exaltata	kupukupu, native sword fern	(dry) med-wet	NATIVE
Schiedea globosa	māʻoli'oli	med-wet	NATIVE (ENDEMIC)
Capparis sandwichiana	maiapilo, native caper	dry-med	NATIVE (ENDEMIC)
Cyperus laevigatus	Makaloa	wet	NATIVE
Peucedanum sandwicense***	Makou	(dry) med-wet	NATIVE (ENDEMIC)
Pipturus albidus	māmaki, Hawaiian tea	med-wet	NATIVE (ENDEMIC)
Gossypium tomentosum	maʻo, Hawaiian cotton	dry-med	NATIVE (ENDEMIC)
Fimbristylis cymosa ssp. spathacea	mauʻu ʻaki ʻaki, fimbristylis	dry-med	NATIVE
Psilotum nudum	Moa	(dry) med-wet	NATIVE
Dubautia scabra	naʻenaʻe	dry-med	NATIVE (ENDEMIC)
Myoporum sandwicense	Naio	dry-med	NATIVE
Vigna marina	nanea	med-wet	NATIVE
Scaevola chamissoniana	naupaka kuahiwi	med-wet	NATIVE (ENDEMIC)
Scaevola sericea	naupaka kahakai, beach naupaka	(dry) med	NATIVE
Lipochaeta connata var. connata	nehe	(dry) med-wet	NATIVE (ENDEMID)
Lipochaeta rockii	nehe	dry med	NATIVE (ENDEMIC)
Lipochaeta succulenta	nehe	(dry) med-wet	NATIVE (ENDEMIC)
Melanthera integrifolia	nehe	(dry) med	NATIVE (ENDEMIC)
Melanthera lavarum	nehe	dry-med	NATIVE (ENDEMIC)
Sesbania tomentosa***	ʻohai	dry-med	NATIVE (ENDEMIC)
Vaccinium reticulatum	ʻōhelo	dry-med	NATIVE (ENDEMIC)
Lycium sandwicense	ʻōhelo kai	(dry) med	NATIVE
Fragaria chiloensis	ʻōhelo papa	(dry) med	NATIVE
Curcuma longa	ʻōlena, turmeric	(dry) med-wet	POLYN. INTRO.
Microlepia strigosa	palapalai	(dry) med-wet	NATIVE
Phyllanthus distichus	pāmakani māhū	med	NATIVE (ENDEMIC)

GROUND COVERS NATIVE & POLYNESIAN INTRODUCED			
Scientific Name	**Common Name**	**Water Requirement**	**Distribution**
Jacquemontia ovalifolia ssp. sandwicensis	pāʻūohiʻiaka	dry-med	NATIVE
Tacca leontopetaloides	piʻa, arrowroot	(dry) med	POLYN. INTRO.
Dioscorea pentaphylla	piʻa, yam	(dry) med-wet	POLYN. INTRO.
Vitex rotundifolia	pōhinahina, beach vitex	(dry) med	NATIVE
Ipomoea pes-caprae	pōhuehue, beach morning glory	(dry)-med	NATIVE
Solanum nelsonii	popolo, beach solanum	dry-med	NATIVE (ENDEMIC)
Argemone glauca var. glauca	pua kala, Hawaiian poppy	dry-med	NATIVE (ENDEMIC)
Styphelia tameiameiae	pūkiawe	dry-med	NATIVE
Ipomoea batatas	ʻuala, sweet potato	med-wet	POLYN. INTRO.
Dioscorea alata	uhi, yam	(dry) med-wet	POLYN. INTRO.
Dianella sandwicensis	ʻukiʻuki	(dry) med	NATIVE
Osteomeles anthyllidifolia	ʻūlei	dry-med	NATIVE
Scaevola gaudicaudii	yellow naupaka	(dry) med	NATIVE (ENDEMIC)
***Endangered species. Water requirements: Categories in parentheses are too dry for plant natural survival in planting zones. Additional water is required to satisfy plant needs.			

CHAPTER 12. IRRIGATION AND WATER CONSERVATION; DROUGHT TOLERANT PLANTS

12.1 OVERVIEW

12.101 The Maui County Department of Water Supply is developing landscape irrigation guidelines to be adopted as a Maui County Ordinance. The County Ordinance will be the authority developers need to abide by. Topics in this chapter not addressed in the new ordinance should be complied with.

12.2 PURPOSE

12.201 The objective of this chapter is to emphasize efficient and conservative water use in landscape irrigation. Conservation of water can be achieved through wise planning, careful plant selection, proper plant and irrigation installation, and efficient water application.

12.3 WATER APPLICATION AND CONSERVATION

12.301 The irrigation system should be targeted by zones. Lush plantings close to buildings should be irrigated more often while distant plantings with less human activity should be irrigated with a drip system or none at all.

12.4 SEVEN WATER CONSERVATION PRINCIPLES

12.401 Planning and Design

12.401-A Careful design and wise planning can provide sufficient irrigation and yet conserve water. A landscaping or planting design must carefully consider the conditions of the site. Plants best adapted to the climate, temperature, sun, wind, and physical nuances of the site thrive best and require the least expenditures of water, energy, and maintenance. The intensity of human activity dictates plant types selected and amount of water needed.

12.402 Soil Improvement

12.402-A Normal soil horizons are mixed unevenly both vertically and horizontally at construction sites and consequently are difficult to manage. Often hardpans exist and impede drainage. Many urban soils have been compacted by heavy equipment or traffic. Many of the physical and chemical soil properties that plants require for growth are often at less than optimum levels.

12.402-B Soil amendments will help correct poor water infiltration, percolation, and drainage, while improving water holding capacity and nutritional status. Organic amendments meet most of these requirements and improve soil tilth. See 10.201E and10.201F on page 150 for turfgrass and groundcover recommendations.

12.403 Efficient and Zoned Irrigation

12.403-A Grouping plants according to their water requirements and use of zoned irrigation systems eliminates over watering and run-off. Grouping high or medium water requiring plants near swales and water collection basins may provide most of the plant's water needs by natural moisture accumulations rather than irrigation. Conversely, drought tolerant species should be located on southern exposures or at the tops of slopes.

12.404 Limit Turf Area

12.404-A Turfgrass plays a primary role in most landscapes. Although lawns make excellent ground covers, tolerate heavy foot traffic, stabilize slopes, prevent soil erosion, and reduce dust and chemical air pollution, due to their lower height and higher transpiration they require more water. Turfgrass requires high maintenance to look good.

12.405 Use of Mulch

12.405-A Mulches (organic, inorganic, or living) function to buffer soils against climatic extremes. Proper mulching reduces soil heating and water evaporation. It also reduces weeds, or makes their removal easier, and reduces or prevents soil erosion. Mulches should be applied 2-4 inches deep over bare soil or 2-3 inches deep over weed barrier.

12.405-B Organic mulches contribute to the nutritional level and tilth of the soil as they break down. They also enhance the presence of beneficial soil microflora. Organic mulches include plant refuse such as chips and slash from tree trimming operations; composted leaves, grass, and manures; peat moss; and graded bark products.

12.405-C Mulching with course organic matter is one of the easiest and most beneficial practices for gradually improving soil structure and plant health.

12.405-D Fresh woody organic mulches have a high nitrogen demand for microbial breakdown. Therefore, it may be necessary to apply a source of nitrogen to prevent plant chlorosis (yellowing).

12.405-E Inorganic mulches include sized and washed rocks and gravels which come in many sizes, colors, and textures. Impervious sheet plastics covered with either organic or inorganic mulches were popular, but because they prevent gas and water exchange between air and soil they create a water-logged root environment and are not recommended. Synthetic woven products are now preferred. If a situation requires using inorganic mulches, a request in writing for approval from the Maui County Arborist Committee is necessary.

12.405-F Living mulches include ground covers and low maintenance grasses. Select hardy drought tolerant species that resist insects and diseases. These species provide the best results and require less maintenance.

12.406 Use of Low Water-Demand Plants

12.406-A Landscapers should consider available plants, both exotics and natives that thrive with natural precipitation or small amounts of supplemental water. Many native and exotic plants are drought tolerant or have low water requirements once they are established. Critical to using drought tolerant and low water use plants in the landscape is matching the specific needs of the plants to the environmental conditions and the intensity of human activity at the planting site.

12.407 Appropriate Maintenance

12.407-A The use of all or most of the first six fundamentals will reduce but not eliminate maintenance. Trees, shrubs, ground covers, and turfgrasses are living organisms that require care. Landscapes require timely fertilizing, watering, pruning, pest management, and other cultural practices. Reduced levels of cultural requirements can be achieved if plants are selected for the environment where they are to be planted and with conservation of resources in mind. Landscapes will need periodic checks and servicing of irrigation and sprinkling systems and regular removal of litter. Properly integrated landscapes save water and energy while producing optimum beauty.

12.5 WATER APPLICATION

12.501 An irrigation system planned for irrigating plantings should not be used for dust control except where approved by the Department of Water Supply.

12.502 Where recycled water is available, it should be used for irrigation rather than potable water, except over wellhead protection areas. Have the nonpotable water checked for salt and mineral content prior to landscape design and making plant selections.

12.503 Developers are required to conform to water conservation principles presented in this chapter and be responsible for ensuring that water is being applied to plantings and not hardscapes.

12.504 For ease of maintenance and reduction of runoff, ground covers other than lawns are recommended in sloped areas greater than 20 degrees.

12.505 It is recommended that ground covers other than turfgrass be planted in narrow strips of land where "on target" water delivery is difficult due to "over shoot". A drip system can then be used to avoid “over spray”.

