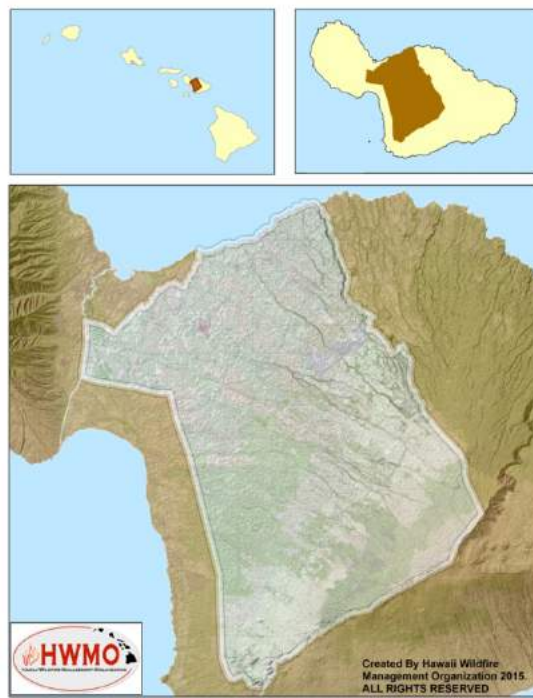
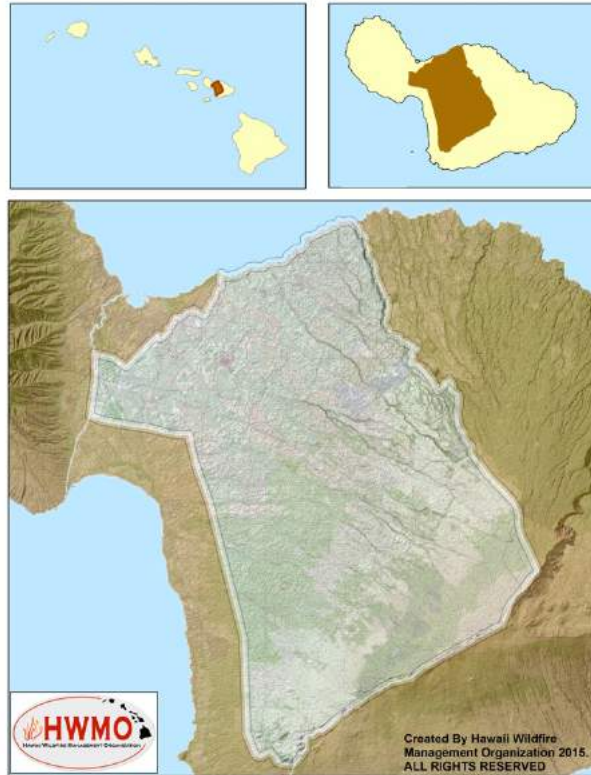


Community Wildfire Protection Plan



Upcountry Maui 2016

UPCOUNTRY MAUI COMMUNITY WILDFIRE PROTECTION PLAN



DEVELOPED BY HAWAII WILDFIRE MANAGEMENT ORGANIZATION © 2016



IN PARTNERSHIP WITH:
DEPARTMENT OF LAND AND NATURAL RESOURCES- DIVISION OF FORESTRY AND WILDLIFE; MAUI FIRE DEPARTMENT; AND COUNTY OF MAUI CIVIL DEFENSE AGENCY



ACKNOWLEDGEMENTS

Project Developed and Coordinated by: Hawai'i Wildfire Management Organization (HWMO), a 501 (c)3 nonprofit organization dedicated to protecting communities and natural resources in Hawai'i and the Pacific from wildfire. hawaiiwildfire.org

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Special Thanks to: Lance De Silva, Chief Jeffrey Murray, Anna Foust, Andrea Buckman, and Dr. Clay Trauernicht.

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MUTUAL AGREEMENT SIGNATURE PAGE
UPCOUNTRY MAUI COMMUNITY WILDFIRE PROTECTION PLAN

This Community Wildfire Protection Plan was developed for Upcountry Maui, Hawai'i by the Hawaii Wildfire Management Organization. This plan:

- Was collaboratively developed by agencies, entities, community members, and individuals with interest or jurisdiction in Upcountry Maui.
- Identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment that will mitigate wildfire in Upcountry Maui, Hawai'i.
- Recommends measures to reduce the ignitability of structures throughout the planning area.

The following entities mutually agree with the contents of this Community Wildfire Protection Plan:



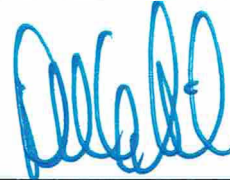
Jeffrey Murray, Fire Chief
Maui Fire Department

7/29/2016
Date



Anna Foust, Emergency Management Officer
County of Maui Civil Defense

7/29/2016
Date



David G. Smith, Administrator
State of Hawaii
Department of Land and Natural Resources
Division of Forestry and Wildlife

1/9/17
Date

INTRODUCTION

UPCOUNTRY MAUI COMMUNITY WILDFIRE PROTECTION PLAN

GOALS AND OBJECTIVES

This Community Wildfire Protection Plan (CWPP) was developed by the Hawai'i Wildfire Management Organization (HWMO) with guidance and support from federal, state, and county agencies and representatives, private resource management entities, community members, and decision makers concerned about wildfire issues in Upcountry Maui. State of Hawai'i Department of Land and Natural Resources- Division of Forestry and Wildlife (DLNR-DOFAW) was the primary partner in developing this plan.

This plan includes elements of fire protection, hazard assessment, wildfire mitigation priorities, and community outreach and education. The process used to develop this plan engaged a diversity of agencies and individuals concerned with the at-risk area, following the guidelines and requirements of federal programs such as the Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation program and the National Fire Plan (NFP).

The goals and objectives of this plan follow the intent and requirements of the *Healthy Forests Restoration Act (HFRA) of 2003 – HR 1904*, which describes a CWPP as a fire mitigation and planning tool for an at-risk community that:

- Is developed within the context of the collaborative agreements and the guidance established by the Wildland Fire Leadership Council and agreed to by the applicable local government, local fire department, and state agency responsible for forest management, in consultation with interested parties and the federal land management agencies managing land in the vicinity of the at-risk community.
- Identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment on Federal and non-Federal land that will protect one or more at-risk communities and essential infrastructure.
- Recommends measures to reduce structural ignitability throughout the at-risk community.¹

Stakeholder participants in the development of this plan agree that wildfire threats are imminent and can have widespread damage to Upcountry Maui watersheds, natural resources, and human communities. The danger of fire is related to high numbers of human-caused fires, dry conditions, strong winds, and high fire potential of vegetation. In the last decade, numerous areas of Upcountry Maui have burned. The CWPP is a first step toward increased public-private collaboration toward wildfire preparedness and protection .

PLANNING AREA BOUNDARIES

The Upcountry Maui CWPP planning area includes the upland areas commonly referred to as *Upcountry Maui*, on the Island of Maui, Hawai'i, as well as nearby downslope communities. The planning area lies between East Maui, South Maui, and the main city center of Kahului.

The plan includes Federal, State of Hawai'i, County of Maui, Department of Hawaiian Home Lands (DHHL), and privately owned lands. The CWPP planning boundaries meet other Maui-based CWPP boundaries, comprehensively defining the entire island of Maui as a WUI at-risk area. The concurrent WUI and CWPP planning areas include communities and their surrounding lands to ensure adequate protection of natural areas and associated human communities from the threat of wildfire. The Upcountry Maui planning boundaries were chosen through stakeholder meetings and addresses one of the County of Maui's fire prone regions.



The Upcountry Maui CWPP is part of a series of CWPPs in Maui County. The Western Maui CWPP was completed in 2014. Upcountry Maui and Moloka'i are being developed concurrent to the Upcountry Maui CWPP. A CWPP exists for Kahikinui, as well, and will soon be updated. Additional CWPPs in the County of Maui may be developed as communities gain interest in wildfire preparedness planning and as funds become available to complete the planning process. See Map 1 for the Upcountry Maui CWPP planning area boundaries.

Map 1. *Upcountry Maui CWPP Planning Area Map.*

PLANNING PROCESS, METHODS, AND PARTICIPANTS

CWPP PROCESS AND METHODS

The process of developing a CWPP helps to clarify and refine priorities for the protection of life, property, and critical infrastructure in the wildland-urban interface (WUI) areas. Local residents, landowners, fire suppression agencies, and community leaders have participated in valuable discussions regarding wildfire history, resources at risk, areas of concern, and priority mitigation actions. The methods used to create this CWPP followed the guidelines established by the HFRA, which requires the following actions during the planning process:

- Contact Decision Makers
- Involve Federal Agencies
- Involve State and Local Agencies
- Engage Interested Parties

This CWPP followed these guidelines and additionally satisfies the requirements of the FEMA Pre-Disaster Mitigation program and the NFP.



Photo 1. Two community meetings were held in Upcountry Maui to collect wildfire-related concerns and recommended action ideas from residents.



Photo 2. Maui Civil Defense and DLNR-DOFAW were also represented at the meetings. Representatives provided additional input to the plan and answered questions posed by community participants.



Photo 3. Meeting participants separated into small groups to discuss wildfire issues and came back together toward the end of each meeting to share their highest priorities with the larger group.

PARTICIPANTS

State and Local Agencies

The representatives of the state and local agencies that have jurisdictional responsibilities in the vicinity of the Upcountry Maui CWPP planning area, and who have been involved in the development of the Upcountry Maui CWPP are:

Agency	Representative(s)
Maui Fire Department	Jeffrey Murray Fire Chief
Hawai'i Department of Land and Natural Resources- Division of Forestry and Wildlife	Lance De Silva, Forest Management Supervisor I David G. Smith, Administrator Robert Hauff, State Protection Forester
County of Maui Civil Defense Agency	Anna Foust

Table 1. CWPP Participants: State and Local Agencies.

Federal Agencies

The following federal agencies were consulted for area-specific and regional fire and environmental information and expertise:

Agency	Representative(s)
US Fish and Wildlife Service (USFWS)	Dawn Bruns, Acting Assistant Field Supervisor Section 7 & Habitat Conservation Plans Andrew Kikuta, Fire Management Specialist, Hawai'i and Pacific Islands

Table 2. CWPP Participants: Federal Agencies.

Decision Makers

The decision makers contacted for input and involvement in the development of the Upcountry Maui CWPP are represented in the following table. Neither provided specific input, however Councilperson Baisa responded with support for both the CWPP effort and for increasing wildfire response and preparedness capacity in the area.

Local Government	Name	Representing
Maui County Council	Mike White, Council Chair	Makawao-Ha'iku-Pā'ia
	Gladys C. Baisa, WR Chair	Upcountry Maui

Table 3. CWPP Participants: Decision Makers.

Interested Parties

The parties from our community that have shown interest in forest/fire management and contributed input into the Upcountry Maui CWPP are:

Interested Parties	Affiliation
Local Associations and Large Landowners	Leeward Haleakalā Watershed Restoration Partnership
Private Citizens	General Public

Table 4. CWPP Participants: Interested Parties.

WILDFIRES IN UPCOUNTRY MAUI BACKGROUND

Steep slopes, rough terrain, strong winds, and a large percentage of highly ignitable invasive grasses characterize the Upcountry Maui landscape. This, coupled with warm weather, recurring drought conditions, and a history of human-caused fires put the area at increased risk of wildfire. The proximity of development to fire-prone wildlands present hazardous conditions that now threaten Upcountry Maui communities and natural resources. Overgrown vegetation close to homes, pockets of open space within subdivisions, and an increase of non-native high fire-intensity plants around developed areas pose increasing threats to commercial, community, environmental, and residential resources. Together, these factors create the fire environment that puts Upcountry Maui at risk of wildfire. This section discusses those factors in detail.

FIRE ENVIRONMENT

CLIMATE

Wildfire occurrence in Upcountry Maui is tied to broad climate patterns, in that more and larger fires typically occur in the drier areas or areas affected by drought conditions. Rainfall in Upcountry Maui is highly variable over space and time and can greatly influence fire risk. For example, there is a greater likelihood of large wildfires during drought. Additionally, wet periods may increase the quantity of available vegetative fuels, which can increase both fire risk and the frequency that mitigation measures such as firebreaks and fuels reduction need to be maintained. Rainfall is typically greater in mauka (upland) and windward areas (Map 3), which may result in lower fire risk on average, but may also require more frequent maintenance of fuel management efforts. Daily weather patterns also influence fire risk. Key factors indicating high fire danger in Hawai'i are low relative humidity (RH), high temperature, and high wind speeds (Map 4). The combination of drought, low RH and high winds are tracked at the Honolulu International Airport by the National Weather Service and used to issue Red Flag warnings when high fire danger conditions are present in Hawai'i.

TOPOGRAPHY

The Upcountry Maui CWPP planning area sits entirely on the western slopes of Haleakala, a 10,023 ft. shield volcano, which makes up more than 75% of Maui and spans from the island's eastern coast to its central plains. The CWPP area is characterized by a combination of residential and agricultural areas, and rugged, often inaccessible terrain (Map 5). This topography creates dangerous conditions when wildfires occur and often limits the ability of emergency response agencies to effectively contain and suppress wildfires. Topography influences fire behavior, as wildfires spread more quickly as they progress upslope and drier areas burn at higher intensity. Upcountry Maui's diverse and steep topography

also places constraints on emergency access and evacuation options for local communities. Once wildfires spread into steep, upland areas, the lack of roads and difficult terrain frequently can limit fire response to costly aerial operations (i.e., bucket drops by helicopters).

VEGETATION AND NATURAL RESOURCES

The Upcountry Maui CWPP region has areas that are agricultural, nonnative grasslands and shrublands, and mixed forests (Map 6). The lower elevations contain little to no threatened or endangered species, but native and protected species do exist in the higher elevations (Maps 7, 8, 9).

The widespread establishment of nonnative grasslands and shrublands is a leading cause of increased fire risk in Upcountry Maui. In many areas, native forests have been replaced by nonnative species such as guinea grass (*Megathyrsus maximus*), buffel grass (*Cenchrus ciliaris*), kikuyu grass (*Pennisetum clandestinum*), red top natal grass (*Melinis repens*), cane grass (*Cenchrus purpureus*), pampas (*Cortaderia selloana* and *C. jubata*), tumbleweed (*Salsola tragus*), and gorse (*Ulex europaeus*). Nonnative grasslands and shrublands often act as uninterrupted 'wicks' that allow fires to spread from communities and roads (where ignition risk is highest) into areas that have contiguous fuels and more challenging access for firefighting efforts.

Several nonnative trees such as eucalyptus (*Eucalyptus spp.*), pine (*Pinus spp.* and *Araucaria spp.*), black wattle (*Acacia mearnsii*), and faya bush (*Morella faya*) also contribute to high fire risk in parts of Upcountry Maui. Chemical content in wattle and eucalyptus leaves and bark prevents decomposition, resulting in large and persistent fuel loads beneath live trees. These increased fuel loads can result in high intensity fires that result in 'torching' or vertical fire spread into tree canopies, as has been observed in eucalyptus stands during wildfires in areas statewide. Grass fires can also become canopy fires when fire travels into treetops via low hanging tree branches. This increases the difficulty of firefighting efforts, as canopy fires can spread quickly due to increased exposure to wind.

These nonnative, fire prone grass, shrub, and tree species provide abundant fine fuels that cure rapidly in dry conditions, are easily ignitable even in humid conditions, and allow fires to spread rapidly which create dangerous conditions for fire responders.

In addition to a small portion of Haleakalā National Park, there are two state-managed forested areas within the planning area (Map 2):

Waihou Spring State Forest Reserve

Waihou Spring Forest Reserve is located on the northwest slope of Haleakalā, approximately three miles mauka of Makawao town. It was established for the purpose of protecting the sources of Waihou Spring,

one of the few perennial springs on the west slope of Haleakalā. At approximately 186 acres, Waihou Spring Forest Reserve is relatively small but is a popular day-use area. Waihou Spring Forest Reserve is close to residential neighborhoods and has a well-used hiking trail, which are both potential ignition sources, since 99% of all fires in Hawai'i are started along roads and trails. Most of the Reserve has been planted with an assortment of timber species over the years, reforesting an area that was previously weedy grazing land. DLNR-DOFAW's current management objectives for Waihou Spring Forest Reserve include preserving the watershed, controlling target weed species, maintaining trails, and removing fallen trees to manage fire fuel loads. Na Ala Hele State of Hawai'i Trail and Access Program maintains one trail in the forest reserve: the Waihou Spring Trail, which follows the old Waihou Spring Forest Reserve tree plantation road and descends southward to the gulch below.²

The vegetation at Waihou Spring Forest Reserve consists predominantly of non-native plantation forest with some native trees remaining, mostly in the steeper gulch areas. Waihou Spring Forest Reserve contains no critical habitat as designated by the U.S. Endangered Species Act. Gorse has been a problem weed in the area ever since the establishment of the Forest Reserve, and contributes to the fire hazard. Historically, small fires have been common in the area, especially along the Maui Electric Company, Ltd. Power line easement that crosses the Forest Reserve. DLNR-DOFAW is the primary responder for fighting fires in the Forest Reserve.³

The following wildfire-related goals were identified in the 2010 management plan for the area:

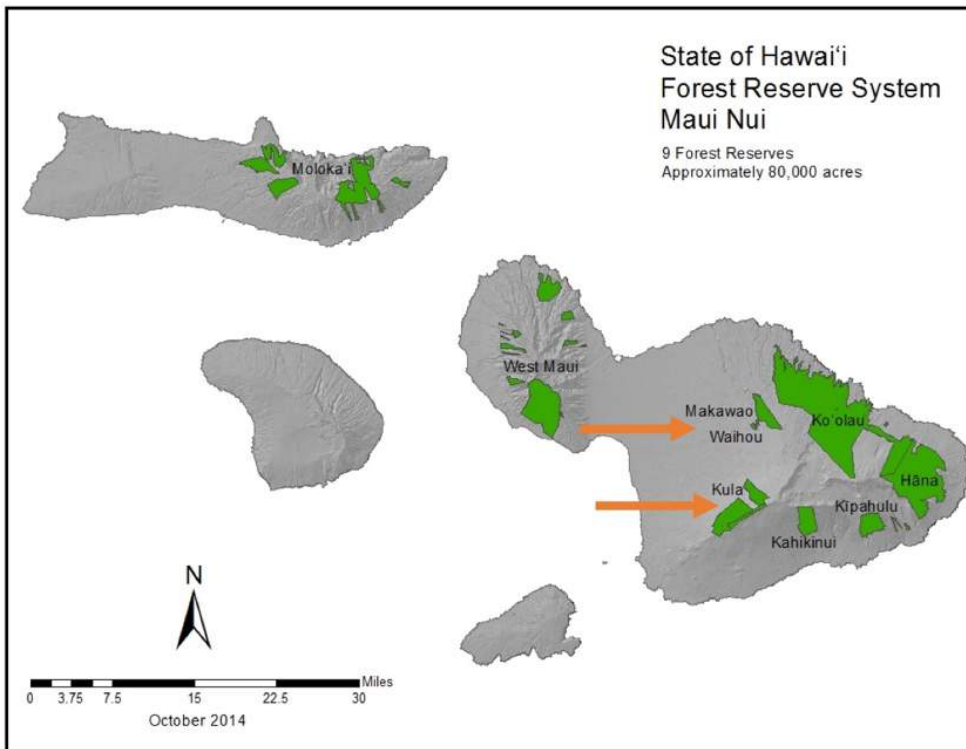
- Work with MECO to locate/develop a formal land use agreement for this power line.
- Require relocation of power lines underground or improve maintenance of MECO power line route.
- Cooperate with community in the creation and implementation of community wildfire protection plan.
- Mitigate downed tree fuel accumulation and minimize gorse and black wattle growth via mechanical and chemical vegetation control.