12.506 It is the responsibility of developers to provide water to plantings at their project site for one year from the date of completion of the project.

12.507 After the initial year, developers need to inform abutting property owners that it is now their responsibility to care for the planting strips between their property line and the curb or street. Sufficient water, fertilizer, and weed control need to be provided in order to adequately maintain the street trees and accompanying plants. Those lots which have not been sold after the one (1) year period shall be the responsibility of the developer.

12.508 The amount and frequency of water applied depends on soil texture and season. Clay soils store more water than sandy soils and do not require irrigation as often. Sandy soils need to be irrigated more often but with a lesser amount. When the same amount of water is applied to a sandy soil as to a clay soil, the water will penetrate about twice as deeply in the first.

12.509 A suggested watering guide (varies by time of year and site conditions) for newly planted material:

- First Month: Daily (Check under mulch and make determination.)
- Second and Third Month: Three times a week
- Fourth to Twelfth Month: Weekly

- After First Year: Use annual water requirements as listed under characteristics for specific plants.

12.6 PIPED IRRIGATION SYSTEMS

12.601 The tremendous variety of tubing, emitters, and controllers make possible water delivery systems that conserve water and minimize vandalism.

12.602 Automatically controlled systems with a rain shut off switch are recommended. Rain shut off switches need to be checked periodically because debris may malfunction the device. Manually controlled systems should not be used because water application duration is difficult to control and is time consuming.

12.603 It is recommended that conventional sprinklers not be used in areas where their radius of "throw" exceeds the watering distance. Drip, bubblers, low volume sprays, micro emitters, etc. should be used to minimize wasting of water.

12.604 Emitters should have matched precipitation rates within each control valve circuit.

12.605 Anti-drain check valves should be installed in strategic points to minimize or prevent "low head" drainage.

12.606 All irrigation systems shall be equipped with a controller capable of multiple programming for separation of turf and non-turf areas, multiple cycle capabilities so as to apply water more than once to an area not to exceed soil infiltration rate, and flexible programming for seasonal modifications.

12.607 Trees should be watered separately from other landscape plants unless the irrigation fixtures can deliver the amount of water required to wet just beyond the root zone in the time interval the circuit is on for accompanying plants. Unlike shallow watering, deep watering will encourage deep rooting and avoid hardscape damage. Bubblers, groupings of micro emitters, etc. may be able to provide the volume needed (depth and area wetted) if left on long enough. Under or over irrigating the first year is the primary cause for tree death.

12.608 Turfgrass is usually irrigated with a sprinkler system.

12.609 Ground cover and shrubs can be irrigated with a subsurface irrigation system. A drip system can be laid on the soil surface and covered over by porous synthetic weed barrier topped with 2 inches of organic mulch, or laid on the soil surface and topped with 3 inches of organic mulch. The soil

type needs to be considered when determining the number of drip lines necessary for required horizontal water movement. Consult with the irrigation supplier regarding the type of installation method to be used. Always consider ease of maintenance and avoiding vandalism.

12.7 IRRIGATION MANAGEMENT

12.701 Water should be applied so that no runoff occurs.

12.702 To improve irrigation efficiency, irrigation frequency and duration shall be set according to the planting's actual water needs. Group plants with similar water requirements together so as to apply water according to their needs.

12.703 Electric controllers should be set to water between dusk and 10:00 am to reduce evaporation losses. Systems need to be inspected and monitored (turned on briefly) during working hours for making necessary repairs and adjustments at least once a month. Where water is being wasted, or not applied as needed, inspect and repair immediately.

12.704 Automatic irrigation systems must be governed by a rain shut off valve. The irrigation industry has controllers with soil moisture sensors and evapotranspiration (ET) stations to make for more conservative applications of water. Low flow sprinkler heads, drip systems, and flow sensors with automatic shut-off for unexpected leaks should be incorporated in irrigation designs and upgrades. These and other available components for conserving water are recommended because water is a limited commodity.

12.705 Subsurface watering may be appropriate for irrigating turfgrass. When used, fertilizer injection into the irrigation system may be more appropriate because wetting fertilizers applied to the soil’s surface will be difficult.

12.8 LOW WATER USE AND DROUGHT TOLERANT PLANTS

12.801 Water is very important at the time of planting and during plant establishment. Drought tolerance is a characteristic of matured plants and indicates the plant's ability to survive periods of no or low water. It does not mean that no water is ever needed. All plants require some water.

12.802 Included in Table 12-1 is a listing of drought tolerant plants. Use the Index at the end of this document to locate a plant’s listing to obtain its

characteristics. Use plant characteristics and planting zones to locate plants in their preferred habitats.

12.9 KEY TO PLANT WATER REQUIREMENTS

12.901 **Dry**: Less than 20 inches of water per year - Includes self-sustaining plant materials and natural vegetation with emphasis on plants that require little or no supplemental irrigation after becoming established.

12.902 **Medium**: 20-40 inches of water per year - Includes lawns, ground covers, and shrubs.

12.903 **Wet**: More than 40 inches of water per year - Includes lush lawns, ground covers, and shrubs.

Drought-tolerant plants

STREET TREES - SMALL

Tournefortia argentea	beach heliotrope, tahinu	dry-med	NON-NATIVE
Conocarpus erectus	buttonwood, silver buttonwood	dry-med	NON-NATIVE
Ceratonia siliqua	carob	dry-med	NON-NATIVE
Cordia sebestena	kou haole	dry-med-wet	NON-NATIVE
Diospyros sandwicensis	lama	dry-med	NATIVE (ENDEMIC)
Tabebuia impetiginosa	lavender trumpet	dry-med	NON-NATIVE
Guaiacum officinale	lignum vitae	dry-med-wet	NON-NATIVE
Gliricidia sepium	madre de cacao	dry-med	NON-NATIVE
Callistemon citrinus	red bottlebrush, crimson bottlebrush	dry-med	NON-NATIVE
Bolusanthus speciosus	Rhodesian wisteria	dry-med	NON-NATIVE
Eucalyptus platypus	round-leafed moort	dry-med	NON-NATIVE
Eucalyptus stoatei	scarlet pear gum	dry-med	NON-NATIVE
Coccoloba uvifera	sea grape	dry-med	NON-NATIVE
Eucalyptus kruseana	tidy blue	dry-med	NON-NATIVE
Schotia brachypetala	tree fuchsia, schotia	dry-med	NON-NATIVE

STREET TREES - MEDIUM

Eucalyptus gardneri	blue mallet	dry-med	NON-NATIVE
Cochlospermum vitifolium	buttercup tree	dry-med-wet	NON-NATIVE
Colvillea racemosa	colvillea	dry-med-wet	NON-NATIVE
Eucalyptus torquata	coral gum	dry-med	NON-NATIVE
Thespesia grandiflora	maga	dry-med-wet	NON-NATIVE
Reynoldsia sandwicensis	ohe makai	dry	NATIVE (ENDEMIC)
Tabebuia heterophylla	pink tecoma	dry-med-wet	NON-NATIVE
Eucalyptus cinerea	silver dollar eucalyptus	dry-med	NON-NATIVE
Tipuana tipu	tipa	dry-med	NON-NATIVE
Tabebuia ochracea	yellow trumpet tree	dry-med-wet	NON-NATIVE

PARK, GREENWAY, AND OPEN SPACE TREES - SMALL

Dodonaea viscosa	aalii	dry-med	NATIVE
Psydrax odorata	alahee	dry-med	NATIVE
Tournefortia argentea	beach heliotrope, tahinu	dry-med	NON-NATIVE
Conocarpus erectus	buttonwood, silver buttonwood	dry-med	NON-NATIVE
Ceratonia siliqua	carob	dry-med	NON-NATIVE
Erythrina crista-galli	coral tree	dry-med	NON-NATIVE
Dracaena draco	dragon tree	dry-med	NON-NATIVE
Caesalpinia pulcherrima	dwarf poinciana	dry-med-wet	NON-NATIVE
Pleomele auwahiensis	hala pepe	dry-med	NATIVE (ENDEMIC)
Rauvolfia sandwicensis	hao	dry-med	NATIVE (ENDEMIC)
Nesoluma polynesicum	keahi	dry	NATIVE
Acacia koaia	koaia, koaie	dry-med	NATIVE (ENDEMIC)
Kokia drynarioides	kokio, kokia	dry-med	NATIVE (ENDEMIC)
Senna surattensis	kolomona, scrambled eggs	dry-med	NON-NATIVE
Cordia sebestena	kou haole	dry-med-wet	NON-NATIVE
Diospyros sandwicensis	lama	dry-med	NATIVE (ENDEMIC)
Tabebuia impetiginosa	lavender trumpet	dry-med	NON-NATIVE
Guaiacum officinale	lignum vitae	dry-med-wet	NON-NATIVE
Gliricidia sepium	madre de cacao	dry-med	NON-NATIVE
Hibiscus brackenridgei	mao hau hele (Hawaii state flower)	dry-med	NATIVE (ENDEMIC)
Gardenia brighamii	nanu, nau	dry-med	NATIVE (ENDEMIC)
Morinda citrifolia	noni, Indian mulberry	dry-med-wet	POLYN. INTRO
Nestegis sandwicensis	olopua	dry-med	NATIVE (ENDEMIC)

Drought-tolerant plants

PARK, GREENWAY, AND OPEN SPACE TREES - SMALL

Plumeria rubra	plumeria, frangipani	dry-med	NON-NATIVE
Callistemon citrinus	red bottlebrush, crimson bottlebrush	dry-med	NON-NATIVE
Bolusanthus speciosus	Rhodesian wisteria	dry-med	NON-NATIVE
Jatropha integerrima	rose-flowered jatropha	dry-med	NON-NATIVE
Eucalyptus platypus	round-leafed moort	dry-med	NON-NATIVE
Eucalyptus stoatei	scarlet pear gum	dry-med	NON-NATIVE
Coccoloba uvifera	sea grape	dry-med	NON-NATIVE
Callistemon rigidus	stiff bottlebrush	dry-med	NON-NATIVE
Eucalyptus kruseana	tidy blue	dry-med	NON-NATIVE
Schotia brachypetala	tree fuchsia, schotia	dry-med	NON-NATIVE

PARK, GREENWAY, AND OPEN SPACE TREES - MEDIUM

Adansonia digitata	baobab, dead rat tree	dry-med	NON-NATIVE
Eucalyptus gardneri	blue mallet	dry-med	NON-NATIVE
Cochlospermum vitifolium	buttercup tree	dry-med-wet	NON-NATIVE
Colvillea racemosa	colvillea	dry-med-wet	NON-NATIVE
Eucalyptus torquata	coral gum	dry-med	NON-NATIVE
Noronhia emarginata	Madagascar olive	dry-med-wet	NON-NATIVE
Thespesia grandiflora	maga	dry-med-wet	NON-NATIVE
Reynoldsia sandwicensis	ohe makai	dry	NATIVE (ENDEMIC)
Tabebuia heterophylla	pink tecoma	dry-med-wet	NON-NATIVE
Delonix regia	royal poinciana	dry-med-wet	NON-NATIVE
Eucalyptus cinerea	silver dollar eucalyptus	dry-med	NON-NATIVE
Erythrina variegata	tiger's claw, Indian coral	dry-med	NON-NATIVE
Tipuana tipu	tipa	dry-med	NON-NATIVE
Erythrina sandwicensis	wiliwili	dry-med	NATIVE (ENDEMIC)
Tabebuia ochracea	yellow trumpet tree	dry-med-wet	NON-NATIVE

PARK, GREENWAY, AND OPEN SPACE TREES - LARGE

Ficus religiosa	bo tree, peepul tree	dry-med-wet	NON-NATIVE
Enterolobium cyclocarpum	earpod tree	dry-med	NON-NATIVE
Eucalyptus tereticornis	forest redgum	dry-med	NON-NATIVE
Eucalyptus salubris	gimlet	dry-med	NON-NATIVE
Tabebuia donnell-smithii	gold tree, prima vera	dry-med-wet	NON-NATIVE
Ficus benghalensis	Indian banyan	dry-med-wet	NON-NATIVE
Ficus elastica	Indian rubber tree	dry-med-wet	NON-NATIVE
Ficus macrophylla	Moreton bay fig	dry-med-wet	NON-NATIVE
Eucalyptus crebra	narrow-leafed ironbark	dry-med	NON-NATIVE
Cassia grandis	pink shower tree, coral shower tree	dry-med-wet	NON-NATIVE
Eucalyptus sideroxylon	red ironbark	dry-med	NON-NATIVE
Pseudobombax ellipticum	shaving brush tree	dry-med	NON-NATIVE
Tamarindus indica	tamarind	dry-med-wet	NON-NATIVE
Terminalia catappa	tropical almond, false kamani	dry-med-wet	NON-NATIVE
Ficus benjamina	weeping banyan	dry-med-wet	NON-NATIVE
Peltophorum pterocarpum	yellow poinciana	dry-med-wet	NON-NATIVE

PARK, GREENWAY, AND OPEN SPACE PALM TREES - MEDIUM

Syagrus romanzoffiana	queen palm	dry-med-wet	NON-NATIVE
Coccothrinax barbadensis	silver thatch palm	dry-med	NON-NATIVE

Drought-tolerant plants

PARK, GREENWAY, AND OPEN SPACE PALM TREES - LARGE

Bismarckia nobilis	Bismarck palm	dry-med	NON-NATIVE
Cocos nucifera	niu, coconut	dry-med-wet	POLYN. INTRO

SOUND/WIND/VISUAL BARRIERS

Dodonaea viscosa	aalii	dry-med	NATIVE
Wikstroemia uva-ursi	akia	dry-med	NATIVE (ENDEMIC)
Psydrax odorata	alahee	dry-med	NATIVE
Caesalpinia pulcherrima	dwarf poinciana	dry-med-wet	NON-NATIVE
Abutilon eremitopetalum	hidden petal abutilon	dry-med	NATIVE (ENDEMIC)
Ligustrum japonicum	Japanese privet	dry-med-wet	NON-NATIVE
Senna gaudichaudii	kolomona	dry-med	NATIVE
Senna surattensis	kolomona, scrambled eggs	dry-med	NON-NATIVE
Abutilon menziesii	kooloa ula	dry-med	NATIVE (ENDEMIC)
Nototrichium sandwicense	kului	dry-med	NATIVE (ENDEMIC)
Gossypium tomentosum	mao, Hawaiian cotton	dry-med	NATIVE (ENDEMIC)
Murraya paniculata	mock orange	dry-med-wet	NON-NATIVE
Myoporum sandwicense	naio	dry-med	NATIVE
Carissa macrocarpa	natal plum	dry-med-wet	NON-NATIVE
Nerium oleander	oleander	dry-med-wet	NON-NATIVE
Pittosporum tobira	pittosporum	dry-med-wet	NON-NATIVE
Coccoloba uvifera	sea grape	dry-med	NON-NATIVE
Crinum asiaticum	spider lily	dry-med-wet	NON-NATIVE
Osteomeles anthyllidifolia	ulei	dry-med	NATIVE

PARKING LOT TREES - 15' SPREAD

Tabebuia impetiginosa	lavender trumpet	dry-med	NON-NATIVE
Bolusanthus speciosus	Rhodesian wisteria	dry-med	NON-NATIVE
Schotia brachypetala	tree fuchsia, schotia	dry-med	NON-NATIVE

PARKING LOT TREES - 20' SPREAD

Conocarpus erectus	buttonwood, silver buttonwood	dry-med	NON-NATIVE
Ceratonia siliqua	carob	dry-med	NON-NATIVE
Gliricidia sepium	madre de cacao	dry-med	NON-NATIVE
Reynoldsia sandwicensis	ohe makai	dry	NATIVE (ENDEMIC)
Eucalyptus kruseana	tidy blue	dry-med	NON-NATIVE

PARKING LOT TREES - 25' SPREAD

Eucalyptus gardneri	blue mallet	dry-med	NON-NATIVE
Colvillea racemosa	colvillea	dry-med-wet	NON-NATIVE
Thespesia grandiflora	maga	dry-med-wet	NON-NATIVE
Tabebuia heterophylla	pink tecoma	dry-med-wet	NON-NATIVE
Eucalyptus cinerea	silver dollar eucalyptus	dry-med	NON-NATIVE
Tipuana tipu	tipa	dry-med	NON-NATIVE

PARKING LOT TREES - 30' SPREAD

Cochlospermum vitifolium	buttercup tree	dry-med-wet	NON-NATIVE
Eucalyptus torquata	coral gum	dry-med	NON-NATIVE
Tabebuia donnell-smithii	gold tree, prima vera	dry-med-wet	NON-NATIVE
Tabebuia ochracea	yellow trumpet tree	dry-med-wet	NON-NATIVE

Drought-tolerant plants

PARKING LOT TREES - 35' SPREAD

Pseudobombax ellipticum	shaving brush tree	dry-med	NON-NATIVE
Peltophorum pterocarpum	yellow poinciana	dry-med-wet	NON-NATIVE