Kula Forest Reserve and Polipoli State Recreation Area

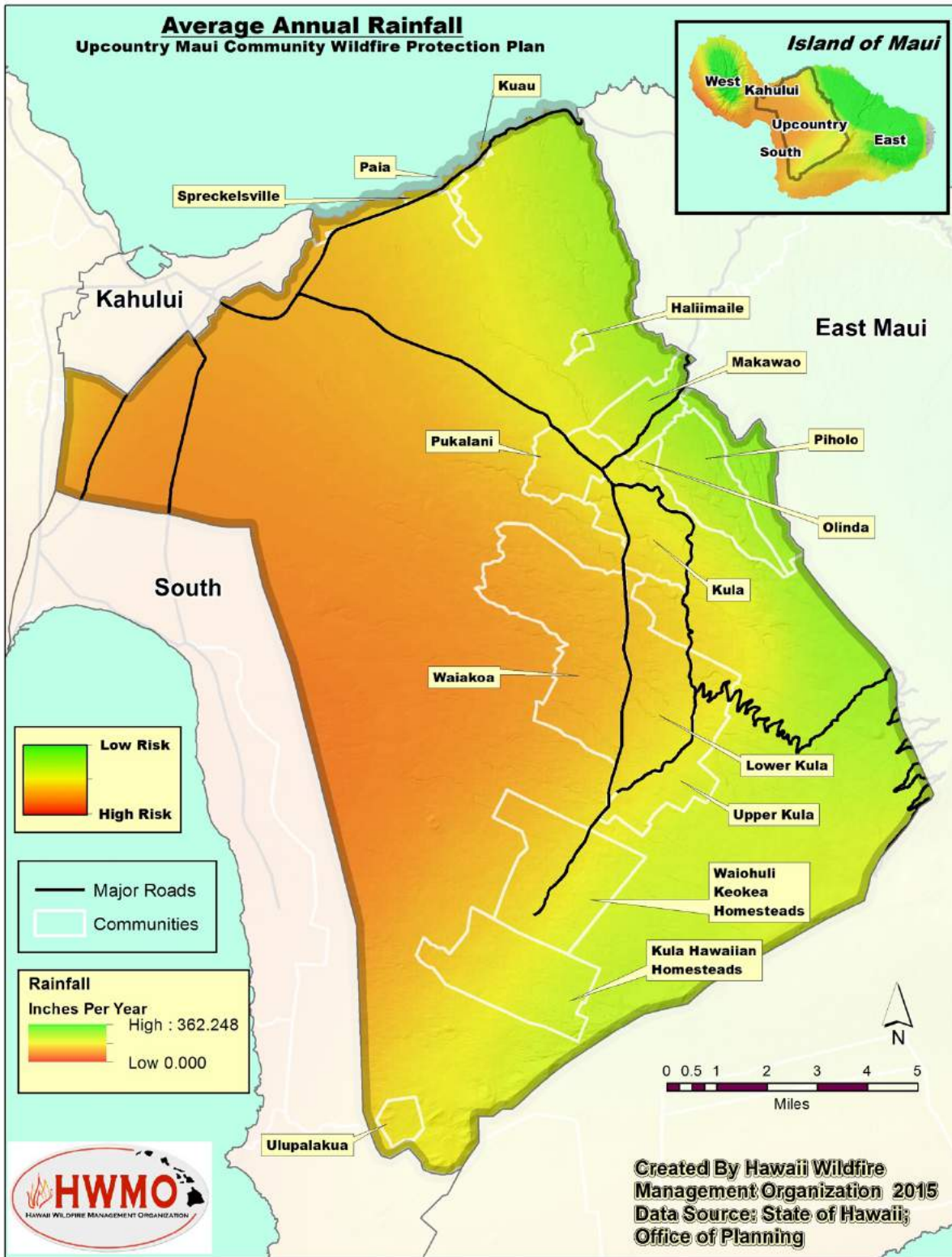
The Kula Forest Reserve is a 21,000-acre forested area managed by DLNR-DOFAW. The area was originally covered in dense forests of koa (*Acacia koa*), māmane (*Sophora chrysophylla*), and 'ōhi'a lehua (*Metrosideros polymorpha*). When the reserve was established, many parts were devoid of trees and have subsequently been reforested with pines, eucalyptus, tropical ash (*Fraxinus uhdei*), cypress (*Cupressus spp.*), China-fir (*Cunninghamia lanceolata*), and coast redwood (*Sequoia sempervirens*). Polipoli State Recreation Area is located within the fog belt of the Kula State Forest Reserve. Located at 6200-ft elevation, its 10 acres are frequented by recreationists for camping, hiking, and hunting. There is an extensive trail system in the forest reserve.

Dense fuel loads and high fire hazard exists in areas of the Kula Forest Reserve and its adjacent lands. The Kula Forest Reserve has significant levels of rare and endangered plants at risk. Fuels vary depending on location. The lower elevations and northwestern border contain black wattle, pine, and eucalyptus forest, all high hazard fire fuels, which stretch down to Kula highway and beyond. Bordering properties on other boundaries contain open pasture, with varied levels of fuel management, some of which also pose fire threats.

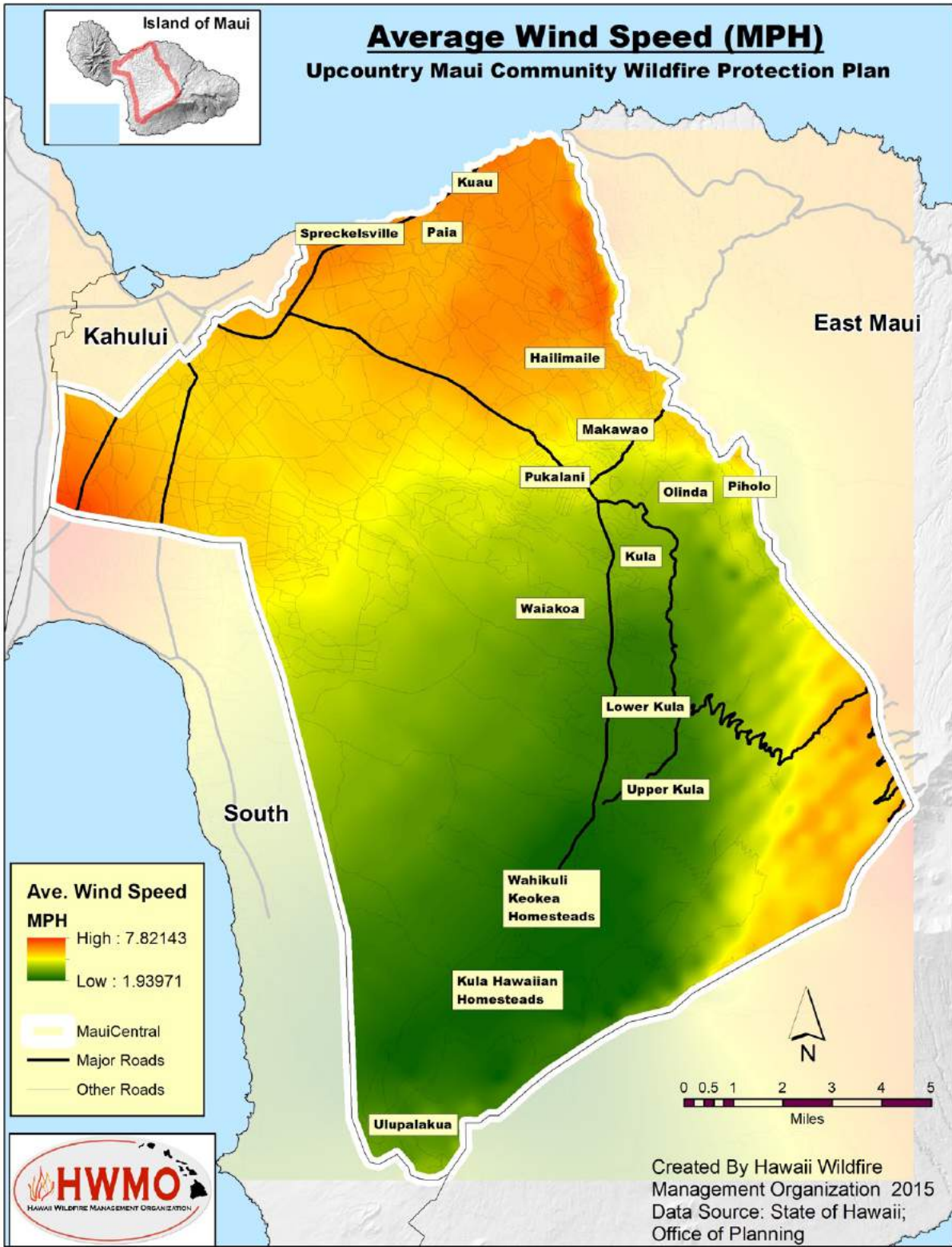
In 2007, a 2000-acre wildfire did extensive damage to the Kula Forest Reserve. In the years since the fire, the forest and downslope areas below the reserve have been severely damaged by wind and flooding, with much of the damage a direct result of wildfire.⁴ Public access was affected by long closures to hunting areas, hiking trails, and camping. Numerous fire prone invasive and nonnative species established after the 2007 fire in the burned areas and beyond. It is believed that fires in the Kula Forest Reserve and Polipoli State Recreational Area promote the spread of nonnative species like pine (which regenerate widely after fire) into nearby protected areas such as Haleakalā National Park.⁵ While typical weather and climate conditions do not frequently favor ignition and fire spread, the area does experience occasional sustained “light and variable” winds and periodic drought conditions that can desiccate vegetation, leading to heavy fuel loads and large and devastating fires if ignited.



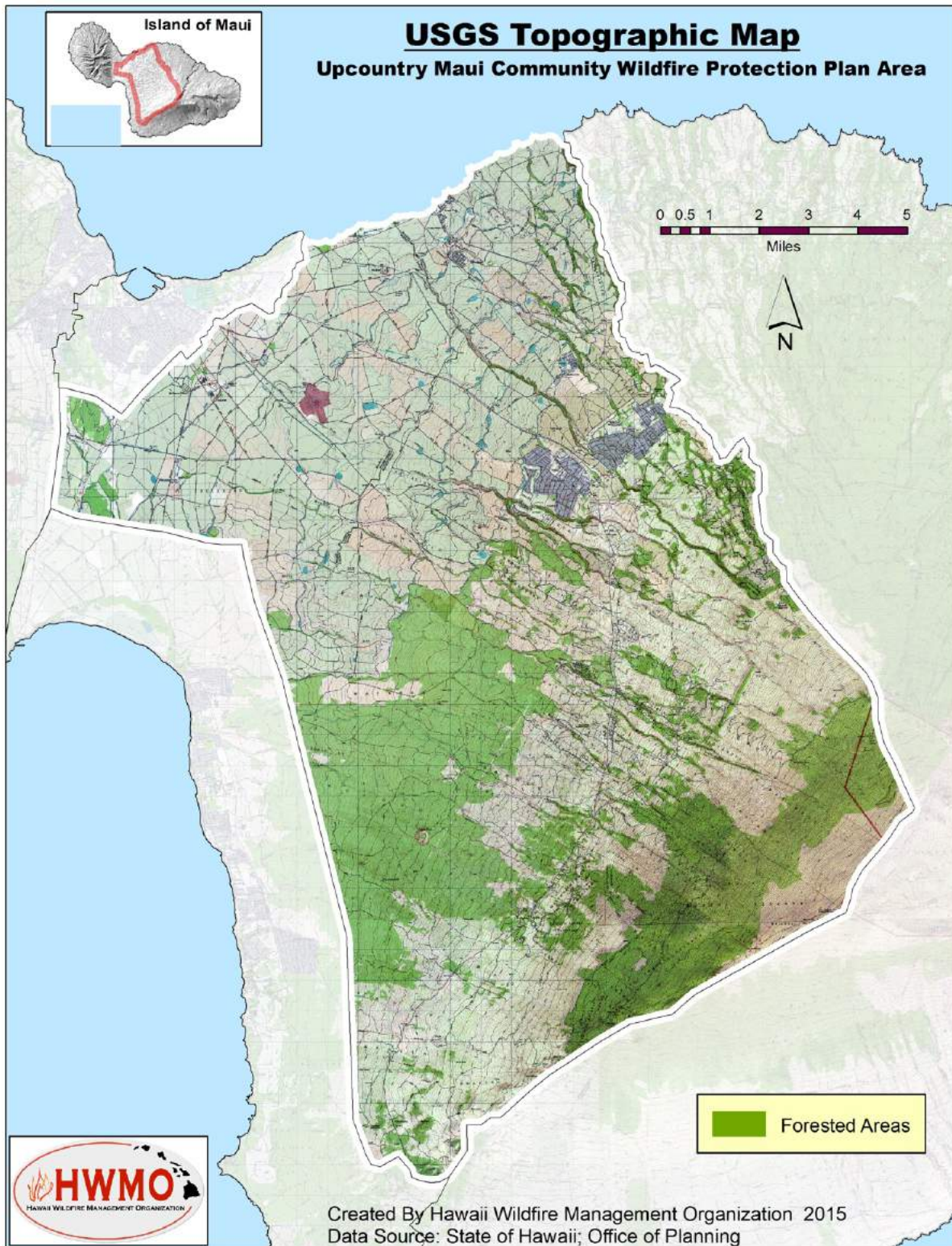
Map 2. Maui Forest Reserves. Waihou Spring (top arrow) and Kula Forest Reserves (bottom arrow) are both within the Upcountry Maui CWPP area. Source: DLNR-DOFAW.



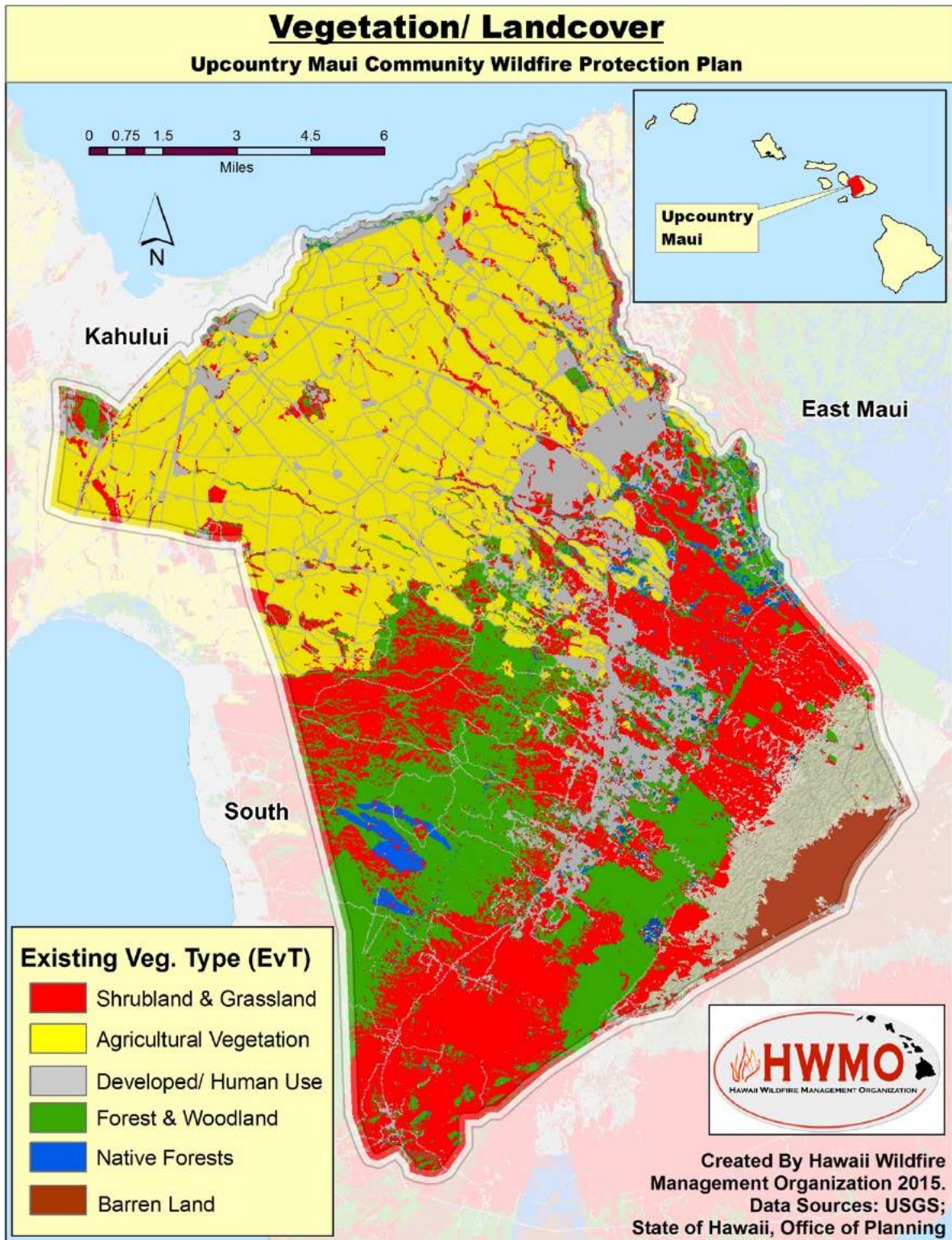
Map 3. Average Annual Precipitation Map.



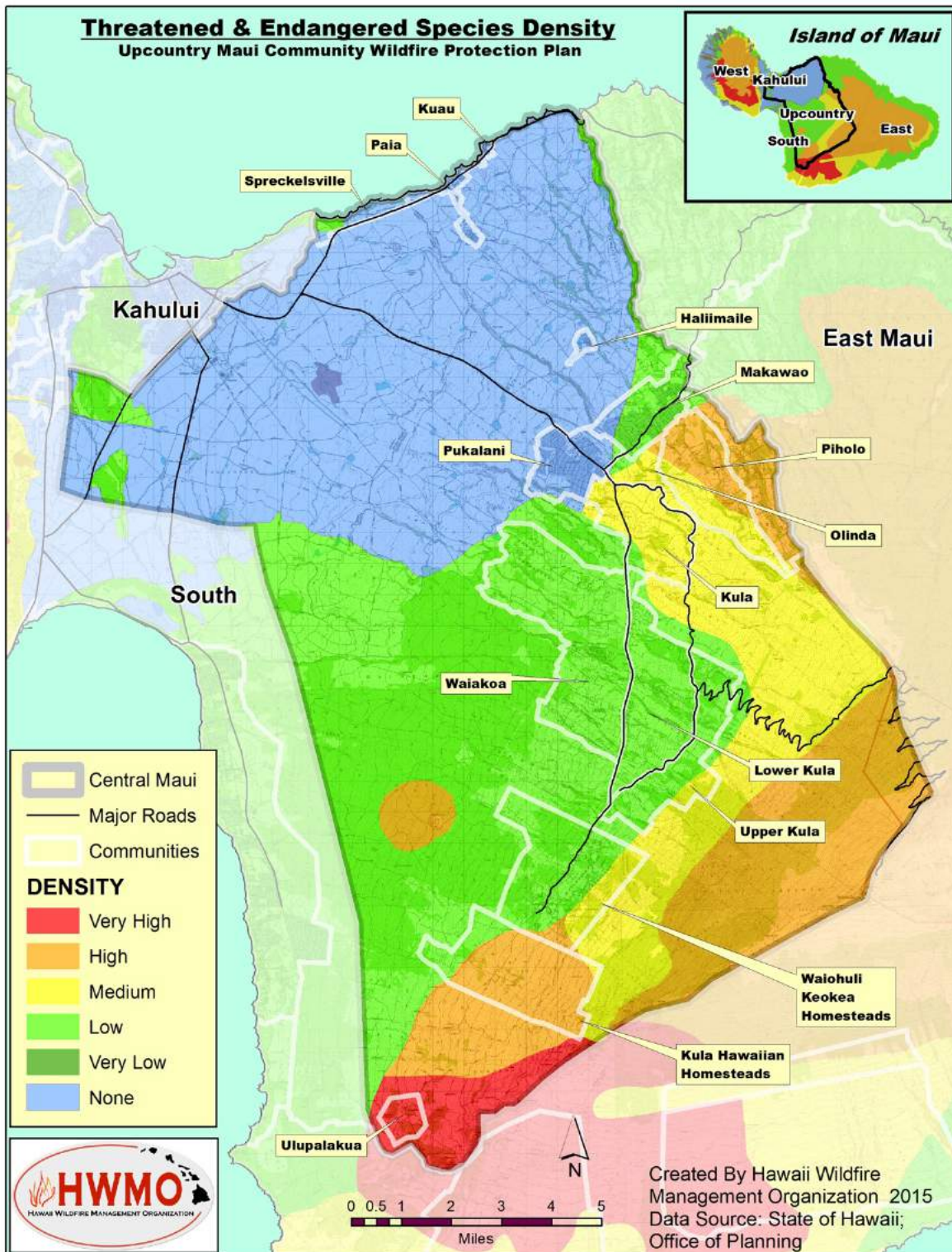
Map 4. Average Wind Speed Map.



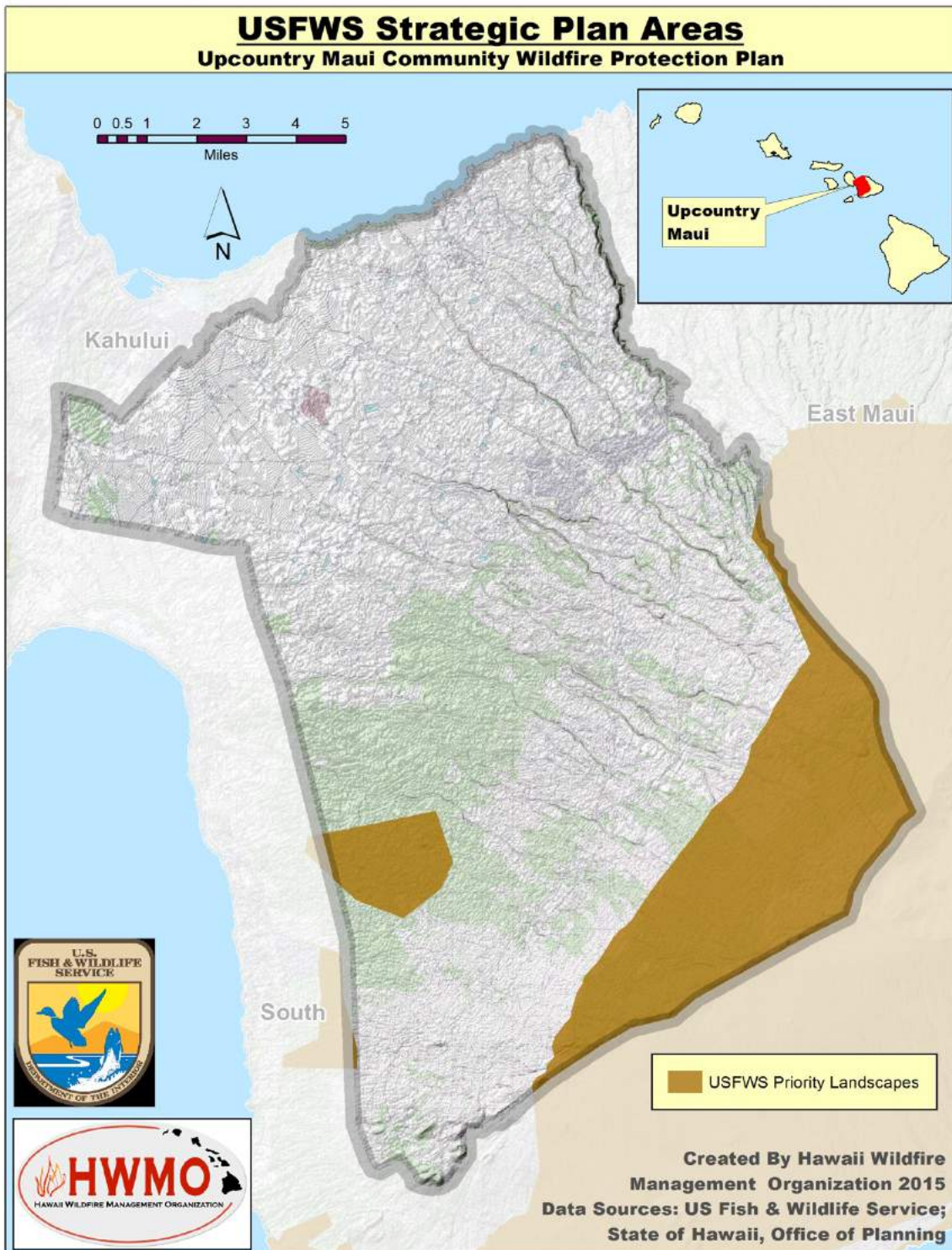
Map 5. Topographic Map of Upcountry Maui CWPP planning area, based on US Geological Survey data.



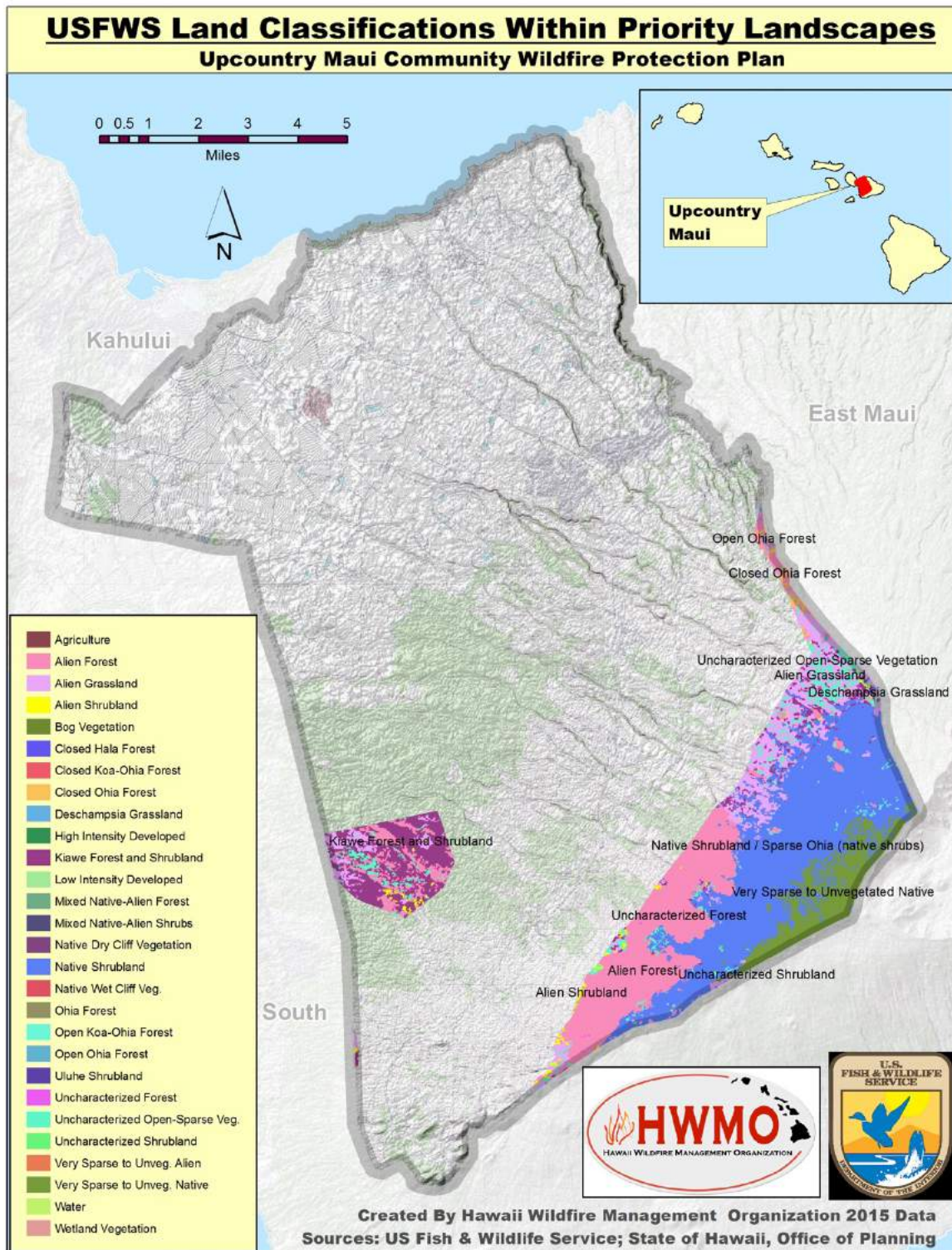
Map 6. Land cover/ Vegetation Map for Upcountry Maui CWPP planning area.



Map 7. Threatened and Endangered Species Densities Map for the Upcountry Maui CWPP planning area.



Map 8. USFWS Service map of Priority Landscapes within the CWPP planning area.



Map 9. USFWS Service map of land cover type within their Priority Landscapes areas of Upcountry Maui.

FIRE HISTORY

IGNITIONS

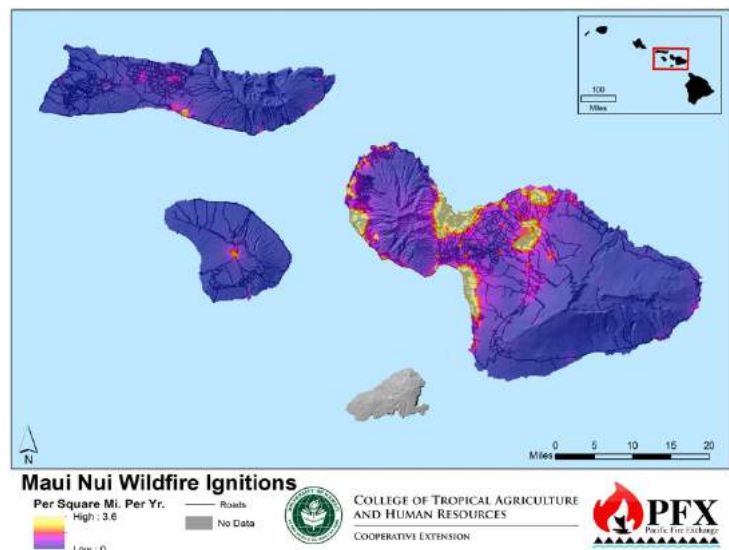
The WUI— the wildland-urban interface along which developed areas, roads, and community infrastructure abut undeveloped land— is where the majority of wildfire ignitions occur in all of Hawai'i. The Upcountry Maui CWPP planning area is no exception. Because of this, WUI areas often experience the greatest risk of loss of property, life, and natural resource function due to wildfire. The majority of wildfires on Maui are caused by human error or arson, especially near developments, power line right of ways, and along roadsides. Additionally, sprawling dry nonnative grasslands surround many communities. Once ignited along the interface, wildfire can spread rapidly through and around residential areas, threatening both property and life. Wildfires in lesser developed areas, follow agricultural lands, and in the higher elevations also spread and threaten natural areas, and the native and protected species they may contain.

FIRE INCIDENT MAP

In 2013, HWMO completed an effort to compile wildfire records from fire suppression agencies across the state, which resulted in a statewide wildfire database, as well as region-specific wildfire incident maps. The Upcountry Maui Wildfire Incident Map (Map 11) includes MFD's documented responses to wildfires between January 2000 and January 2011 and wildfire ignition points recorded by DLNR-DOFAW from 1998-2012. The map displays ignition points, and does not indicate the final perimeter of burned areas. However, using this and other information, Dr. Clay Trauernicht at University of Hawai'i Cooperative

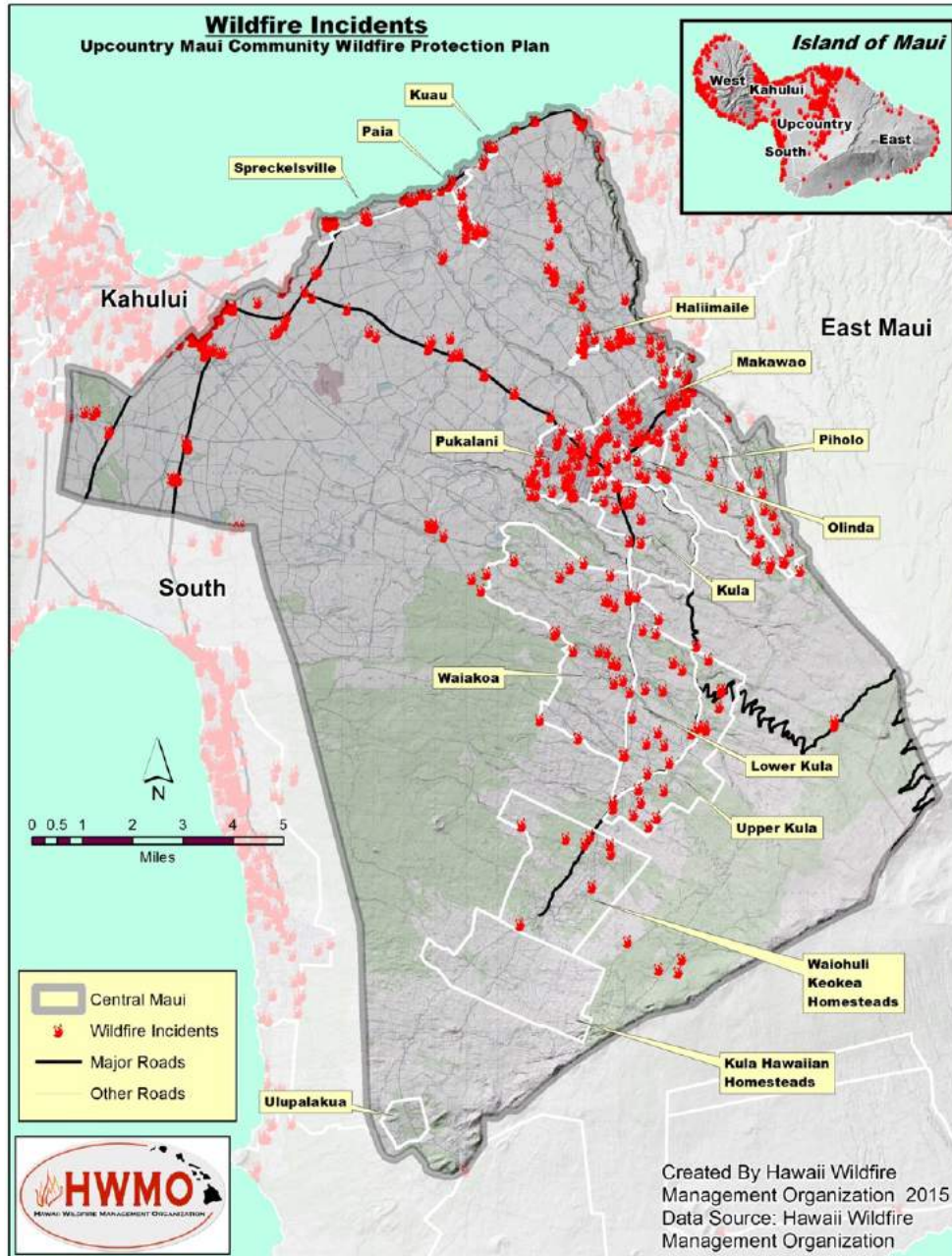
Extension, College of Tropical Agriculture and Human Resources was able to analyze the frequency of ignitions per area and create Map 10, which shows wildfire ignition densities. Upcountry Maui emerges as a "hot spot" for its high density of wildfire ignitions per square mile.