PARKING LOT TREES - 40' SPREAD

Delonix regia	royal poinciana	dry-med-wet	NON-NATIVE

PARKING LOT TREES - 70'+ SPREAD

Ficus benjamina	weeping banyan	dry-med-wet	NON-NATIVE

GROUND COVERS

Artemisia mauiensis	ahinahina	dry-med	NATIVE (ENDEMIC)
Wikstroemia uva-ursi	akia	dry-med	NATIVE (ENDEMIC)
Chamaesyce celastroides	akoko	dry-med	NATIVE (ENDEMIC)
Chamaesyce skottsbergii var. skottsbergii	akoko	dry-med	NATIVE (ENDEMIC)
Peperomia leptostachya	alaala wai nui, Hawaiian peperomia	dry-med	NATIVE
Boerhavia repens	alena	dry-med	NATIVE
Hippeastrum puniceum	amaryllis	dry-med-wet	NON-NATIVE
Canavalia pubescens	awikiwiki	dry-med	NATIVE (ENDEMIC)
Bonamia menziesii	bonamia menziesii	dry-med	NATIVE (ENDEMIC)
Scaevola coriacea	creeping naupaka	dry-med	NATIVE (ENDEMIC)
Cressa truxillensis	cressa	dry-med	NATIVE
Ipomoea tuboides	Hawaiian moon flower	dry-med	NATIVE (ENDEMIC)
Abutilon eremitopetalum	hidden petal abutilon	dry-med	NATIVE (ENDEMIC)
Heliotropium anomalum var. argenteum	hinahina ku kahakai	dry-med	NATIVE
Portulaca molokiniensis	ihi	dry-med	NATIVE (ENDEMIC)
Santalum ellipticum	iliahi	dry-med	NATIVE (ENDEMIC)
Plumbago zeylanica	iliee	dry-med	NATIVE
Sida fallax	ilima papa	dry-med	NATIVE
Eragrostis monticola	kalamalo	dry-med	NATIVE (ENDEMIC)
Bidens mauiensis	kookoolau	dry-med	NATIVE (ENDEMIC)
Senna gaudichaudii	kolomona	dry-med	NATIVE
Abutilon menziesii	kooloa ula	dry-med	NATIVE (ENDEMIC)
Coprosma ernodeoides	kukaenene	dry-med	NATIVE (ENDEMIC)
Nototrichium sandwicense	kului	dry-med	NATIVE (ENDEMIC)
Capparis sandwichiana	maiapilo, native caper	dry-med	NATIVE (ENDEMIC)
Gossypium tomentosum	mao, Hawaiian cotton	dry-med	NATIVE (ENDEMIC)
Fimbristylis cymosa ssp. spathacea	mauu aki aki, fimbristylis	dry-med	NATIVE
Dubautia scabra	naenae	dry-med	NATIVE (ENDEMIC)
Myoporum sandwicense	naio	dry-med	NATIVE
Lipochaeta rockii	nehe	dry-med	NATIVE (ENDEMIC)
Melanthera lavarum	nehe	dry-med	NATIVE (ENDEMIC)
Sesbania tomentosa	ohai	dry-med	NATIVE (ENDEMIC)
Vaccinium reticulatum	ohelo	dry-med	NATIVE (ENDEMIC)
Lotus berthelotii	parrot's-beak, coral gem	dry	NON-NATIVE
Jacquemontia ovalifolia ssp. sandwicensis	pauohiiaka	dry-med	NATIVE
Solanum nelsonii	popolo, beach solanum	dry-med	NATIVE (ENDEMIC)
Argemone glauca var. glauca	pua kala, Hawaiian poppy	dry-med	NATIVE (ENDEMIC)
Styphelia tameiameiae	pukiawe	dry-med	NATIVE
Osteomeles anthyllidifolia	ulei	dry-med	NATIVE

CHAPTER 13. ALIEN INVASIVE PLANT SPECIES

13.1 HAWAII-PACIFIC WEED RISK ASSESSMENT

13.101 The University of Hawaii and the United States Department of Agriculture Forest Service created the Hawaii-Pacific Weed Risk Assessment (HPWRA) protocol to identify pest plants in Hawaii. The HPWRA is a modified version of the Australia/New Zealand Weed Risk Assessment method. The screening protocol consists of 49 questions, the answers to which are analyzed in an attempt to predict the invasive potential of a particular plant species. Answers to the HPWRA questions for each plant evaluated were obtained from information sources around the world. Based on the HPWRA results plants are classified, with respect to invasiveness, as "low risk", "high risk", or "evaluate further."

13.102 A more detailed description of how the HPWRA was designed and the current screening results (list of plants screened by this process) can be found online at **www.hpwra.org**. As more plants are screened using the HPWRA, they will be added to the list. Additionally, as more information becomes available for already-screened species, this information will be posted. (Note that new information may change the assessment results.)

13.103 Excluded from the analysis were native species to Hawaii.

13.104 Even though the Polynesian introduced plants kukui, *Aleurites moluccana*; milo, *Thespesia populnea*; and noni, *Morinda citrifolia*, were determined to be invasive, they are included as "okay to plant" because they have been in Hawaii long enough to have fulfilled their potential for invasiveness and occupy mainly lower elevation areas.

13.105 Turfgrasses are invasive when evaluated with the HPWRA instrument. However, because of their important role in reducing and preventing soil erosion and widespread usage in landscapes, the more popular ones used in urban forests are permitted to be planted and are included in Chapter Ten, "Turfgrass and Ground Covers: Types, Planting, and Care".

13.106 Plants that have a HPWRA rating of "low risk" as found in the above web site are recommended for planting on public property owned by Maui County or in projects partially or completely funded by Maui County. It is also suggested that private property owners, and federal and state agencies, plant only these species and thus prevent creating a reservoir of seeds of potentially invasive plants to be spread by wind, birds, or people.

13.107 Plants that have an HPWRA rating of “evaluate further” are all right to plant for now, but if proven to be invasive after more information is obtained, they will be disallowed.

13.108 All plants in the Maui County Planting Plan (MCPP) are either “low risk” or “evaluate further” and therefore all right to plant at the time of this publication.

13.109 Tables at the end of various chapters include species marked with a single asterisk (*). This single asterisk (*) indicates a species needing to be evaluated further, but can be included in landscapes at this time.

13.2 INVASIVE HORTICULTURAL PLANTS IN HAWAII: AN OVERVIEW

13.201 One of the major threats to Hawaii's native species and forests is the rampant spread of a large number of invasive alien plant species across the state. These plants displace Hawaii's distinctive native flora, resulting in the loss of diverse native forests that support a large array of native animals. Preservation of native plants and animals that make Hawaii unique requires that we confront the problem of invasive alien plant species.

13.202 The ornamental plant trade accounts for the majority of invasive plant introductions to Hawaii. It is important to educate the public about how this has occurred and to inform them that they should avoid using invasive species in landscapes to protect Hawaii’s native ecosystems.

13.203 What is an invasive species?

13.203-A In addressing the invasive plant threat to our native ecosystems, it is necessary to bear in mind some important distinctions. First, the term alien species refers to a species transported or established outside its native range by the activities of humans, whether done so intentionally or not. This definition does not imply that human dispersal of species is inherently unnatural, but it recognizes that the rate at which humans are homogenizing the world's diverse biota is occurring at a scale previously absent in Earth's evolutionary history. For example, it has been estimated that the rate of new species established in the Hawaiian Islands was approximately one new species every 35,000 years prior to human arrival in the islands; it is now on the order of 20-30 species per year, an approximately million-fold rate increase. Not all alien

species pose a threat to Hawaii's native forests and species; in fact, only a small fraction does. Those that are a problem are called invasive species because they are alien species that significantly disrupt the community structure or proper function of an ecosystem. Of the approximately 13,000 alien species of plants that have been introduced to Hawaii, only about 1% (130 species) has become invasive so far. Biological evidence suggests another 200-300 species already present in the state may become problems in the future. Given these distinctions, it must be emphasized that efforts to protect Hawaii's native ecosystems and species from destructive alien species is focused only on invasive alien species and not all alien species *per se*.

13.204 How do we determine whether a plant species is invasive in Hawaii?

13.204-A Plant invasiveness can be determined in either of two manners. First, we may rely on local evidence of invasiveness, typically indicated by a plant showing numerical dominance, physical dominance, alteration of nutrient or water cycling regimes, or alteration of disturbance regimes in an area. This is the most direct means of demonstrating invasiveness, but reliance on this method is of limited usefulness in protecting Hawaii because by the time evidence of invasiveness is locally available it is typically too late to effectively control the problem. Secondly, one may rely on evidence of the behavior of particular plant species in similar habitats elsewhere. For example, if a particular plant has been shown to be invasive in, say, Fiji, it is likely to be invasive in Hawaii as well because of the similar habitats in the two archipelagos. This method does not guarantee that a particular plant will be invasive in Hawaii but it does make it quite likely to be so. The strength of this line of reasoning is that it can be used proactively to entirely avoid introducing destructive plants to Hawaii or can be used to remove them at an early stage in the invasion process. For example, cogon grass, *Imperata cylindrical,* is widely destructive throughout the Old World tropics and in Florida and, consequently, is banned from importation into Hawaii. Similarly, Chinese privet, *Ligustrum sinense*, is highly invasive in the southeastern United States and in Australia, has started to form dense thickets in a small area of Kauai, and is, consequently, the target of a campaign to remove it from Kauai before it causes lasting damage.

13.204-B With respect to Hawaii, potentially invasive plant species can be divided into several groups: (1) species that do not occur in Hawaii; (2) species not yet widespread anywhere in Hawaii but just beginning to show invasive tendencies here; (3) species already widely invasive somewhere in Hawaii but not widely established on all islands; (4) species which may already occur in Hawaii that do not *yet* show invasive tendencies in Hawaii, but may still have the potential to be invasive in Hawaii; and (5) species that are already widely invasive throughout Hawaii.

13.204-C The easiest, cheapest, and most effective way — in fact, often the *only* effective way — to prevent problems caused by invasive species is to simply not bring those species to Hawaii in the first place. A weed risk assessment protocol (*See HPWRA, above*) can help predetermine which species are likely to be problematic, so as to make wise decisions about not introducing these species to the state.

13.204-D By not planting species that are not yet widespread anywhere in Hawaii, but just beginning to show invasive tendencies in some places, we can spare some of our islands from suffering the ecological disruptions these species have caused elsewhere in the state. An example is fountain grass, *Pennisetum setaceum*, which has been tremendously destructive so far only on the Big Island because active control programs are working to keep it off or remove it from the other islands. For these species, it is early enough to stop them from becoming major ecological problems everywhere in Hawaii by discontinuing their planting and by removing known plants.

13.204-E Species not yet widespread anywhere in Hawaii but just beginning to show invasive tendencies here often are already known to be problems in similar habitats elsewhere in the world. One example of this is Chinese privet, *Ligustrum sinense*, which is highly problematic elsewhere in the world and promises to follow suit in Hawaii.

13.204-F There are also species which may already occur in Hawaii that do not yet show invasive tendencies in Hawaii, but may still have the potential to be invasive in Hawaii. There is often a "lag phase" between the time a species is introduced and the time it begins to exhibit invasive tendencies; problematic invasion can occur many decades after initial introduction. A weed risk assessment protocol (See HPWRA, above) would be useful to identify these potentially invasive species so we can take preventive measures by not promoting their use.