Ignitions are important for understanding trends and patterns of fires. The Upcountry Maui Wildfire Incident Map (Map 11) demonstrates that WUI, roadside, and human access area fire starts are important trends across Maui. While larger fires tend to occur in the drier



Map 10. Wildfire Ignition Density Map. Bright regions on the map show areas with the highest number of wildfire ignitions per square mile. Note that Upcountry Maui is one area that stands out for its high density of ignitions.

areas with unmanaged vegetative fuels, the high frequency of ignitions along every WUI is of concern. As drought conditions become more frequent (and they are predicted to increase), there are concerns that large fires in dense unmanaged vegetation will correspondingly increase.



Map 11. Upcountry Maui Fire Incident Map. Incidents recorded from 1988-2012 (see text above). Note: points displayed are ignition sites only and do not indicate perimeter boundaries of burned areas.

SIGNIFICANT FIRES

Numerous large wildfires (over 100 acres) have taken place in the Upcountry Maui region. Detailed records are scant before 2000, but many since that time have received media attention or been noted for their significant impacts. Table 5 highlights the fires on record that were significant in terms of size, media coverage, or impact.

Incident Name	Location	Date Started	Acres	Cause	Property/ Vegetation	Notes
Upper Waiohuli Fire	Kula State Forest Reserve- Ulupalakua Ranch- Waipoli Road	January 23, 2007 (1:17pm first alarm)	2,291	Cigarette	Open land or field	HDF Costs: \$357,000 Damage Costs: \$5,700,000 Structures lost: 0
Mahamenui Fire	DHHL Kahikinui Section- Mahamenui- Piilani Highway	July 6, 2003 (4:42pm first alarm)	2,072	Misc.	Open land or field	HDF Cost: \$9,466 Damage Cost: \$414,400 Structures lost: 2
Pa'ia	Pā'ia cane fields	June 22, 2014	272	n/a	n/a	Prompted road closures
Makawao June 2016	Gulch near Kamehameha School Maui campus; south of Akalani Loop	June 16, 2016 (2:21 p.m. - first reported)	200	Undetermined	Open land or field; brush or brush-and-grass mixture	Evacuations for a few homes were called
Kula-Piliwale	Kula-Piliwale Road	August 3, 2004 (8:09am first alarm)	200	Undetermined	Open land or field, Brish-grass mixture	
Pukalani	Hawai'i Commercial & Sugar	n/a	100	n/a	Cane fields	No homes lost
Kula-Piilani Hwy	Kula-Piilani Hwy	July 8, 2005 (11:23am first alarm)	100	Undetermined	Open land or field	
Kula October 2003	Lower Kula Road	October 14, 2003 (1:02 p.m. - first alarm)	45	Undetermined	Open land or field; brush or brush-and-grass mixture	

Incident Name	Location	Date Started	Acres	Cause	Property/ Vegetation	Notes
Naska 2010	Haleakala Highway	June 22, 2010 (1:16 p.m. - first alarm); Date Contained: June 22, 2010 (6:00 p.m.); Date Controlled: June 23, 2010 (12:00 p.m.)	25	Misuse of fire	Local government and private land; Open land or field; brush or brush-and-grass mixture; buffelgrass, haole koa, kiawe	\$8,500 of damage
Kula March 2003	Piilani Highway	March 3, 2003 (6:32 p.m. - first alarm)	20	N/A	Open land or field; brush or brush-and-grass mixture	
Paia '10	On Keahua Road	August 24, 2010 (8:17 a.m. - first alarm)	20	Accidental; flying brand, ember, or spark	Livestock, poultry storage; brush or brush-and-grass mixture	
Naska 2012	Hana Highway @ Stable Road - Northeast of Kahului Airport runway - Spread towards Sprecklesville Village	March 29, 2012 (6:27 p.m. - first alarm); Date Contained: April 2, 2012 (6:00 p.m.)	20	Debris burning;	Local government land; Crops or orchard; grass; hau, kiawe, date palm	\$10,000 of damage; 2 structures lost
Kula September 2005	Pulehu Road	September 2, 2005 (4:57 p.m. - first alarm)	10	Undetermined	Open land or field; brush or brush-and-grass mixture	
Makawao July 2007	1290 Haliimaile	July 9, 2007 (3:18 p.m. - first alarm)	10	Undetermined	Open land or field; brush or brush-and-grass mixture	
Makawao August 2007	On Makani Road	August 7, 2007 (10:08 a.m. - first alarm)	10	Undetermined	Open land or field; brush or brush-and-grass mixture	
Pā'ia Unscheduled Cane Fire June 2015	Near Hāna Highway and Pā'ia mini-bypass	June 26, 2015 (8:42 p.m. - first reported)	4	Undetermined; suspicious	Cane	2nd unscheduled cane fire in Pā'ia in as many days

Table 5. Upcountry Maui Large and Significant Wildfires.

Narrative accounts including published photos of some notable fires in Upcountry Maui are provided below:

Upper Waiohuli Fire^{6,7,8}

The largest fire in Upcountry Maui between January 2000 and December 2012 took place on the slopes of Haleakala in the Kula State Forest Reserve. 2,291 acres of pine, redwood, cypress and sandalwood forest were consumed, according to records from the DLNR-DOFAW. Sixteen miles of hiking trails and approximately six miles of roads were affected by the forest fire. Kula Forest Reserve officials closed a number of areas including the Ka'ono'ulu Ranch cooperative lease area, Polipoli Springs State Park, all Na Ala Hele trails in the area and the Waipoli access road, above the boundary gate. Extensive repairs of the access roads were needed following the fire due to damage caused by trucks and other heavy equipment used in firefighting, salvage, and reforestation. Rain helped with the suppression efforts, helping to cool hot spots and extinguish burning embers.

Post-fire restoration efforts began soon after the fire, to prevent erosion and to clear and plant the burned areas before they were subject to aggressive invasion by grasses and weeds. DLNR-DOFAW planted koa, 'ohi'a, mamane, and 'a'ali'i as part of the restoration effort.



Photo 4. DLNR workers removed up to 300 hazardous trees that were badly damaged from the fire. Photo Credit: Honolulu Advertiser.



Photo 5. Helicopters were used to fight the Upper Waiohuli Fire. Visibility was limited in some places due to cloud cover. Photo Credit: Star Bulletin, 2007.

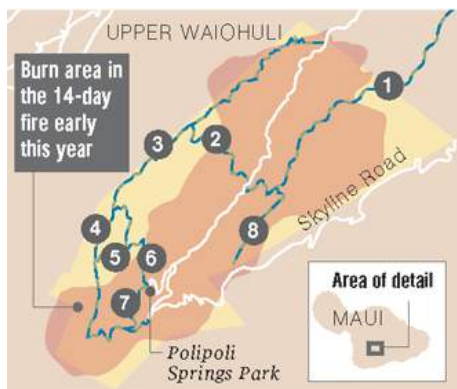


Figure 1. Waiohuli burn area, as published in the Honolulu Advertiser, 2007.



Photo 6. The Upper Waiohuli Fire sent up a huge smoke column from the slopes of Haleakala, and destroyed approximately 75% of the Forest Reserve. Follow up efforts were made to replat, restore, and rehabilitate the area. Photo credit: DLNR.

Mahemenui Fire⁹

A 2,072-acre fire burned in a remote area along the leeward slopes of Haleakala starting on July 6, 2003, making it the second largest fire in Upcountry Maui between January 2000 and December 2012. The fire began, according to Deputy Chief Alan Cordeiro, “from Mile Post 26 along the main road at the 150-foot elevation” moving towards a native koa forest. Along with MFD firefighters, Haleakala National Park, Ulupalakua, and Goodfellow Bros. Inc. construction company provided fire suppression assistance. Winds reached up to 30 miles per hour, causing the fire to spread quickly.

Pa’ia 2014 Fire¹⁰

Starting on June 22, 2014, a brush fire burned 270 acres of cane fields in Paia, prompting road closures between Holomua Road at Hana Highway and the Old Maui High School. To fight the blaze, firefighters from Paia, Makawao, Kahului, Kihei, and Wailea were called to the scene and were able to contain it within a few hours.



Photo 7. Smoke can be seen above the cane fields from the 2014 fire in Pa’ia. Photo Credit: Karen Chun, Maui Now.

Pukalani 2015 Fire¹¹

An evening brush fire in Pukalani was captured in the Photo 8 on April 9, 2015. Residents in the area witnessed a glowing fire downslope of Ikea Place spreading quickly away from homes towards the southwest. The fire burned through over 100 acres of Hawaiian Commercial & Sugar cane fields, prompting HC&S to help extinguish the fire in coordination with MFD. No structures were threatened or lost.



Photo 8. The 2015 100 acre Pukalani fire burned into the night. Photo Credit: Bill Thompson, Maui Watch.

Makawao June 2016 Fire¹²

In what has been a very busy year for wildfires in Maui, a 200 acre fire burned along a gulch near Kamehameha Schools' Maui campus in Makawao. Beginning in the afternoon around 2:21 p.m., MFD crews sent 26 firefighters from five companies and three helicopters to fight the blaze. Within 5 hours of the initial response, the fire was extinguished but not before threatening homes within the area. The fire reportedly encroached some homes within 30 feet, prompting brief evacuations. According to fire officials, strong 25-mile winds helped spread the fire quickly, but pineapple and sugar cane fields acted as fuelbreaks and slowed the spread.



Photo 9. *The fire burned along a gulch in Makawao, coming close to some homes.*
Photo Credit: MFD

WILDFIRE IMPACTS

Many of the community, economic, natural, and cultural resources in Upcountry Maui are exposed to wildfire impacts. These impacts are compounded by the fact that land-based, aquatic, and marine-based natural and cultural resources all lie within close proximity across the region.

IMPACTS TO NATURAL RESOURCES

Across Hawai'i, recurrent wildfires result in the conversion of both native and nonnative forested areas to fire-adapted grasslands and shrublands – and are one of the reasons these fire-prone ecosystems are expanding in many parts of the state. Wildfire is a major cause of the loss and degradation of native forest and other habitat. Most of the plant and animal species within native ecosystems in Hawai'i do not survive and/or recover from wildfires. More generally, the conversion of forest from fire and the conversion of active agriculture into fallow unmanaged weed fields increases the potential for future and larger fires by expanding the availability of fine fuels.

Wildfire also increases the potential for erosion and sediment delivery from upland to coastal and nearshore areas. The immediate loss of vegetation after a wildfire directly exposes soils to rainfall, which can dramatically increase erosion. Wildfire can also alter the physical and chemical properties of soils,

making them more prone to surface run-off which can increase downstream flooding and sediment delivery. Forest conversion to grassland due to recurrent wildfires over the long-term also alters water cycling. The replacement of deep-rooted trees by shallow, matted root systems of grasses results in a higher water table and reduces the ability of rainfall to infiltrate into the soil. This causes an increase in surface runoff during rainfall events and thus increases the risk of flooding and sediment delivery downstream.

Forest loss and increased downstream sediment delivery to nearshore reefs have important implications for cultural and civic resources, as well, in terms of tourism, recreation, food resources, and cultural practices. Sediment loading destroys reefs and impacts nearshore fisheries which are critical subsistence resources to many Maui families. Burned areas can remain closed to the public for days to months due to landslide and tree-fall danger, limiting access to areas for hiking, hunting, gathering plants, and tending cultural sites. Even when nearby fires do not have immediate or direct impacts on these resources, there are often indirect or longer term impacts. For example, suppression efforts, such as the use of bulldozers, can damage important landscape features and alter water flow patterns. Frequent fires also impact powerlines, communication infrastructure, and can lead to road closures – exacerbating already congested traffic areas.

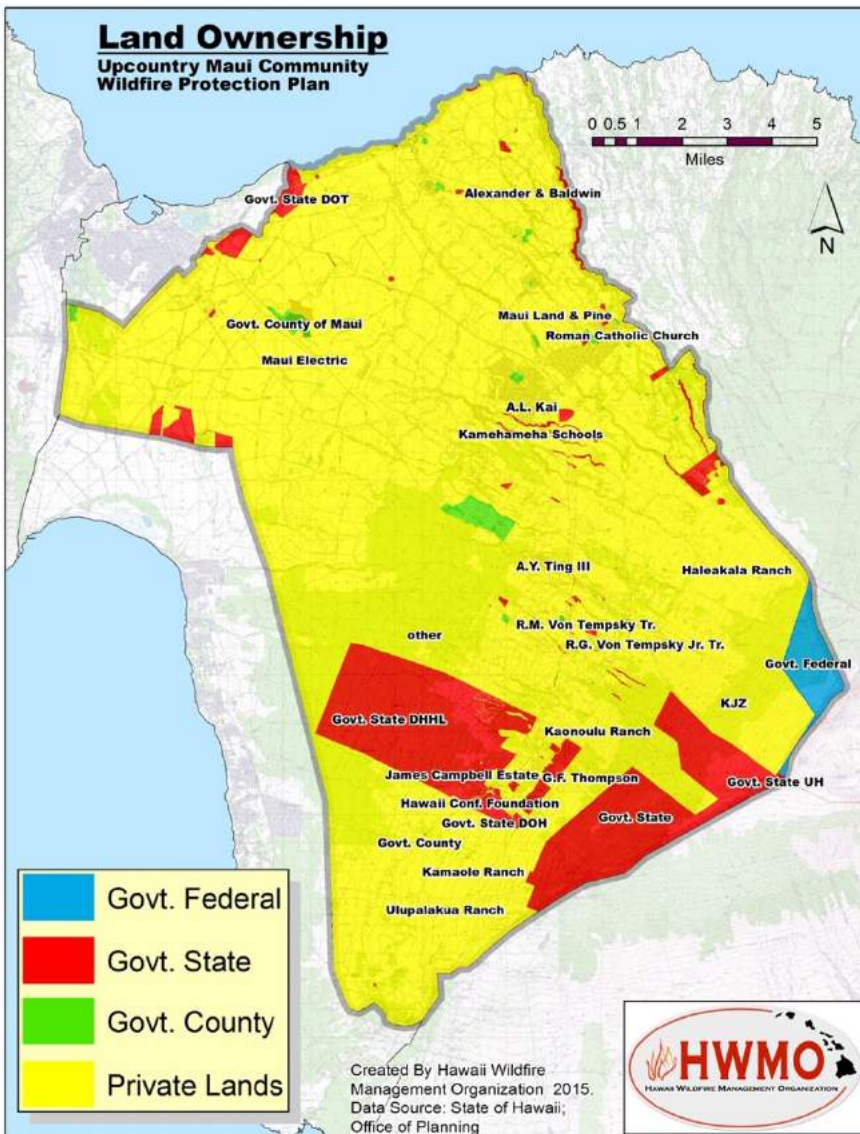
IMPACTS TO COMMUNITIES AND MUNICIPAL ACTIVITIES

Wildfires threaten lives, homes, and human health in several ways. Many neighborhoods have unmanaged/untended fire fuels interspersed within developed areas, promoting fire spread through communities and into surrounding areas. This creates an increased hazard to lives and homes in the area. Air quality is greatly reduced from smoke during fires and for months to years after fire due to high levels of wind-born dust. This dust is due to fire-caused changes to soil that leaves it water-repellant, and therefore easily lifted into the air.

Wildfires also impact economic and municipal infrastructure and activities. Burned soil from wildfires decreases groundwater recharge, which can affect drinking water supplies. As noted above, post-fire rain events cause erosion that damages nearshore resources (coral reefs, fisheries), which can have effects on one of the area's primary economic bases— coastal and marine-based tourism, as well as resident and visitor recreational activities. Traffic and road closures during fire events and post-fire flooding can block access routes and keep people from their homes and work, and are costly to local government.

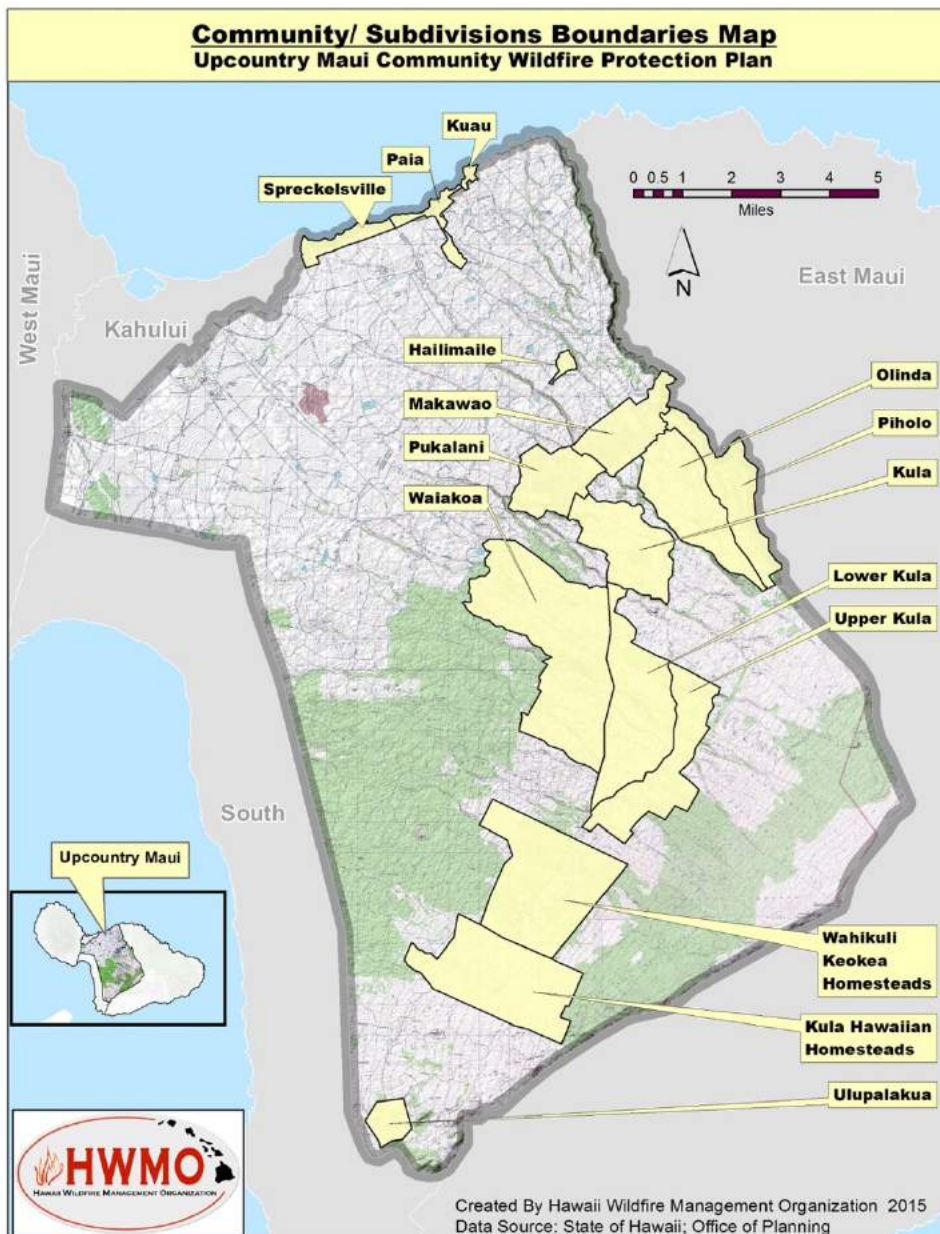
**GENERAL OVERVIEW OF CWPP PLANNING AREA
UPCOUNTRY MAUI**

The area comprising Upcountry Maui, as defined in this plan, includes federal, state, county, and privately owned lands (Map 12). The CWPP planning boundaries also simultaneously define this region of Maui’s WUI boundaries. They were delineated to ensure adequate protection of natural areas and associated human communities. The CWPP boundaries were chosen through stakeholder meetings and addresses one of Maui’s priority fire prone regions.



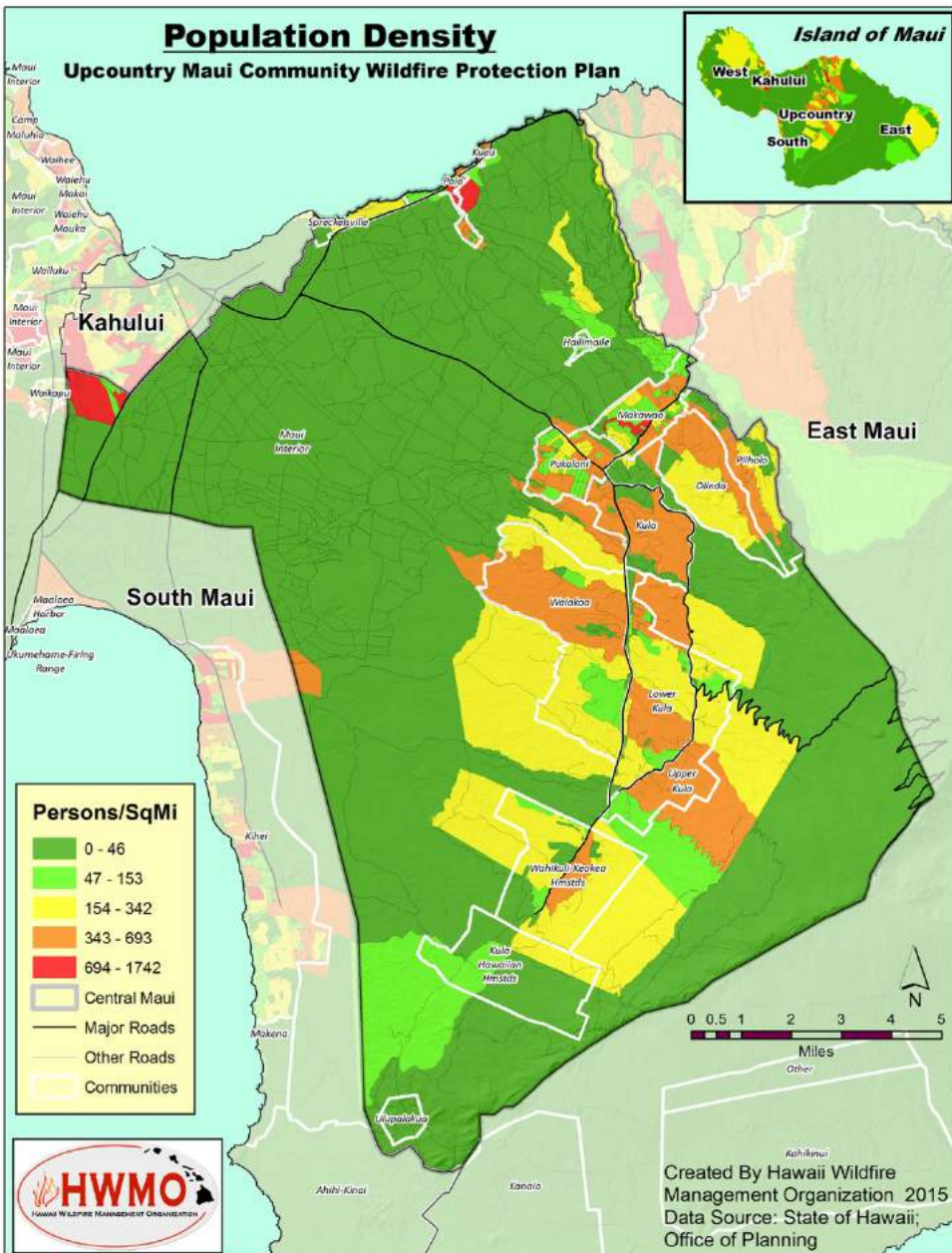
Map 12. Land Ownership Map for Upcountry Maui CWPP planning area.

For the purposes of assessing hazards and wildfire threats to resources, residential areas within the Upcountry Maui CWPP planning area were simplified into fifteen “communities” (Map 13). The boundaries depict the areas determined by DLNR-DOFAW to have similar features in terms of wildfire hazard characteristics and have long been the boundaries used in the DLNR-DOFAW’s Communities at Risk from Wildfire maps, which are updated every few years to assess and depict wildfire threats to developed areas and communities. See *Communities at Risk from Wildfires* section for more information and hazard assessment summary maps.

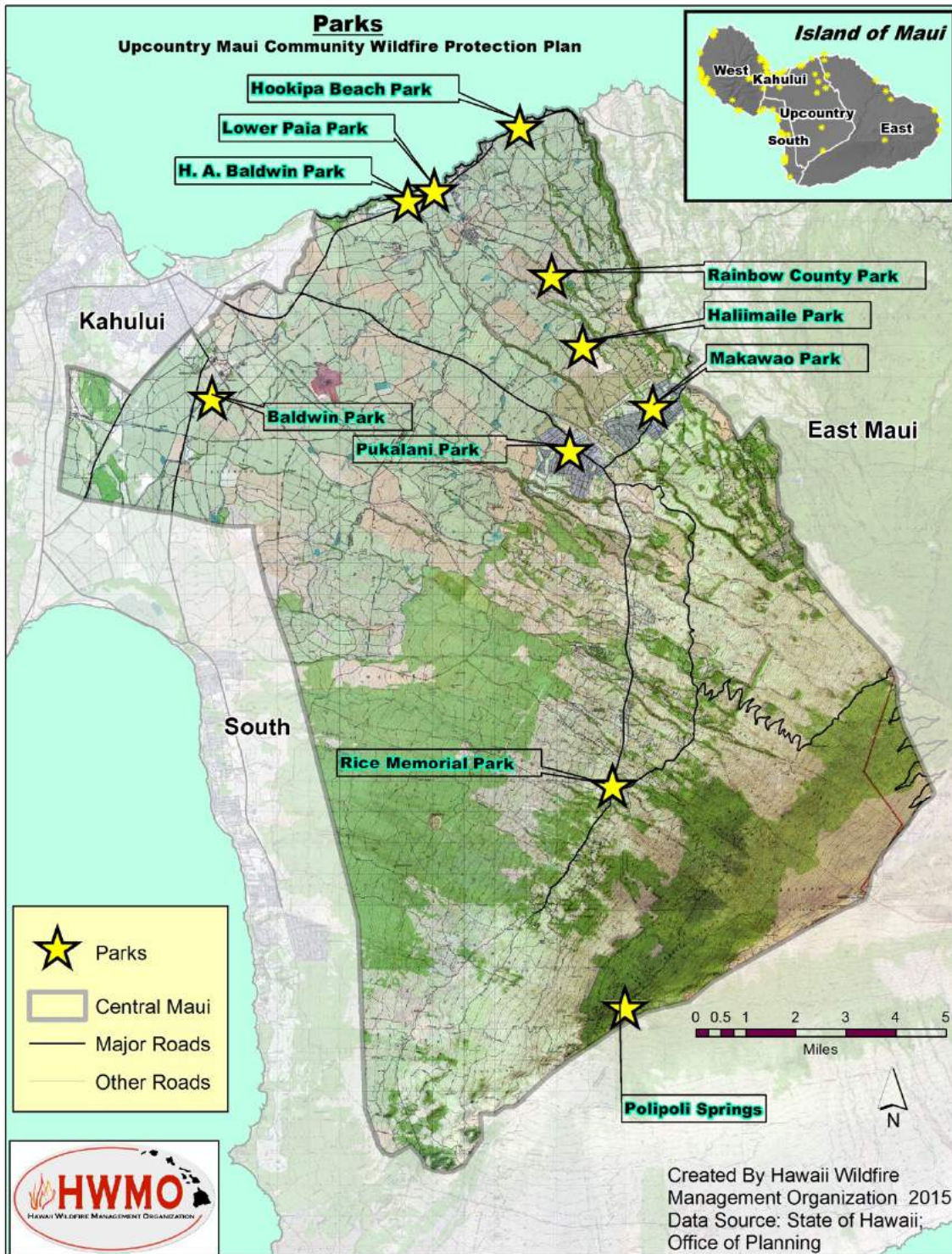


Map 13. Simplified community delineations used within the Upcountry Maui CWPP planning area.

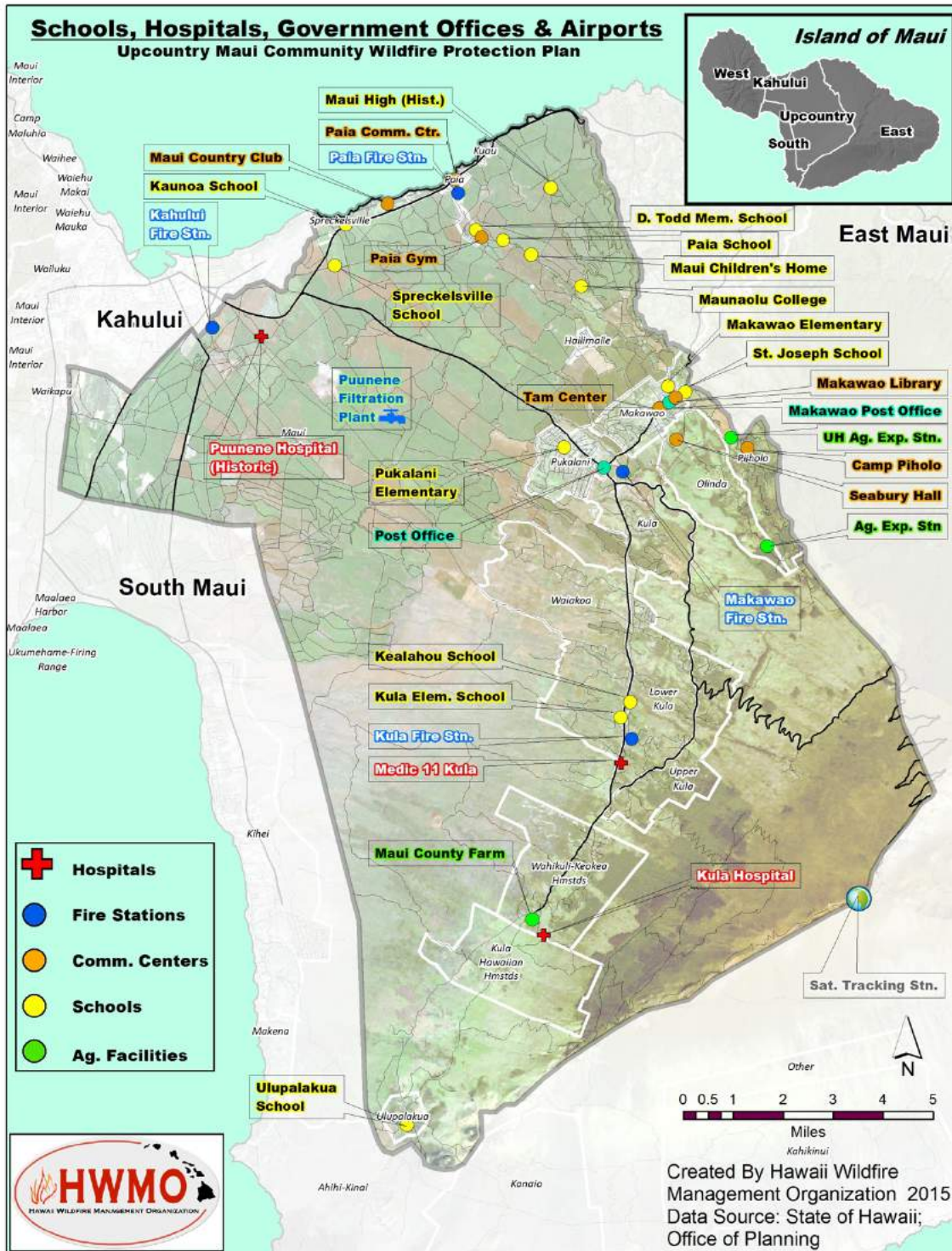
Upcountry Maui exemplifies a WUI, in that it contains both undeveloped fire prone wildland areas adjacent to populated subdivisions and developed areas (Map 14). There are numerous community assets, resources, and infrastructural features at risk of wildfire in Upcountry Maui, to include civil, industrial, medical, educational, recreational, and environmental features. These are depicted on Maps 15-18. These features may or may not be directly threatened by the flames of wildfire, but all are subject to the broader impacts of wildfire, such as changes in water quality and availability, post-fire erosion and mudslides, smoke and dust, changes in access, traffic, and more.



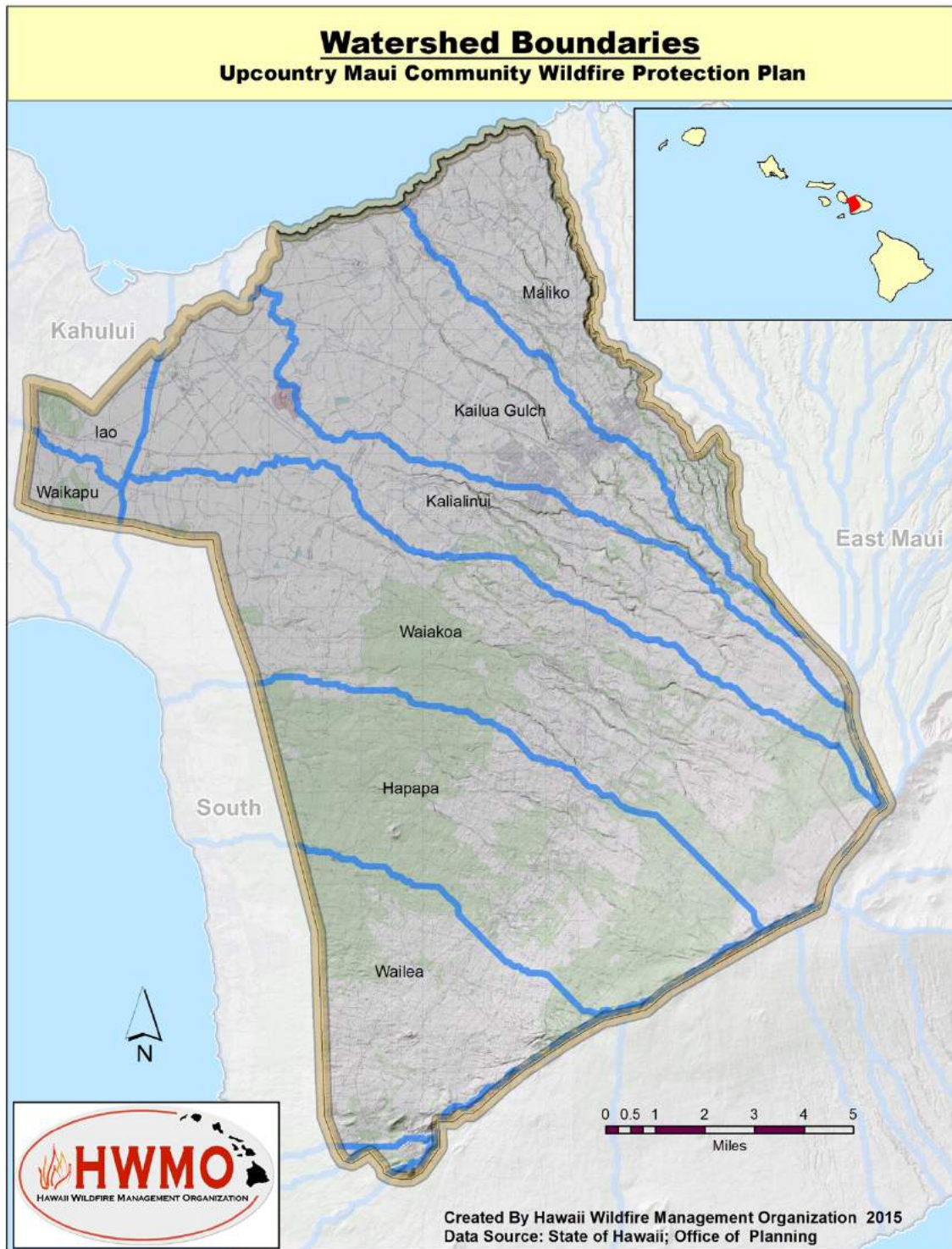
Map 14. Upcountry Maui Population Density Map.