13.204-G And, of course, there are numerous species that are already widely invasive throughout Hawaii. There is no point to perpetuate the use of these plants in horticulture, if for no other reason than to prevent sending mixed messages when trying to educate the public about not using invasive species in landscaping.

13.205 How do most invasive species arrive in Hawaii?

13.205-A Invasive species arrive in Hawaii in a variety of ways, but by far the most prevalent method is horticultural use for ornamental purposes. In fact, this single pathway of entry accounts for approximately 70% of all documented invasive plant species in Hawaii. Other pathways of lesser importance include introductions for use as crops, livestock forage, or forestry species, and accidental introduction of weed seeds as contaminants in other products.

13.206 What attributes of plants make them invasive?

13.206-A A variety of biological attributes of plants serve to make them invasive, but three are of primary importance:

- Propagules (seeds, spores) dispersed by animals or wind.
  - Because plants do not invade native ecosystems by simply pulling up their roots and moving there, it should be clear that plants disperse to new areas via movement of their seeds and spores. These propagules can disperse by a variety of mechanisms, but those propagules adapted to be spread by animals or wind can most easily move long distances. Hence, plants using animals or wind as dispersal mechanisms are capable of quickly invading native ecosystems in areas remote from where the adults themselves are planted. Because of this trait alone, many plants that have animal- or wind-dispersed propagules have high potential to be invasive in Hawaii. All such species should be viewed with caution as ornamentals. (An exception to this rule is most orchids, which have small wind-dispersed seeds but have not usually been invasive because fertilization generally requires specialized pollinators that are absent from Hawaii. Of course, if orchid pollinators were introduced to Hawaii this situation could change.)
  - Wind-dispersed seeds can be identified by the structural features on the seeds that allow them to be carried long distances on light currents. These structures typically consist of either clusters of long hairs, as seen in fireweed, *Senecio madagascariensis*, or wings.
  - Animal-dispersed seeds are typically fleshy berries, relatively small in size, and variously colored red, orange, yellow, black, or bluish-black. The dispersers of greatest importance in Hawaii (as elsewhere) are fruit-eating birds, but some mammals, such as pigs, are also important dispersers of some alien plant fruits. A large percentage of Hawaii's invasive plants possess bird-dispersed fruits.
  - An additional attribute making some of these plants even more invasive is the capability of growing vegetatively by cuttings. Such plants have the ability to rapidly spread in thick mats and the new populations are accidentally started by humans disposing of unwanted garden waste; such as wedelia, *Sphagneticola trilobata*. Many of the most invasive plants in Hawaii and other oceanic islands can reproduce vegetatively as well as by seed.

- High fecundity.
  - All else being equal, plants that produce many seeds per plant each year are far more capable of quickly invading native ecosystems than are those that produce relatively few seeds per year. For example, miconia, *Miconia calvescens* — which is the subject of a multi-year control effort by state, federal, and private organizations — is capable of producing several million seeds per year per plant, making its rate of population increase explosive and partially accounting for its great threat to Hawaii's forests.
- Rapid growth rate.
  - All else being equal, fast-growing plants that quickly reach maturity will be more invasive and harder to control than slower-growing plants. An outstanding example of the importance of this phenomenon is salvinia, *Salvinia molesta*, a floating aquatic fern, which under ideal conditions is capable of doubling its population size every 2-3 days, quickly choking out water bodies that it infests.

13.3 SUMMARY

13.301 In considering how to stem the flood of plant invasions into Hawaii, it is important to remember that the vast majority of these invasions don't "just happen"; they result from conscious choices made by humans to plant invasive species. Even though it is tempting to think that planting some beautiful tree or shrub in one's backyard, along the street, or in an agricultural lot is harmless, the fact that seeds of many of these plants are widely dispersed by birds or wind means that these seemingly innocuous plantings can easily impact what remains of native Hawaii, even if that impact is not easily seen by the original planter.

13.301-A The prudent choice for the responsible horticulturist is to avoid such invasive plants and, instead, landscape or garden with either native plants or non-invasive Introduced Post Captain Cook plants.

APPENDIX ENTRIES

Appendix A. History of the Maui County Arborist Committee

No	Date	Instrument	Specifics
1	12/ 1/1922	Ordinance 60	"AN ORDINANCE FOR THE PROTECTION OF TREES, PLANTS, AND SHRUBS, PLANTED ALONG PUBLIC HIGHWAYS, OR IN PUBLIC PARKS OF THE COUNTY OF MAUI." Signed by S. E. Kalama, Chairman and Executive Officer, Board of Supervisors within and for the County of Maui, T. H. The ordinance consisted of one paragraph (somewhat similar to number 4 below) with fines ranging from $10.00 to $50.00 for malicious mutilation of county trees, shrubs, and plants. Imprisonment was an option if the fine and costs were unpaid.
2	1975	HRS 58	Establishing County Arborist Advisory Committees Statewide. a. 58, Exceptional Trees. The purpose of this legislation was to consider the importance and value of exceptional trees to the community and to provide for their care and protection in the planning process. HRS 58 said that "Each county of the State shall establish a county arborist advisory committee,…." b. See Appendix C, page 225, for a copy of HRS 58.
3	1977	Tree City USA	Jan Dapitan was hired by Mayor Elmer F. Cravalho under contract to write a Recreation Plan for Maui County. She worked with the Maui Outdoor Circle to plant street and park trees that qualified Maui to receive the "Tree City USA" recognition from the National Arbor Day Foundation. The award has been given to Maui annually since 1977, making Maui the oldest Tree City USA in the State of Hawaii. Jan Dapitan was hired as a Maui County employee in 1979.
4	1980	Ordinance 60 became 12.24	"Injuring Trees or Plants". "Prohibited Acts. A. Whoever shall willfully, maliciously or negligently mutilate, cut down, dig up, burn or otherwise injure any shade or ornamental trees, or other ornamental plant or shrub, growing on any public highway or in any public park of the county, unless the same is authorized by the council of this county or those acting under its authority or by other persons by law authorized, shall be deemed guilty of a misdemeanor and upon conviction thereof may be punished by a fine not less than the sum of ten dollars nor more than fifty dollars." (The above paragraph is a slightly revised version of the 1922 Ordinance 60 when it became Chapter 12.24 in the 1980 Maui County Code, see Appendix B, page 220).

No	Date	Instrument	Specifics
5	12/23/1981 and 2/28/1983	Bill No. 14; & Ordinance No. 1297	Mayor Hannibal Tavares proposed amending Maui County Code Chapter 12.24 in Bill 14 (1981). He signed ordinance No. 1297 on February 28, 1983. Parts of that ordinance follow: a. Title changed from "Injuring Trees or Plants" to: "Policies and Guidelines for the Planting and Protection of Trees". b. "There shall be a Maui County Arborist Advisory Committee (MCAAC) consisting of seven (7) members who shall be ……." c. "The Committee shall prepare for recommendation to the mayor and county council a tree plan which shall serve as a guide for the care, preservation, pruning, planting, replanting, removal and disposition of trees in the county." d. "The Committee shall have the following powers and duties concerning the identification and preservation of exceptional trees….." The amended 12.24 satisfied the intent of HRS 58. It also gave the MCAAC the assignment of developing a "Maui County Planting Plan" (MCPP). The MCAAC was placed within Parks and Recreation and Jan Dapitan, Volunteer Action Coordinator, provided its administrative support.
6	9/24/1990	Ordinance 1944	Replaced Maui County Code Chapter 12.24 with 12.24A. Mayor Hannibal Tavares' signature approved ordinance 1944. The ordinance: a. Repealed Chapter 12.24 and replaced it with Chapter 12.24A "Landscape Planting and Beautification". b. Renamed the MCAAC to the Maui County Arborist Committee (MCAC). Increased the committee membership from seven to nine members. c. Transferred administrative support of the MCAC to the Department of Planning. d. Increased the responsibility of the Director of Parks and Recreation to include "overseeing and coordinating the planting and maintaining of all trees and landscape plantings in public parks and rights-of-way of streets in the county."
7	4/5/1991	MCPP Draft	The County Council approved a draft of the First Edition of the Maui County Planting Plan (MCPP).
8	9/1/1991	First Edition of the MCPP	Because the First Edition of the Maui County Planting Plan dealt only with trees, some text and appropriate tables, it was published "in house". A more inclusive edition was being written.

No	Date	Instrument	Specifics
9	10/29/93	Ordinance 2268	By signing this ordinance, Mayor Linda Crockett Lingle authorized MCAC members to be appointed to a second consecutive term. It also returned the committee to Parks and Recreation for Administrative support.
10	7/20/1994	MCPP Second Edition	This edition contained chapters on trees, turfgrass and groundcovers, Native and Polynesian introduced plants, proper planting methods, irrigation and water conservation, and exceptional trees. It was printed by a commercial company.
11	2/1995		Sue Kiang joined Parks and Recreation Department as its Volunteer Action Coordinator. She provided the MCAC with administrative support.
12	9/9/1996	County Arborist Position	After Arborist Committee members testified on its behalf for many years and worked with the County Personnel Services Office on a job description and salary placement, David I. Sakoda was hired as the first Maui County Arborist.
13	12/2000	MCPP reprinted	No changes of text were made. The cover was "off white" in color and the County Logo and wording were in black.
14	2012	MCPP third edition	Because the Arborist Committee wanted more shade along streets, in parks, and especially in parking lots, and wanted to exclude planting of invasive species in public places, this third edition of the Maui County Planting Plan was necessary.
Planting projects the Maui County Arborist Committee partnered with the Maui Outdoor Circle, the Maui Association of Landscape Professionals, and various community groups to beautify Maui's highways.			
1	11/11/1995	Planted 28 loulu palms, *Pritchardia hillebrandii*, and 31 royal poinciana, *Delonix regia,* within Kaahumanu Avenue's medial strip from the Kaahumanu Shopping Center to the overhead bridge in Wailuku. The second of three phases.	
2	July 2002	Planted 35 monkeypod, *Samanea saman*, 23 royal poinciana, *Delonix regia*, and 17 kukui nut, *Aleurites moluccana,* along a two mile stretch of Hana Highway's eastern shoulder from its Haleakala Highway intersection down to its Pulehu Road intersection; a two mile stretch.	