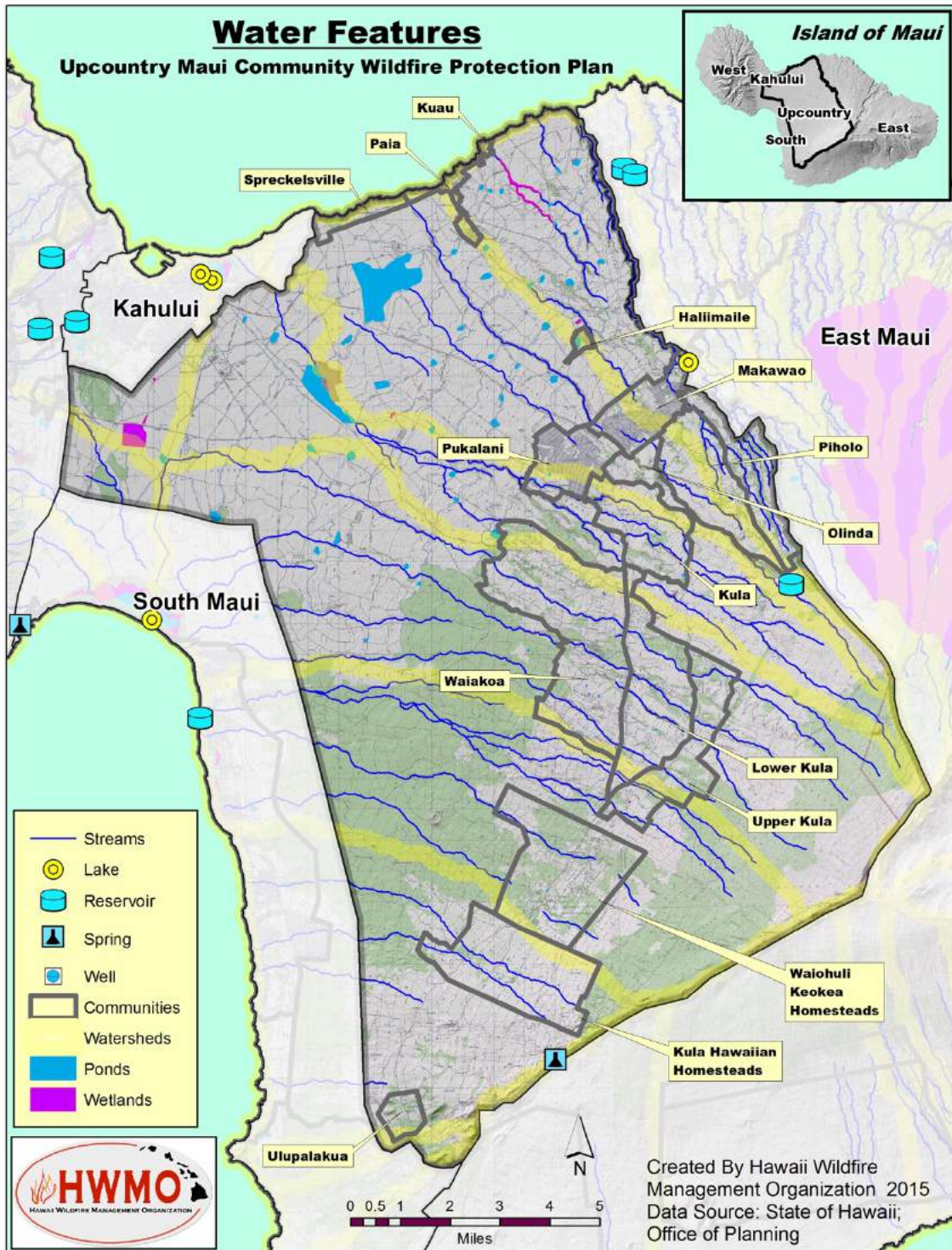
Map 15. Parks in Upcountry Maui CWPP planning area.



Map 16. Community/government service features in the Upcountry Maui CWPP planning area.



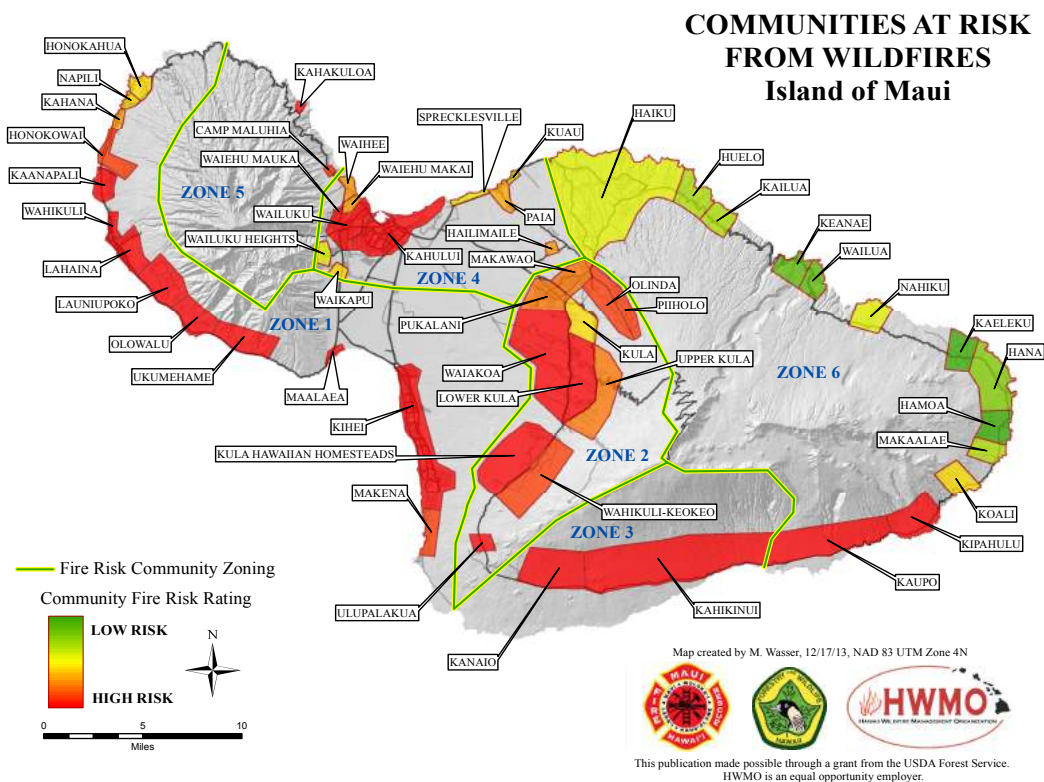
Map 17. Watershed areas within the Upcountry Maui CWPP planning area.



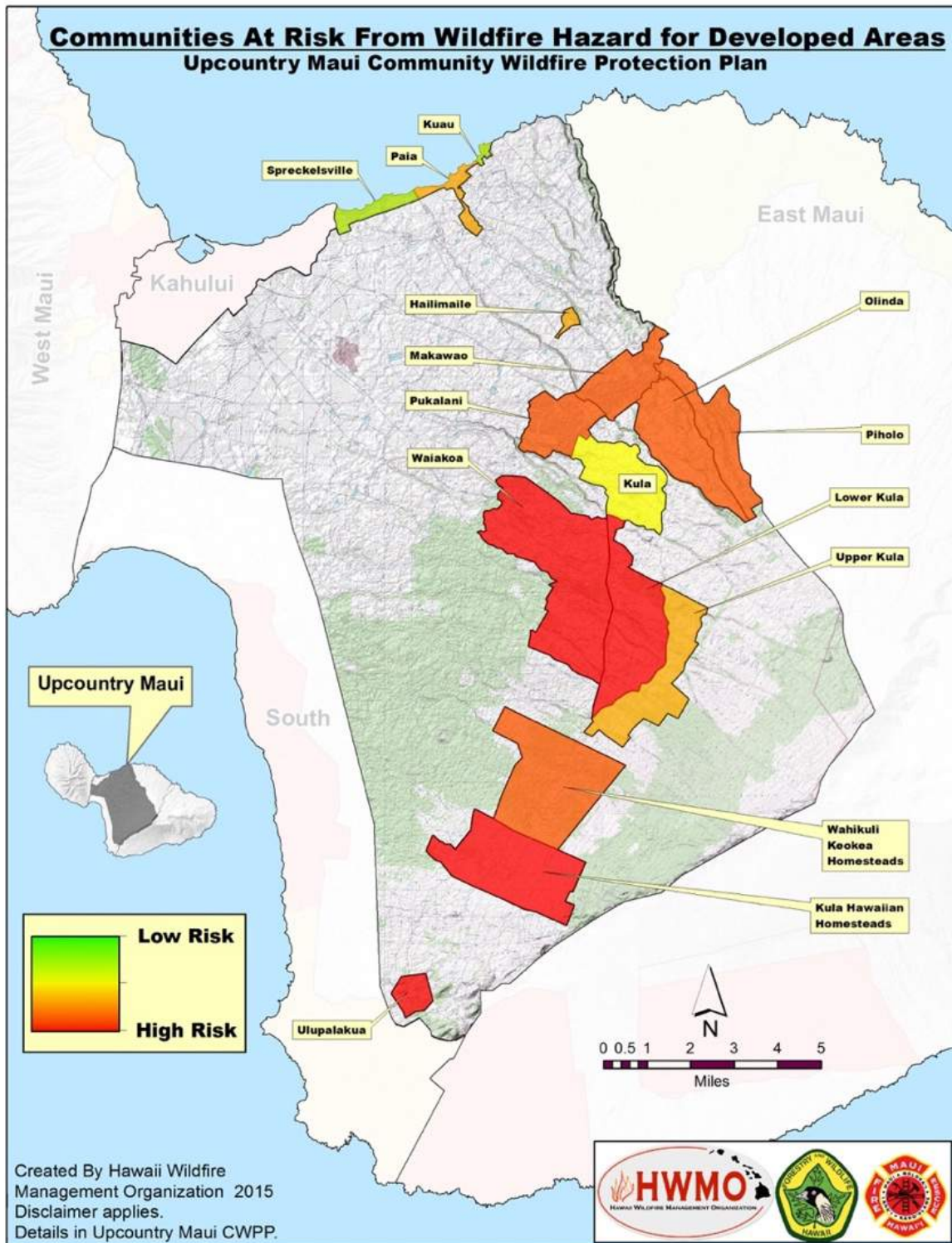
Map 18. Water features in the Upcountry Maui CWPP planning area.

COMMUNITIES AT RISK FROM WILDFIRE

Nationally, Communities at Risk from Wildfires (CARW) Maps delineate communities that share similar environmental conditions, land use characteristics, fuel types, hazards, and general wildfire issues, and provide ratings to characterize generalized hazards in each area. DLNR-DOFAW has been developing Hawai'i CARW maps for more than a decade, and has developed streamlined community boundaries for the purposes of the Hawai'i CARW map. In 2013, HWMO partnered with DLNR-DOFAW and the county fire departments across Hawai'i to update the Hawai'i CARW maps. The original community boundaries were replicated in the 2013 map update, with changes made to reflect current hazards and subdivision expansions. Map 19 provides the Island of Maui's overall CARW map for context. Map 20 depicts the hazard ratings for Upcountry Maui's developed areas. It is important to note that many factors were weighed into developing the hazard level, so areas with like environmental conditions may be rated differently based on other hazard or protection factors, like ingress/egress, community Firewise activities, etc.



Map 19. Island of Maui 2013 Communities at Risk from Wildfires Map.



Map 20. Upcountry Maui Communities at Risk from Wildfires Map- Hazard Ratings for developed Areas.

WILDFIRE RISK ASSESSMENT

PURPOSE AND METHODS

The purpose of the required community risk assessment is to:

- Provide site-specific information to the public to promote wildfire awareness.
- Help identify and prioritize areas for treatment.
- Determine the highest priority uses for available financial and human resources.

The methods for this plan's community wildfire risk assessment followed the guidelines established by the HFRA, which requires the following actions:

- Establish a Community Base Map (Maps 15-18 and 26).
- Develop a Community Hazard Assessment (see *Wildfire Hazard Assessment* section, Maps 21-25, and Appendix C).
- Identify Overall Community Priorities (see *Hazard Reduction Priorities* section and Figures 2, 3, and 5-9).

The wildfire risk assessment also follows the guidelines and requirements of the FEMA Pre-Disaster Mitigation program and the NFP. Locally, we have opted to name the effort *Wildfire Hazard Assessment*, rather than *Wildfire Risk Assessment*.

WILDFIRE HAZARD ASSESSMENT

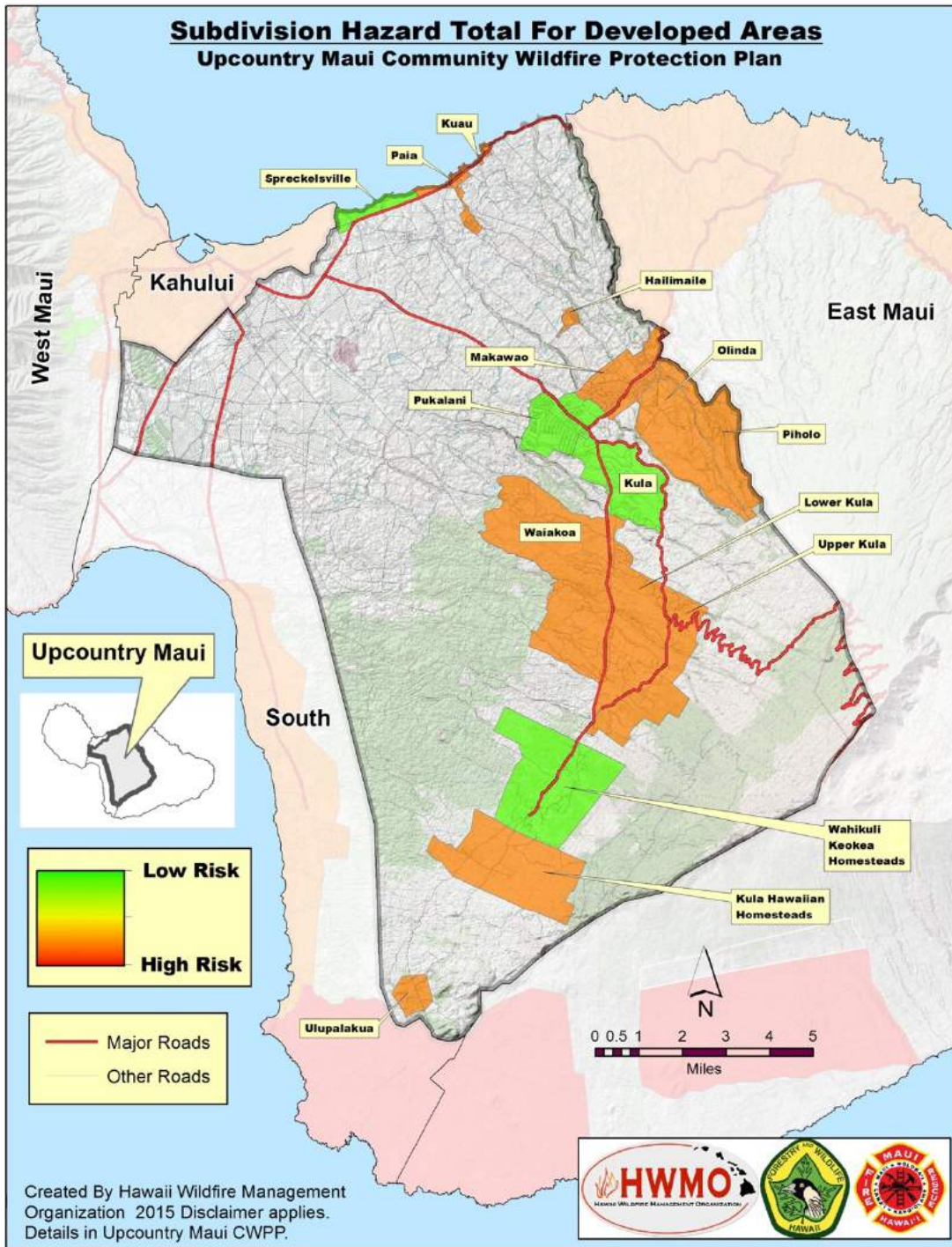
In partnership with DLNR-DOFAW and MFD, HWMO assessed the communities within Upcountry Maui for 36 wildfire hazard characteristics, which have been further grouped into 5 categories. As described in detail above, community delineations for the assessment followed those for the CARW map. The five categories assessed for wildfire hazard are as follows.