Appendix B: Maui County, Hawaii, Code of Ordinances: Title 12 - STREETS, SIDEWALKS, AND PUBLIC PLACES Chapter 12.24A - LANDSCAPE PLANTING AND BEAUTIFICATION

Chapter 12.24A - LANDSCAPE PLANTING AND BEAUTIFICATION

Sections:

12.24A.010 - Purpose.

The purpose of this chapter is to encourage the establishment of landscape planting and to protect, preserve and encourage the planting of trees in the county. It is intended that establishment of landscape planting, with proper maintenance and the protection and preservation of exceptional trees, will contribute to the outstanding environmental and aesthetic quality associated with Maui County.

(Ord. 1944 § 2 (part), 1990)

12.24A.020 - Definitions.

Wherever used in this chapter, unless the context otherwise requires:

"Arborist" means the Maui County arborist.

"Committee" means the Maui County arborist committee.

"Exceptional trees" means a tree or stand or grove of trees with historic or cultural value, or which by reason of age, rarity, location, size, aesthetic quality, or endemic status has been designated by ordinance as worthy of preservation. Exceptional trees may be designated generally by history or individually by location or class or as otherwise provided by law.

"Hazardous tree or shrub" means any tree or shrub which overhangs or encroaches onto any sidewalk, street or other public place in such a way as to impede or interfere with pedestrian or vehicular traffic or travel on such public place, or which obstructs any street lamp, traffic-control device or utility line except for electric power lines.

"Landscape planting" means the establishment of plantings in a comprehensive fashion which is intended to enhance environmental and visual quality.

"Landscape planting plan" means the Maui County landscape planting plan prepared by the committee pursuant to section 12.24A.030 of this chapter.

"Park trees" means trees in areas, other than street rights-of-way, which are owned, controlled or regulated by the county and used for public park or recreational purposes.

"Plan reviewer" means the Maui County arborist committee plan reviewer.

"Public area" means all parks, roads, streets, rights-of-way, and other areas owned, leased, maintained or otherwise under the control and domain of the county.

"Street trees" means all trees planted or growing within the right-of-way of all streets, avenues, roads or highways under the jurisdiction of the county.

"Tree" means any perennial plant with a woody trunk, branches, and leaves.

(Ord. 2268 § 1, 1993: Ord. 1944 § 2 (part), 1990)

12.24A.030 - Maui County arborist committee.

A.

Establishment. There is established a Maui County arborist committee which shall consist of nine members appointed and who may be removed by the mayor with notice to, but without approval by, the county council. The members shall be residents of the county with professional or other interest in landscape beautification. There shall be six nonvoting, ex-officio members consisting of: the arborist, the plan reviewer, the director of parks and recreation, the director of public works and waste management, the director of planning, and the director of housing and human concerns or their respective designees.

B.

Terms and Operations. Section 13-2 of the revised charter of the county shall apply to the committee in the same manner as said provisions apply to boards and commissions recognized by the revised charter; provided that any member may be reappointed to a second consecutive term and provided that any vacancy on this committee shall be filled by appointment by the mayor with notice to, and without approval of, the county council.

C.

Duties and Responsibilities.

1.

The committee shall have prepared for review by the mayor and county council a landscape planting plan which shall serve as a guide for the care, preservation, pruning, planting, replanting, removal and disposition of planted material in public areas throughout the county.

2.

The committee shall serve as a reviewing body for any landscape planting in public parks and street beautification programs.

3.

The committee shall review and make recommendations to the director of planning for his approval or disapproval of proposals that have been reviewed by the plan reviewer and found to be inconsistent with the landscape planting plan.

4.

The committee shall research, prepare and recommend exceptional trees to be protected and appropriate protective ordinances, regulations and procedures to the mayor and county council.

5.

The committee shall review and comment on any rules and regulations of executive agencies governing the planting, replanting, removal and disposition of park and street trees and plantings in the county.

6.

The committee shall identify to the director of parks and recreation any areas within the county where there are no abutting owners to maintain street trees and where the county should maintain or beautify.

7.

The committee, after consultation with the department of public works and waste management and the department of parks and recreation, shall promulgate rules and regulations pursuant to chapter 91 of the Hawaii Revised Statutes for the following:

a.

Practice and procedure for the committee,

b.

Exceptional trees,

c.

Approval of landscape planting proposals,

d.

Planting and care of trees and landscape planting in public parks and streets, including irrigation systems for street trees.

When rules or regulations do not cover a particular circumstance, the committee shall recommend appropriate action.

8.

The committee shall establish a list of exception trees in the county. The list of exceptional trees shall be adopted by the county council and shall be deemed incorporated by reference to this section. The procedures for designating an exceptional tree are as follows:

a.

Any citizen or citizen group may petition the committee to recommend for designation of a particular tree or stand or grove of trees with historic or cultural value, or which by reason of age, rarity, location, size, aesthetic quality or endemic status as worthy of preservation as exceptional tree(s) for the county. The committee shall recommend to the county council for its adoption any addition to the exceptional tree list.

b.

The committee, on at least an annual basis, shall re-examine the designated exceptional trees, and in the event such tree is found to be dangerous or diseased beyond repair, the county council, may remove such tree from the list of exceptional trees.

c.

Upon designation by the county council of an exceptional tree, the committee shall notify the property owner and/or the occupant of the property by registered mail that such designation has been made. Notice shall also be filed with the bureau of conveyances stating that the exceptional tree has been so designated.

(Ord. 2268 § 2, 1993: Ord. 1944 § 2 (part), 1990)

12.24A.040 - Landscape planting plan.

A.

Contents. The landscape planting plan shall be advisory and shall include, but not be limited to, the following:

1.

The objectives and policies of the county for the establishment of landscape planting and the preservation and protection of trees in the county;

2.

Guidelines for the establishment of landscape planting on streets and in parks;

3.

Guidelines for the maintenance and care of landscape planting and exceptional trees in public areas;

4.

Contain an official list of street trees;

5.

Designate the type of trees which are suitable for planting in the various geographical locations of the county as delineated in the general plan;

6.

Identify the types of street trees for planting within the rights-of-way of streets, avenues, roads or highways under the jurisdiction of the county;

7.

Identify the types of park trees for planting within public parks and recreational areas under the jurisdiction of the county;

B.

Adoption.

1.

The landscape planting plan may consist of separate parts, as determined by the committee, and may be submitted in parts for public hearing, and to the council and mayor as provided for in subsections 12.24A.040(B)(2) and (3) of this chapter.

2.

The committee shall hold at least one public hearing on the landscape planting plan prior to its submission to the mayor. Prior to the holding of the public hearing, the landscape planting plan shall be submitted to the council for its review and comment.

3.

After holding a public hearing, the landscape planting plan may be amended or approved by the committee and shall take effect upon approval by the mayor.

4.

Upon its approval, the landscape planting plan shall serve as an advisory document to all county departments.

5.

Any subsequent, substantive change in the landscape planting plan shall be subject to the provisions of subsections 12.24A.040(B)(2) and (3) of this chapter.

(Ord. 1944 § 2 (part), 1990)

12.24A.050 - Plan reviewer.

A.

There shall be a Maui County arborist committee reviewer who will act as liaison between the director of planning and the committee.

B.

The plan reviewer shall review all landscaping proposals and recommend for approval to the director of planning those proposals that are consistent with the landscape planting plan. The plan reviewer shall refer those proposals that are inconsistent with the landscape planting plan to the committee for their review and recommendations, which shall be submitted to the director of planning for approval or disapproval.

(Ord. 2268 § 3, 1993: Ord. 1944 § 2 (part), 1990)

12.24A.060 - Administration.

The department of parks and recreation shall provide staffing, and technical and clerical services as may be required by the committee.

(Ord. 2268 § 4, 1993: Ord. 1944 § 2 (part), 1990)

12.24A.070 - Planting of street trees.

A.

The director of parks and recreation shall be responsible for overseeing and coordinating the planting and maintaining of all trees and landscape plantings in public parks and rights-of-way of streets in the county.

1.

There shall be a Maui County arborist and staff within the department of parks and recreation to plant and maintain trees in the public parks and rights-of-way of streets.

2.

The arborist shall advise the arborist committee on the landscape planting plan and exceptional trees, and shall advise the committee, the public and all agencies in the planting, care and preservation of trees and landscape plantings.

B.

The landowner abutting a street, avenue, road or highway under the jurisdiction of the county may plant a street tree within the county right-of-way abutting the landowner's property with the recommendation of the committee and approval of the directors of public works and waste management and parks and recreation and subject to reasonable conditions consistent with the landscape planting plan.