- Subdivision Hazard
- Vegetation Hazard
- Building Hazard
- Fire Environment Hazard
- Fire Protection Hazard

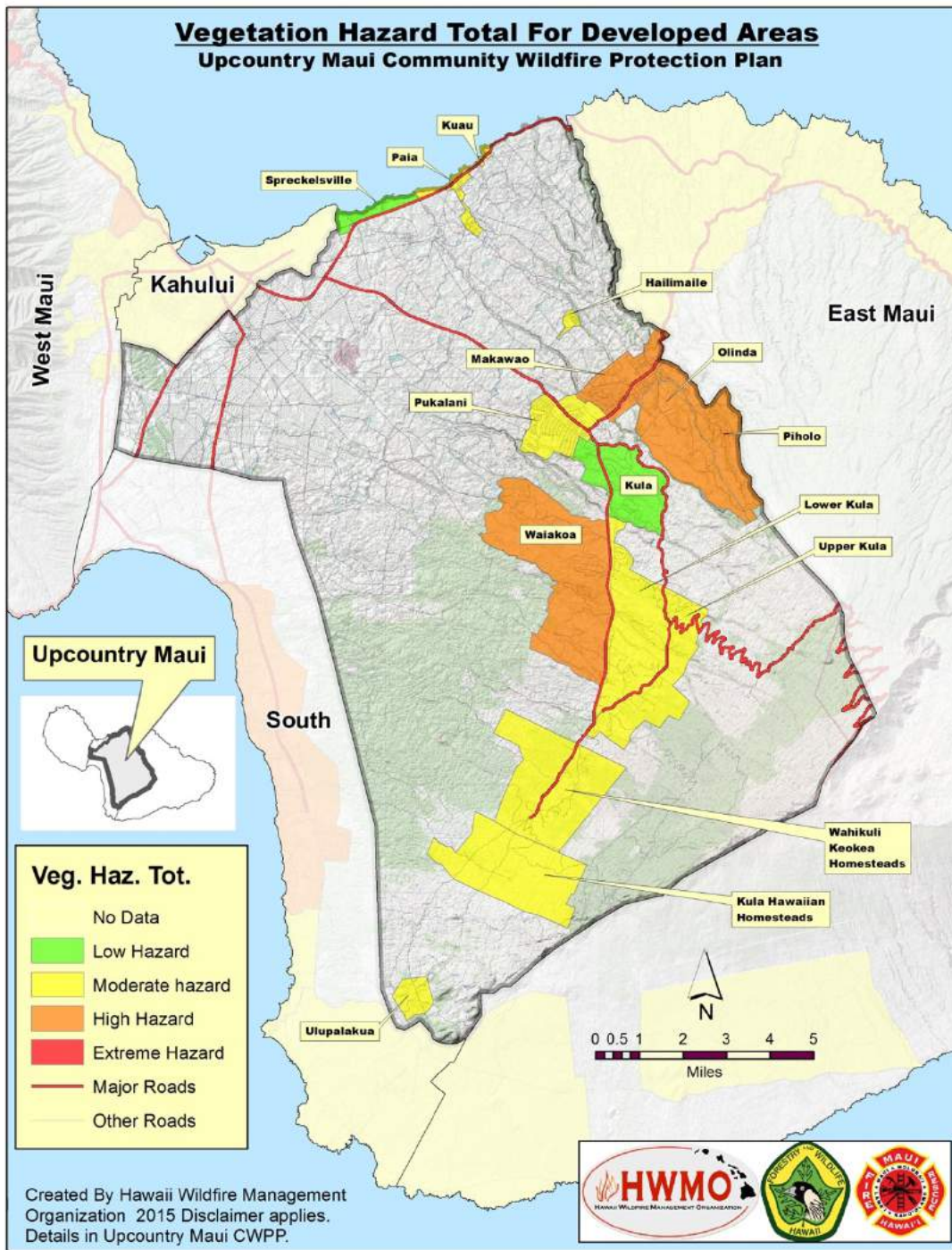
Maps are provided for each of the five categories, and demonstrate the total hazard per category based on a weighted calculation of that category's individual hazards, as detailed in Table 6.

Hazard Category (See Maps 21-25 for Category Total maps)	Individual Hazards Assessed
Subdivision Hazard Total	<ul style="list-style-type: none"> • Fire Service Access • Home Setbacks • Ingress/Egress • Private Landowner Firewise landscaping & Defensible Space • Proximity of Subdivision to Wildland Areas • All Season Road Condition • Road Maintenance • Road Width • Street Signs • Structure Density • Unmanaged, Untended, Undeveloped Lands
Vegetation Hazard Total	<ul style="list-style-type: none"> • Defensible Space: Fuels Reduction Around Homes & Structures • Fuel Loading • Fuel Structure & Arrangement • Proximity of Flammable Fuels Around Subdivision • Vegetation Within 300' of Homes
Building Hazard Total	<ul style="list-style-type: none"> • Siding/Soffits • Roofing Assembly • Structural Ignitability • Under skirting Around Decks, Lanais, Post & Pier Structures • Utilities Placement; Gas & Electric
Fire Environment Hazard Total	<ul style="list-style-type: none"> • Average Rainfall • Prevailing Wind Speeds & Direction • Slope • Topographic Features that Adversely Affect Wildland Fire Behavior • Seasonal or Periodic High Hazard Conditions • Ignition Risk
Fire Protection Hazard Total	<ul style="list-style-type: none"> • Response Time • Community Planning Practices & Ordinances • Community Fire Safe Efforts & Programs Already in Place • Fire Department Structural Training & Expertise • Local Emergency Operations Group or Citizen Group • Proximity to Fire Stations • Water Source Availability • Wildland Firefighting Capacity of Initial Response Agency • Interagency Cooperation

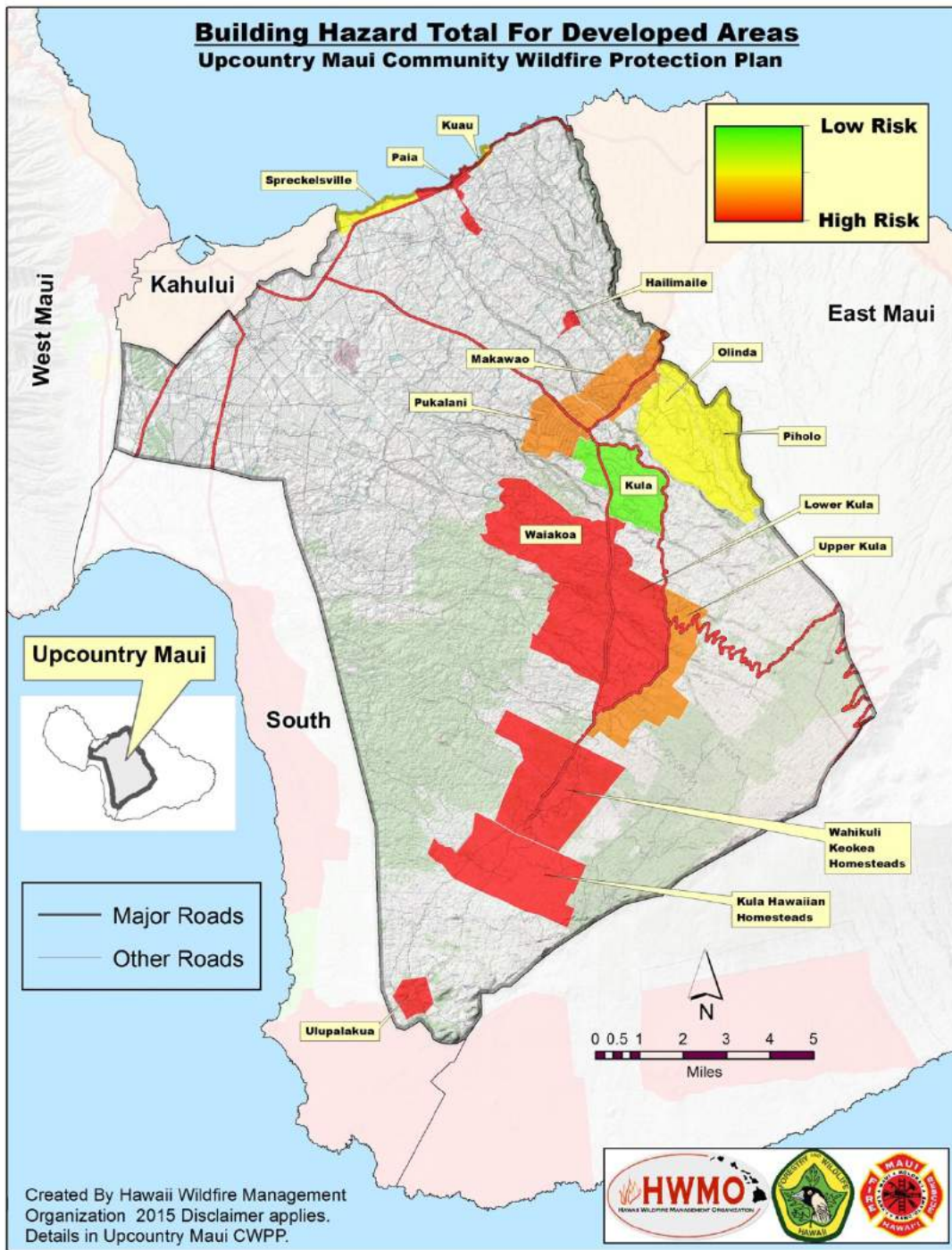
Table 6. Overview of hazard assessment categories and the individual hazards that comprise them. Maps for each individual hazard are provided in Appendix C.



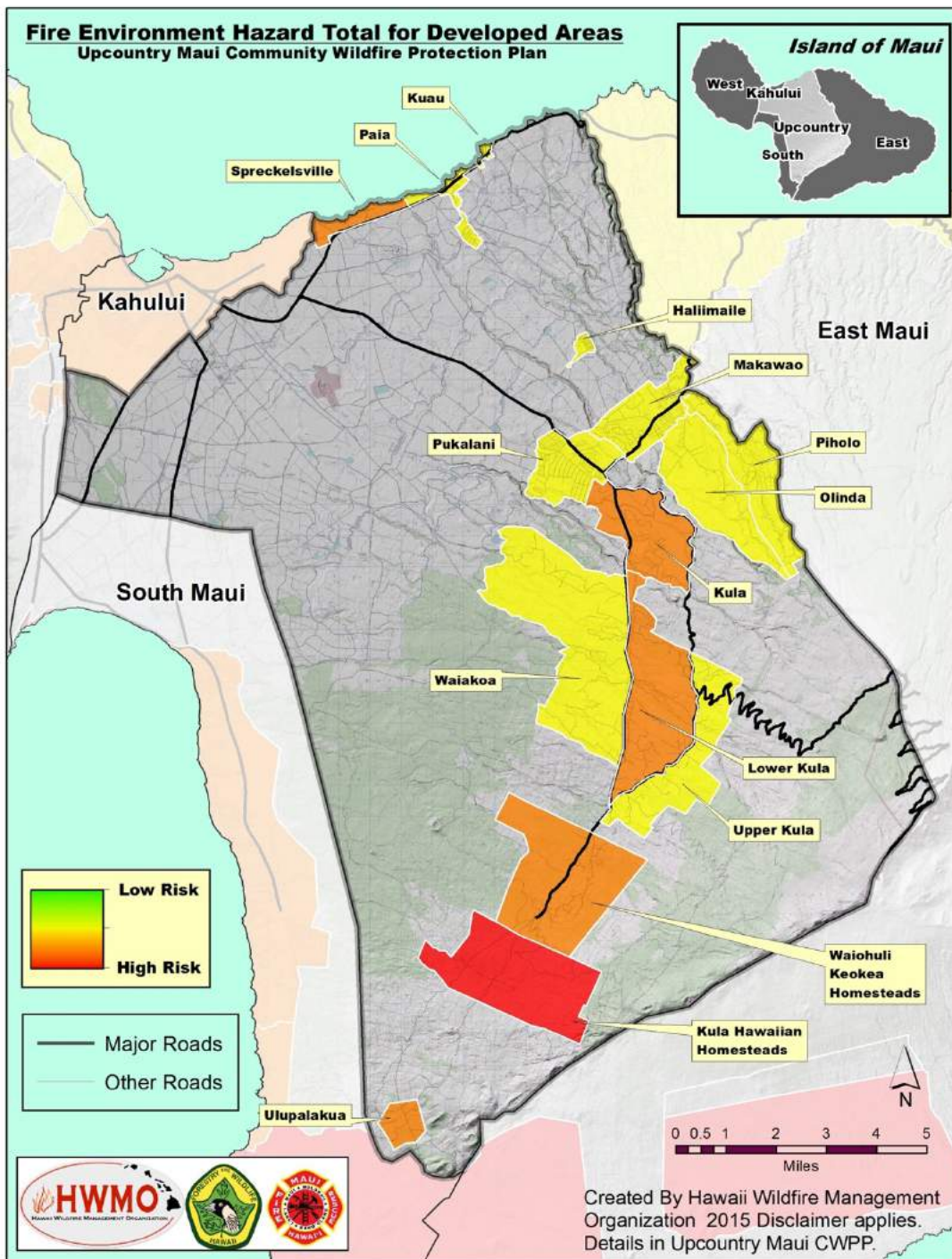
Map 21. Subdivision Hazard Total for Developed Areas of Upcountry Maui CWPP planning area. Reflects hazard assessment findings related to the following categories: Fire Service Access; Home Setbacks; Ingress/Egress; Private Landowner Firewise landscaping & Defensible Space; Proximity of Subdivision to Wildland Areas; All Season Road Condition; Road Maintenance; Road Width; Street Signs; Structure Density; and Unmanaged, Untended, Undeveloped Lands.



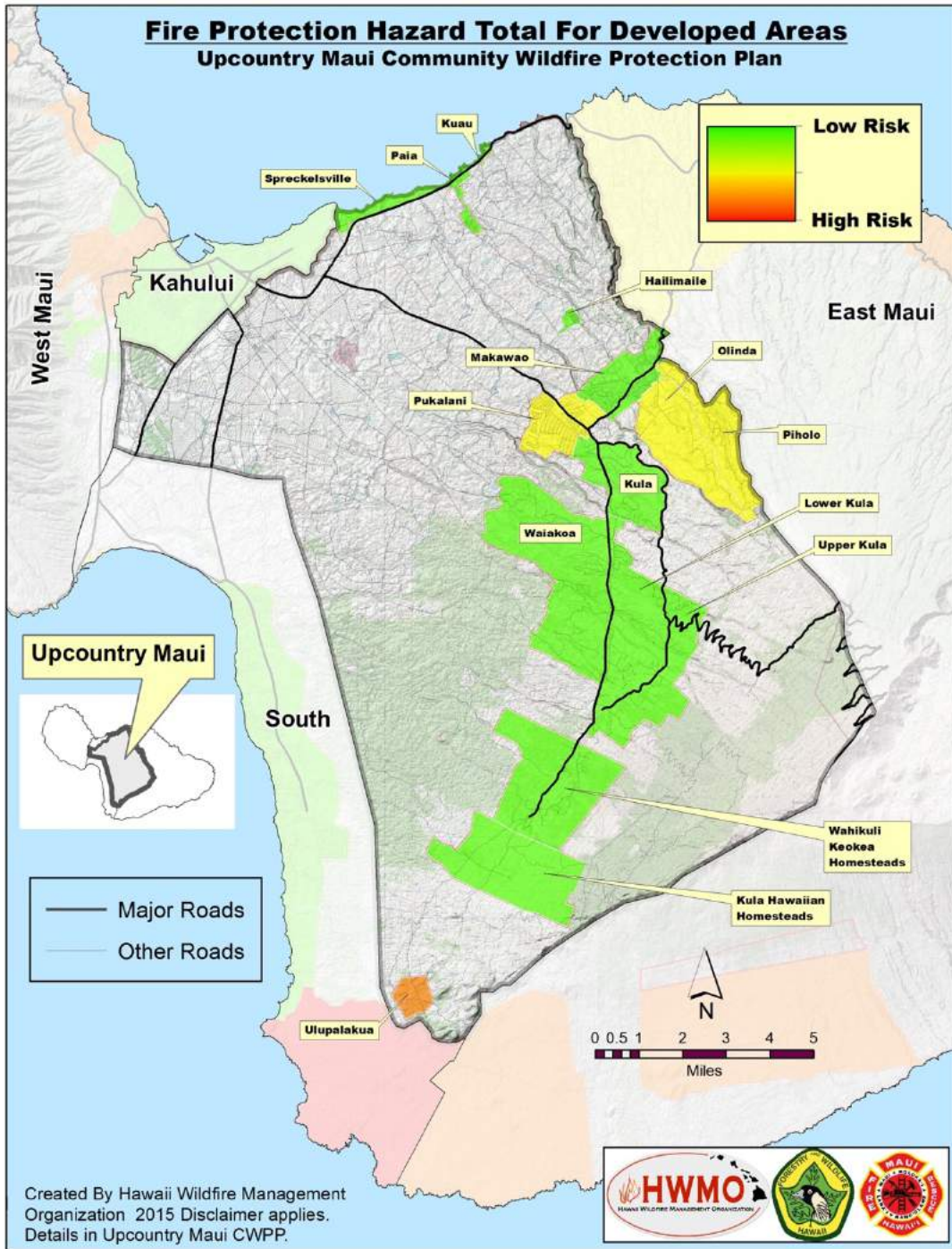
Map 22. Vegetation Hazard Total for Developed Areas of Upcountry Maui CWPP planning area. Reflects hazard assessment findings related to the following categories: Defensible Space: Fuels Reduction Around Homes & Structures; Fuel Loading; Fuel Structure & Arrangement; Proximity of Flammable Fuels Around Subdivision; Vegetation Within 300' of Homes.



Map 23. Building Hazard Total for Developed Areas of Upcountry Maui CWPP planning area. Reflects hazard assessment findings related to the following categories: Siding/Soffits; Roofing Assembly; Structural Ignitability; Under Skirting Around Decks. Lanais, Post & Pier Structures; and Utilities Placement for Gas & Electric.