C.

Any person may plant street trees within the county right-of-way with the recommendation of the committee and approval of the directors of public works and waste management and parks and recreation and subject to reasonable conditions consistent with the landscape planting plan.

D.

Subdivisions.

1.

For any subdivision of property into four or more lots, the director of public works and waste management shall require from the subdivider, a planting plan which identifies the areas where street trees may be planted, so as not to interfere with the health, safety and welfare of the public. The director of public works and waste management shall require the planting of trees in conformance with the approved planting plans, the landscape planting plan and applicable law.

2.

The number of recommended street trees for a subdivision and provisions for their irrigation shall be provided for in accordance with the landscape planting plan.

3.

The director of public works and waste management shall require a plan of irrigation in addition to a description of the number of trees, location, type and sizes and other requirements that are in accordance with the planting plan.

4.

Notwithstanding any provision to the contrary, irrigation systems for street trees shall not require easements when such systems are in the county right-of-way; provided, however, that the landowner abutting the county right-of-way shall execute an agreement, running with the land and recorded with the bureau of conveyances, indemnifying the county against any liability, damages, or claims including property damage or personal injury arising from such systems.

5.

Notwithstanding any provision to the contrary the plans proposed for the subdivision shall be reviewed by the plan reviewer for compliance with the landscape planting plan and approved by the director of planning.

E.

The department of parks and recreation shall be responsible for all general maintenance on street trees that are designated to be maintained by the county except that the property owner abutting any planting strip shall be responsible for watering and occasional fertilizing. The property owner abutting any planting strip shall also be responsible for the maintaining and weeding of the planting strip.

(Ord. 2286 § 5, 1993: Ord. 1944 § 2 (part), 1990)

12.24A.080 - Planting of park trees.

A.

Any person may plant a tree within any park or recreational facility of the county with the permission of the director of parks and recreation consistent with the landscape planting plan.

B.

The department of parks and recreation shall perform all general maintenance on park trees.

(Ord. 1944 § 2 (part), 1990)

12.24A.090 - Hazardous trees and shrubs.

A.

Any hazardous tree or shrub planted on private property shall be trimmed by the owner of the premises on which such tree or shrub grows so that the hazard shall cease.

B.

Any tree or shrub not planted on private property and which interferes with utility lines shall be trimmed by the utility companies whose lines may be affected. Except for electric power lines, private property owners are responsible for trimming trees and shrubs which interfere with utility lines over their property.

C.

When a landowner fails to trim a hazardous tree or shrub pursuant to section 12.24A.090(A), the director of parks and recreation upon being notified of such hazardous condition may notify the owner of record in writing of the hazardous tree or shrub, describing the conditions, and establishing a reasonable time within which corrective steps shall be taken. For the purpose of this chapter, a "reasonable time" shall be no more than fourteen calendar days from the date of mailing of the notification, which mailing shall be by certified mail. In the event that effective steps to correct the dangerous condition are not taken within the time specified, it shall be lawful for the county to abate such condition to the extent necessary to assure compliance with the foregoing requirements. The costs thereof shall be assessed to the responsible owner.

D.

Should the county take action to abate dangerous conditions, the cost of such abatement shall constitute a lien against the property which will run with the land. Notification of the imposition of the lien shall be sent to the owner of record. Failure to discharge such lien shall be enforceable in the same manner as a default in payment of real property taxes.

(Ord. 1944 § 2 (part), 1990)

12.24A.100 - Prohibited acts.

A.

Whoever shall willfully, maliciously or negligently mutilate, cut down, dig up, burn or otherwise injure any street or park tree, or other ornamental plant or shrub, growing on any public way or in any public park of the county, unless authorized by the director of public works where such is located in a public right-of-way or by the director of parks and recreation, where such is located in a county park, shall be deemed guilty of a misdemeanor, and upon conviction, shall be punishable by a fine of one thousand dollars or imprisonment not to exceed one year, or both.

B.

Whoever shall fail to maintain by watering and weeding an abutting street tree or planting strip, or both, pursuant to section 12.24A.070(E) of this chapter, or fail to remove obstructions pursuant to section 12.24A.090 of this chapter shall be deemed guilty of a violation and upon conviction thereof shall be punishable by a fine not exceeding $500.

C.

Whoever shall willfully, maliciously or negligently mutilate, cut down, dig up, burn or otherwise injure any exceptional tree shall be deemed guilty of a misdemeanor and, upon conviction, shall be punishable by a fine of $1,000 or imprisonment not to exceed one year, or both.

(Ord. 1944 § 2 (part), 1990)

Appendix C: HRS Chapter 58 (1 through 5) on Exceptional Trees

Section
58-1 Purpose
58-2 County arborist advisory committees; establishment
58-3 County arborist advisory committees; powers and duties
58-4 County protective regulations
58-5 State assistance

[§58-1] Purpose. It is the policy of the State to safeguard exceptional trees from destruction due to improper land development, and the legislature finds that enactment of protective regulations by the counties to accomplish this is a valid and important public purpose. [L 1975, c 105, pt of §2]

[§58-2] County arborist advisory committees; establishment. Each county of the State shall establish a county arborist advisory committee, which shall be appointed by the mayor and shall include the county planning director, or the director's designee; one member who shall be actively employed in the practice of landscape architecture, and not less than three other members selected on the basis of active participation in programs of community beautification, or research or organization in the ecological sciences, including ethnobotany, or Hawaiiana. [L 1975, c 105, pt of §2; gen ch 1985]

[§58-3] County arborist advisory committees; powers and duties. For the purposes of this chapter, the county committees shall have the following powers and duties in addition to those delegated by the respective county councils:

(1) To research, prepare, and recommend to the county council exceptional trees to be protected by county ordinance or regulation.
(2) To advise property owners relative to the preservation and enhancement of exceptional trees.
(3) To recommend to the county council appropriate protective ordinances, regulations, and procedures.
(4) To review all actions deemed by the county council to endanger exceptional trees.
For the purposes of this section, "exceptional trees" means a tree or stand or grove of trees with historic or cultural value, or which by reason of its age, rarity, location, size, esthetic quality, or endemic status has been designated by the county committee as worthy of preservation. The term "exceptional trees" does not apply to trees planted for commercial forestry operations in each county within the State. Exceptional trees may be designated generally by biotaxy or individually by location or class. [L 1975, c 105, pt of §2; am L 1977, c 69, §1]

[§58-4] County protective regulations. Each county shall enact appropriate protective regulations which designate exceptional trees; provide for special county review prior to destruction of exceptional trees, whether by removal or the existence of conditions which lead to the destruction of such trees; provide for site plan review and amendment to protect exceptional trees; and provide for injunctive relief against the removal or destruction of exceptional trees. [L 1975, c 105, pt of §2]

[§58-5] State assistance. The department of land and natural resources and the University of Hawaii shall cooperate with and to the fullest extent possible assist the counties and their respective committees in carrying out this chapter. [L 1975, c 105, pt of §2; am L 1980, c 293, §8]

Appendix D: Exceptional Trees of Maui County

Maui

M-1 Moreton Bay Fig, *Ficus macrophylla*

Location: Old Baldwin Manor, 355 Haiku Road, Haiku, TMK (2) 2-7-003-087

Landowner: Algal Partners, c/o William Simon & Sons, Inc., 310 South St. Morristown, NJ 7960; P.O. Box 678, Haiku, Hawaii 96708

Description: A very large and attractive specimen

Dimensions: Height 84 feet, Diameter 133 inches, Crown Spread 130 feet

M-2 Royal Palm (group of 21), *Roystonea regia*

Location: Wailuku Elementary School, 355 South High Street, TMK (2) 3-4-007-001

Landowner: State of Hawaii, Department of Education

Description: An attractive array of stately trees around school entrance

Dimensions: Height 54 feet, Diameter 15 inches, Crown Spread 20 feet

M-3 Chinese Banyan, *Ficus microcarpa*

Location: Kalana Pakui Building, 250 South High Street, Wailuku, TMK (2) 3-4-008-042

Landowner: County of Maui, Department of Parks and Recreation

Description: Large tree planted by Dr. Hilario Moncado in 1937

Dimensions: Height 62 feet, Diameter 180 inches, Crown Spread 95 feet

M-4 Monkey Pod, *Samanea saman*

Location: Ka'ahumanu Church, 103 South High Street, Wailuku, TMK (2) 3-4-014-002

Landowner: Trustees of the Wailuku Church, Kaahumanu Church, P.O. Box 323, Wailuku, Hawaii 96793

Description: A large and well-formed specimen

Dimensions: Height 46 feet, Diameter 147 inches, Crown Spread 124 feet

M-5 Date palm, *Phoenix dactylifera*

Tree removed from the Exceptional Tree list because it died from old age.

M-6 West India Locust, *Hymenaea courbaril*

Location: Wailuku Sugar Plantation Manager's Home, 2471 Main Street, Wailuku, TMK (2) 3-4-014-060

Landowner: Kaanapali Kai, Inc., 2145 Wells St., Suite 301, Wailuku, Hawaii 96793

Description: A large specimen, rare in Hawaii

Dimensions: Height 73 feet, Diameter 36inches, Crown Spread 70 feet

M-7 Monkey Pod, *Samanea saman*

Location: Wailuku Sugar Plantation Manager's Home, 2471 Main Street, Wailuku, TMK (2) 3-4-014-060

Landowner: Kaanapali Kai, Inc., 2145 Wells St., Suite 301, Wailuku, Hawaii 96793

Description: A large and attractive specimen

Dimensions: Height 53 feet, Diameter 60 inches, Crown Spread 131 feet

M-8 **Indian Banyan, *Ficus benghalensis***

Location: Lahaina Courthouse Square, listed on National Register of Historic Places, 648 Wharf Street, Lahaina, TMK (2) 4-6-001-009

Landowner: County of Maui, Department of Parks and Recreation

Description: A majestic specimen dominating the historic Lahaina courtyard, planted on April 24, 1873, by Sheriff of Lahaina William O. Smith

Dimensions: Height 54.4 feet, Diameter 311 inches near ground level (11 trunks), Crown Spread 294 feet

M-9 **Breadfruit (Ulu), *Artocarpus altilis***

Location: Baldwin House, 120 Dickenson Street, Lahaina, TMK (2) 4-6-008-007

Landowner: County of Maui, Department of Parks and Recreation

Description: A tree planted by Rev. Dwight D. Baldwin in the early 1800's

Dimensions: Height 45 feet, Diameter 36.3 inches, Crown Spread 47 feet

M-10 **Kou, *Cordia subcordata***

Location: Baldwin House, 120 Dickenson Street, Lahaina, TMK (2) 4-6-008-007

Landowner: County of Maui, Department of Parks and Recreation

Description: A large specimen

Dimensions: Height 38 feet, Diameter 56.8 inches (3 trunks), Crown Spread 46 feet

M-11 **Monkey Pod, *Samanea saman***

Location: Hale Paahao, 187 Prison Street, Lahaina, TMK (2) 4-6-008-044

Landowner: County of Maui, Department of Parks and Recreation

Description: A large and attractive tree growing on the old Prison grounds

Dimensions: Height 67.5 feet, Diameter 74.5 inches, Crown Spread 100 feet

M-12 **Breadfruit, ulu. *Artocarpus altilis***

Tree removed from the Exceptional Tree list because it died from old age.

M-13 **California Featherduster Palm, *Washingtonia filifera***

Location: Hale Paahao, 187 Prison Street, Lahaina, TMK (2) 4-6-008-044

Landowner: County of Maui, Department of Parks and Recreation

Description: An attractive specimen located on the old Prison grounds

Dimensions: Height 46 feet, Diameter 23 inches (at 4 feet), Crown Spread 17 feet

M-14 **Mexican Featherduster, *Washingtonia robusta***

Location: Hale Paahao, 187 Prison Street, Lahaina, TMK (2) 4-6-008-044

Landowner: County of Maui, Department of Parks and Recreation

Description: An attractive specimen located on the old Prison grounds

Dimensions: Height 57.5 feet, Diameter 16 inches (at 4 feet), Crown Spread 10 feet

M-15 **Royal Palm, *Roystonea regia***

Location: Hale Paahao, 187 Prison Street, Lahaina, TMK (2) 4-6-008-044

Landowner: County of Maui, Department of Parks and Recreation

Description: A large and well-formed specimen on the old Prison grounds

Dimensions: Height 63 feet, Diameter 18 inches (at 4 feet), Crown Spread 16 feet

M-16 Royal Palm (2 rows including 20 trees), *Roystonea regia*

Location: Entrance to Lahainaluna High School, the oldest post-secondary school west of the Rocky Mountains, 980 Lahainaluna Road, Lahaina, TMK (2) 4-6-018-005

Landowner: State of Hawaii, Department of Education

Description: A stately avenue of palms

Dimensions (averages): Height 52 feet, Diameter 19 inches, Crown Spread 15 feet

M-17 True Kamani (2 trees), *Calophyllum inophyllum*

Location: Lahainaluna High School, the oldest post-secondary school west of the Rocky Mountains, 980 Lahainaluna Road, Lahaina, TMK (2) 4-6-018-012.

Landowner: State of Hawaii, Department of Education

Description: Two very large, old trees on this historic campus

Dimensions (#1-by museum): Height reduced, Diameter 66 inches, Crown Spread reduced

Dimensions (#2-close to road): Height reduced, Diameter 57 inches, Crown Spread reduced

M-18 'Ohe (2 trees), *Tetraplasandra hawaiiensis*

Location: D.T. Fleming Arboretum at Pu'u Mahoe, Kanaio, TMK (2) 2-1-009-017

Landowner: Martha Vockrodt-Moran, P.O. Box 241, Makawao, Hawaii 96768

Description: Planted by D.T. Fleming

Dimensions (larger of 2): Height 65 feet, Diameter 35.5 inches (below fork), Crown Spread 45 feet

M-19 Alani, *Melicope knudsenii*

Location: D.T. Fleming Arboretum at Pu'u Mahoe, Kanaio, TMK (2) 2-1-009-017

Landowner: Martha Vockrodt-Moran, P.O. Box 241, Makawao, Hawaii 96768

Description: Planted in 1953 from seeds gathered from Auwahi slopes of Haleakala

Dimensions: Height 20 feet, Diameter 9.5 inches, Crown Spread 20 feet

M-20 'Āla'a, *Pouteria sandwicensis*

Location: D.T. Fleming Arboretum at Pu'u Mahoe, Kanaio, TMK (2) 2-1-009-017

Landowner: Martha Vockrodt-Moran, P.O. Box 241, Makawao, Hawaii 96768

Description: This is the larger of two trees

Dimensions: Height 25 feet, Diameter 16.5 inches (below fork), Crown Spread 30 feet

M-21 Podocarpus (2 trees), *Afrocarpus falcatus* (a male and female of this species)

Location: D.T. Fleming Arboretum at Pu'u Mahoe, Kanaio TMK (2) 2-1-009-017

Landowner: Martha Vockrodt-Moran, P.O. Box 241, Makawao, Hawaii 96768

Description: Planted by D.T. Fleming

Dimensions: The larger of two trees: Height 70 feet, Diameter 57 inches (below fork, but above low lateral), Crown Spread 70 feet.

M-22 Loulu, *Pritchardia forbesiana*

Location: D.T. Fleming Arboretum at Pu'u Mahoe, Kanaio TMK (2) 2-1-009-017

Landowner: Martha Vockrodt-Moran, P.O. Box 241, Makawao, Hawaii 96768

Description: This is the largest of four trees

Dimensions: Height 25 feet, Diameter 10.5 inches, Crown Spread 12 feet

M-23 Rainbow Shower, *Cassia x nealiae*

Location: A 6.7 mile stretch of Baldwin Avenue starting at 0.5 miles from intersection with Hana Highway in Paia and ending below 'Ala'a Place in Makawao.

Landowner: County of Maui, Department of Parks and Recreation, county right of way

Description: Eighty-five trees planted along Baldwin Avenue right of way by Ethel Baldwin and later by Mayor Hannibal Tavares

Dimensions: Height 35 feet, Diameter 15 inches, Crown Spread 30 feet

M-24 California Pepper Tree, *Schinus molle*

Location: 406 Lower Kimo Drive, Kula TMK (2) 2-3-015-020

Landowner: Harlan Hughes & Judy E. Anderson, 406 Lower Kimo Drive, Kula 96790

Description: A large and beautiful specimen planted in 1957 by Jack and Loraine Claytor at the first house built on Lower Kimo Drive, (1951), dioecious species Male tree.

Dimensions: Height 50 feet, Diameter 53 inches, Crown Spread 85 feet

M-25 Jacaranda, *Jacaranda mimosifolia*

Location: 165 Hanamu Road, c/o Peter and Kathy Baldwin, Makawao, TMK (2) 2-4-010-001

Landowner: Haleakala Ranch Company, 529 Kealaloa Avenue, Makawao 96768

Description: The spreading canopy with its purple-blue bloom and pastoral setting is the subject of many artists' canvas

Dimensions: Height 60 feet, Diameter 63.5 inches, Crown Spread 103 feet

M-26 Kiawe, *Prosopis pallida*

Location: Honoapiilani Highway, near Mile Marker 11 oceanside, TMK (2) 3-6-001-013

Landowner: State of Hawaii, Department of Transportation

Description: Historic landmark at the ocean's edge with horizontal branch and two dominate lateral branches that reach over the water

Dimensions: Height 30 feet, Diameter 102 inches, Crown Spread 50 feet

M-27 True Kamani, *Calophyllum inophyllum*

Location: Old Hana School, Uakea Road, Hana, TMK (2) 1-4-004-030

Landowner: State of Hawaii, lease to County of Maui

Description: A very large, more than 90 year old tree fronting Old Hana School

Dimensions: Height 60 feet, Diameter 72.6 inches, Crown Spread 101 feet

Molokai

MO-1 Banyan, *Ficus sp.*

Location: Former Pau Hana Inn, 30 Oki Place, Kaunakakai, TMK (2) 5-3-006-028

Landowner: Molokaʻi Ohana Health Care, Inc., dba Molokaʻi Community Health Center, P.O. Box 2040, Kaunakakai, 96748

Description: A large spreading tree with an attractive fluted trunk

Dimensions: Height 80 feet, Diameter 227 inches (seven stems), Crown Spread 130 feet

MO-2 Loulu (grove), *Pritchardia hillebrandii*

This grove of palms, located on Huelo Island off the coast of Molokai, is now under federal jurisdiction and as a result removed from the Maui County Exceptional Tree list.

PLANT INDEX –LISTING BY SCIENTIFIC AND COMMON NAME

Listings below do not have Hawaiian diacritical markings. For proper diacritical marks for native plants, see Table 11-1: NATIVE & POLYNESIAN INTRODUCED PLANTS.

Index to be generated after all draft revisions.