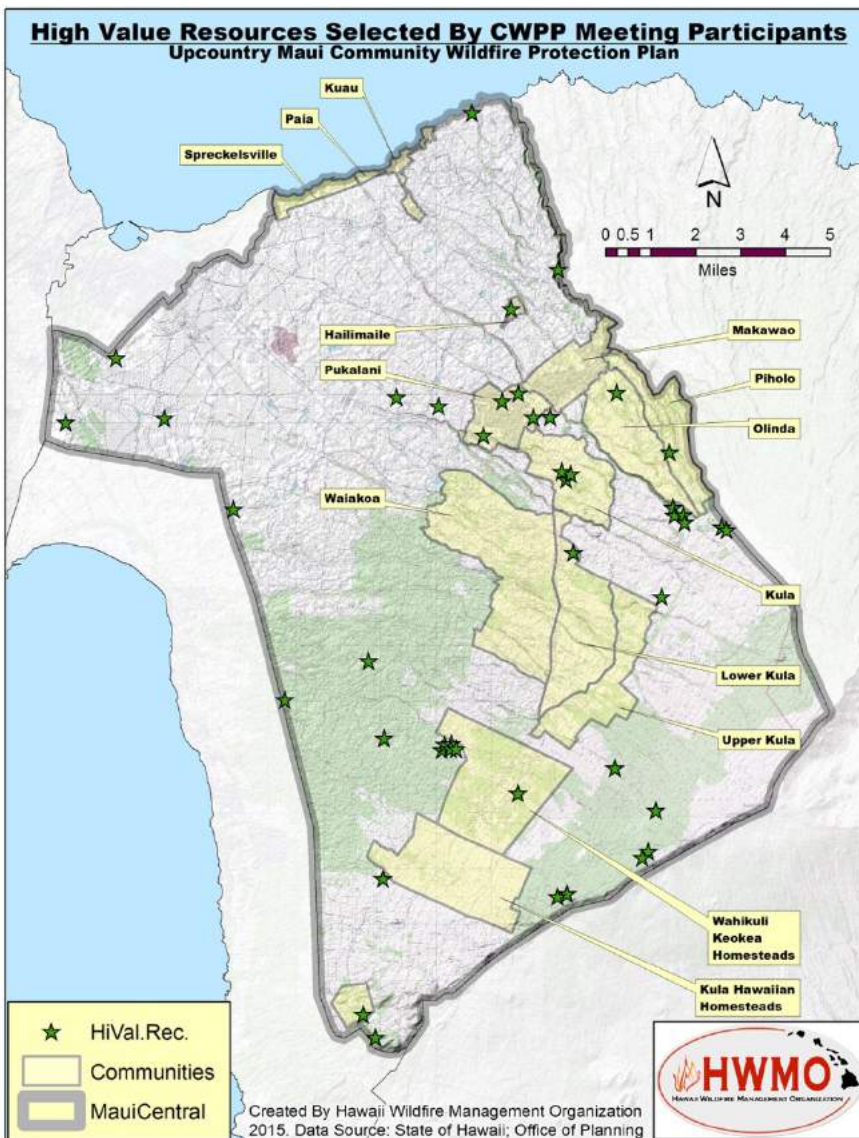
Map 24. Fire Environment Hazard Total for Developed Areas of Upcountry Maui CWPP planning area. Reflects hazard assessment findings related to the following categories: Average Rainfall; Prevailing Wind Speeds & Direction; Slope; Topographic Features that Adversely Affect Wildland Fire Behavior; and Seasonal or Periodic High Hazard Conditions; and Ignition Risk.



Map 25. Fire Protection Hazard Total for Developed Areas of Upcountry Maui CWPP planning area. Reflects hazard assessment findings related to the following categories: Firefighter Response Time; Community Planning Practices & Ordinances; Community Fire Safe Efforts & Programs Already in Place; Fire Department Structural Training & Expertise; Local Emergency Operations Group or Citizen Group; Proximity to Fire Stations; Water Source Availability; and Wildland Firefighting Capacity of Initial Response Agency.

COMMUNITY VALUES

Civic, environmental, and cultural value were determined for the Upcountry Maui CWPP planning area by stakeholders during input meetings. Map 26 demonstrates the points on the map selected by public and agency participants during CWPP meetings as high priorities for mitigation/protection. These were based on their personal, cultural, and community values and priorities, as well as overall risk of wildfire. Due to the sensitive nature of cultural resources in Hawai'i, participants were not required to name the priority resources, only to share the area or location of the valued resources by marking the map poster with stickers. See also Photos 10-12.



Map 26. Stakeholder-determined High Value Priority Resources to Protect from Wildfire in the Upcountry Maui CWPP planning area.



Photo 10. High value resources were selected by participants. To develop an understanding of values at risk in the Upcountry Maui CWPP area, meeting participants placed stickers on the Upcountry Maui CWPP map to indicate their highest priorities geographically.



Photo 11. Community members selected areas they believe need prioritized fire protection. Participants were advised to indicate areas of highest personal importance to them for fire protection, such as natural, cultural, municipal, personal resources and areas.



Photo 12. Meeting participants discussed their own fire-related priorities as they identified places of high personal importance to them.

EMERGENCY MANAGEMENT

FIRE SUPPRESSION CAPABILITIES AND RESOURCES

MFD resources and equipment are spread across the entire county and are made available when needed if they are not already in use. MFD has 14 fire stations across the Maui County. There are 10 fire stations on the Island of Maui, three of which are within the CWPP planning area. Table 7 provides location information for Upcountry Maui fire stations.

A complete list of MFD apparatus and vehicles is provided in Appendix D. DLNR-DOFAW wildland fire suppression resources that are available for use in the event of a wildfire in the Upcountry Maui CWPP planning area are listed in Table 8.

Maui Fire Department (MFD) CWPP Planning Area-Specific Fire Stations	
<u>Fire Station #, Location</u>	<u>Address</u>
Fire Station 2, Pa'ia	179 Hana Hwy Paia, Maui, HI 96779 (808) 579-9588
Fire Station 5, Makawao	134 Makawao Ave Makawao, Maui, HI 96768 (808) 572-9160
Fire Station 13, Kula	50 Calasa Road Kula, Maui, HI 96790 (808) 876-0044

Table 7. MFD CWPP Planning Area Fire Station Locations

Initial response to the majority of wildfires (as well as all medical and other emergencies) is the responsibility of MFD. DLNR-DOFAW responds to wildfire events on state lands and provides additional wildland firefighting assistance when state lands are threatened and/or mutual aid agreements are invoked. Map 27 was developed by DLNR-DOFAW and demonstrates the independent and shared response zones of each agency in the CWPP planning area.

Department of Land and Natural Resources – Division of Forestry and Wildlife (DLNR – DOFAW) Suppression Resources	
Helicopters (contract services)	Air 1 (MFD) (Type III) Air 2 (Type III) Air 3 (Type III) Huey (Type II) Huey (Type II)
Engines/Tenders/Trucks	1 x 6x6 tender (4000 gal) 1 x M62 engine (500 gal) 1 x M5 CDF engine (450 gal) 3 x Gamma Goat engine (350 gal) 3 x 4WD Trucks (Type 6 - 125 gal to 300 gal capacity) 2 x UTV units (100 gal - high psi)
Other Resources	4 x portable pumps 2 x Helicopter tanks 6' (3000 gal) 3 x Helicopter mop up tanks (300 gal) 1 x D6 dozer 2 x backhoe 1 x T320 bobcat

Table 8. Division of Forestry and Wildlife (DLNR – DOFAW) Suppression Resources.



Map 27. Fire suppression response zones. (Map source: DLNR-DOFAW).

EMERGENCY MANAGEMENT DOCUMENTS AND OTHER PLANS

The CWPP is non-regulatory and cooperative in nature. The plan provides (1) a foundation for increased communication, coordination and collaboration among agencies and the public, (2) identification and prioritization of areas for hazardous fuel reduction projects and wildfire mitigation actions, and (3) assistance meeting federal and state planning requirements and qualifying for assistance programs.¹³ The CWPP is designed to work in conjunction with other county and state plans, operational policies, assessments, and programs, etc., including but not limited to:

County of Maui:

County of Maui Drought Mitigation Strategies¹⁴

County of Maui Multi-Hazard Mitigation Plan¹⁵ and Hazard Mitigation Plan Update (2015)¹⁶

County of Maui Water Use and Development Plan Draft¹⁷

Maui Island Plan¹⁸

State of Hawai'i:

State Drought Plan and the County Drought Mitigation Strategies¹⁹

State of Hawai'i Multi-Hazard Mitigation Plan²⁰

Waihou Spring State Forest Reserve Management Plan³

State Division of Forestry and Wildlife Operational Policy for Wildfire Control²¹

Hawai'i Statewide Assessment of Forest Conditions and Resource Strategy²²

MULTIPLE-AGENCY AGREEMENTS

In the County of Maui, there is a coordinating group established to deal with and discuss wildfire issues, mitigation, and response. Federal, state, and local fire agencies have organized into the Maui Wildfire Coordinating Group. The Maui Wildfire Coordinating Group coordinates the programs of the participating wildland fire agencies on Maui and provides a forum for leadership, cooperation and the exchange of information. It also improves procedures to rapidly provide the most effective response to wildfires in the island. In coordination with County of Maui Civil Defense Agency, drought and other fire-hazard conditions are constantly monitored and actions such as burning bans and closures are instituted when needed. The public is informed of these restrictions by radio announcements and newspaper notices.

DLNR -DOFAW has established Memorandums of Agreement, Memorandums of Understanding, and/or Mutual Aid Agreements in place with all four county fire departments as well as with Federal land management agencies, such as National Park Service, U.S. Fish and Wildlife Service, and U.S. military. According to DLNR -DOFAW²³, these, “are the cornerstones by which DLNR -DOFAW’s Fire Management Program is based. These. . . identify the responsibilities of each party as well as other fire management

activities such as joint participation in prevention, training, and equipment acquisition.”

EVACUATION PROTOCOLS AND NEEDS

Evacuation protocols for neighborhoods and areas in Upcountry Maui have been determined for natural hazards such as tsunamis, and can be found in the documents listed below. However, fire safety zones for all neighborhoods and areas of Upcountry Maui are yet to be determined, and are a priority action determined by the public as part of this CWPP process.

The following resources are available for disaster preparedness information:

- County of Maui Civil Defense Agency Website²⁴
- Disaster Preparedness for Maui County: A Citizen's Guide²⁵
- Hurricane Information and Tips²⁶
- Tsunami maps information, and tips²⁷

STATE FIRE CODE

The Hawai'i State Fire Code is the 2012 NFPA 1, Uniform Fire Code, which has both state and county amendments. The state amendments contribute to the State Fire Code. Each county then adopts amendments to the State Fire Code to create the County Fire Code.

Most relevant to the discussion and public input for the Upcountry Maui CWPP Update is the chapter on the WUI, which is described in 2012 NFPA 1, Chapter 17.

HAZARD REDUCTION PRIORITIES UPCOUNTRY MAUI

PURPOSE AND METHODS

Public and government agency participants during the CWPP planning process identified hazard reduction priorities for Upcountry Maui. The wildfire-related concerns and actions provided by participants were focused toward enhancing wildfire response capabilities, addressing priority public concerns and wildfire impacts, and reducing hazards through pro-active wildfire mitigation. Community and agency discussion included the following topics and more:

- Increasing stakeholder knowledge about wildfire risk through education and outreach;
- Encouraging the treatment of structural ignitability;
- Prioritizing fuel reduction projects; and
- Increasing opportunities for collaboration and coordination to implement wildfire mitigation projects.

HFRA guidelines were followed by including community hazard reduction priorities, hazardous fuels reductions, and recommendations to reduce structural ignitability.

STAKEHOLDER CONCERNS AND RECOMMENDED ACTIONS

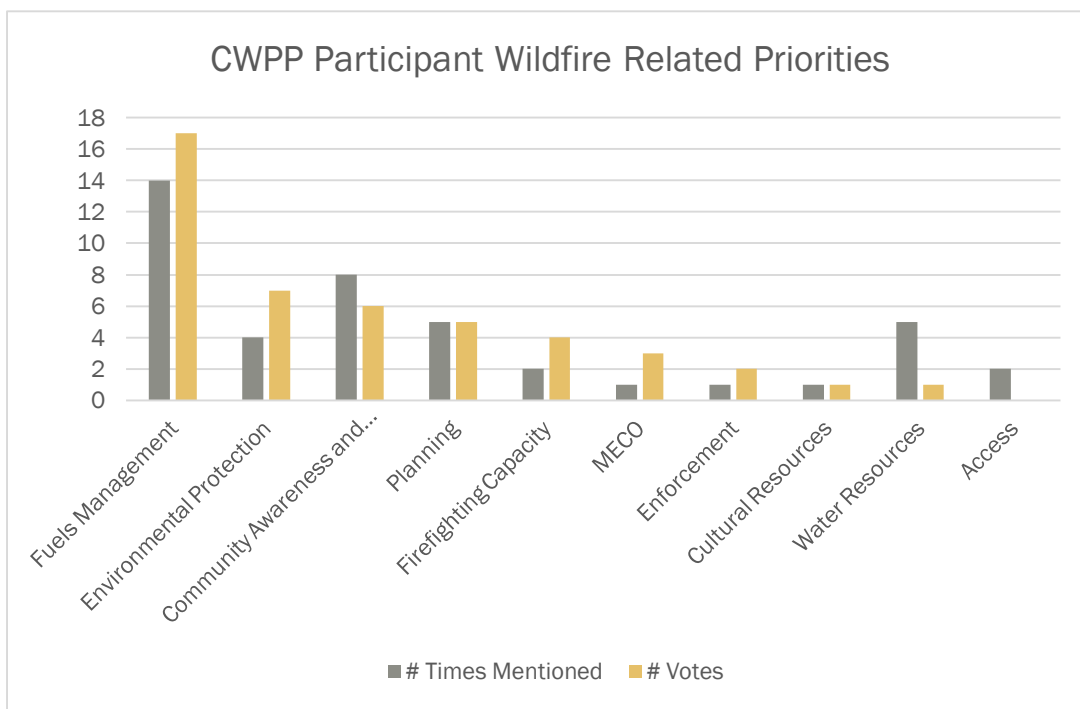


Figure 2. Upcountry Maui CWPP Participant Highest Wildfire-Related Priorities.

HWMO held two meetings for the general public and several meetings with fire response agencies and natural resource managers to collect input and record wildfire-related concerns and recommended actions. Additional input was solicited from decision makers, large landowners, and other stakeholders as noted in the Planning Process chapter of this document.

While Upcountry Maui CWPP participant input yielded diverse and broad concerns and recommended actions, certain topics came up with greater frequency. All input was aggregated and analyzed to capture an overview of the most frequently raised concerns. Concerns were recorded two ways: 1) number of times it was mentioned as an issue by small separate discussion groups during meetings, and 2) number of overall votes it received once participants were asked to vote on priorities from the full list of concerns generated by all groups at the meeting. Figure 2 displays both.

THREE CATEGORIES OF STAKEHOLDER CONCERNS AND RECOMMENDED ACTIONS

Public and agency input was extensive and has been organized to align with the categories used within the National Cohesive Wildland Fire Management Strategy.²⁸ Refer to Appendix A for detailed public input statements per category.

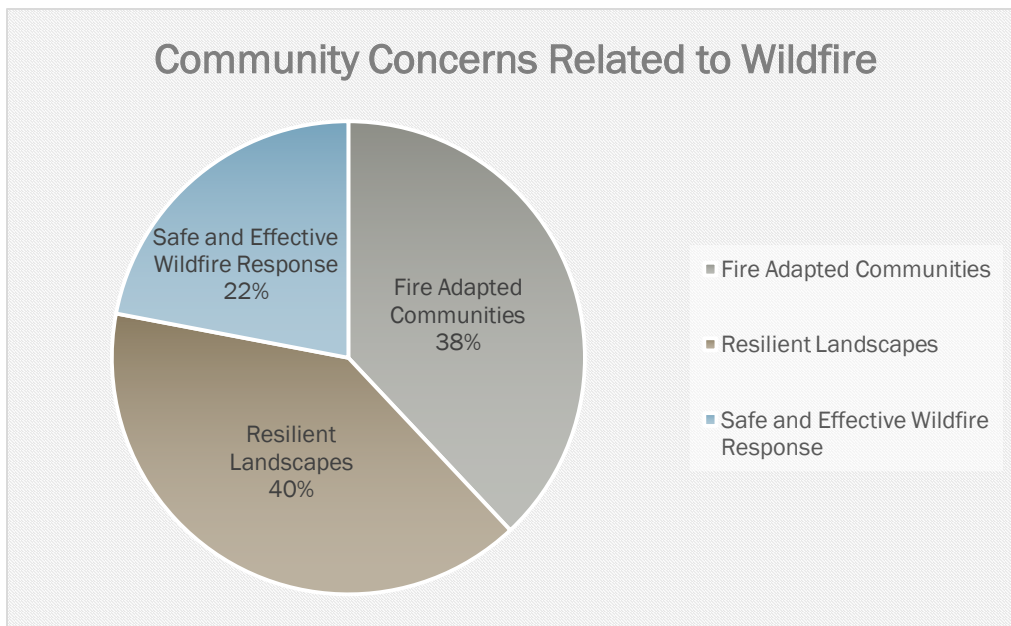


Figure 3. Community Concerns Organized by National Wildfire Management Cohesive Strategy Categories.

The National Cohesive Wildland Fire Management Strategy (subsequently referred to as *Cohesive Strategy*) encourages communities to develop a dynamic approach to planning for, responding to, and recovering from wildland fires. It provides a framework for wildfire-related discussion, efforts, and goals across the United States. The overarching national strategy is further divided into three regions for tighter collaboration and coordination in each area. Hawai'i falls into the Western Region. Public input details

for Upcountry Maui are organized as follows, according to the following categories so that they fit into the national and regional Cohesive Strategy framework of priorities and funding opportunities.

- Fire-Adapted Communities
- Resilient Landscapes
- Safe and Effective Wildfire Response

Figure 3 indicates how much of the participant concerns for Upcountry Maui falls within each category.

FIRE-ADAPTED COMMUNITIES

38% of Upcountry Maui CWPP participant input was related to the need to work toward greater fire awareness, readiness, prevention, and general fire-adaptation by communities and residents. These goals support the concept of Fire-Adapted Communities, defined by the United States Forest Service as "a knowledgeable and engaged community in which the awareness and actions of residents regarding infrastructure, buildings, landscaping, and the surrounding ecosystem lessens the need for extensive protection actions and enables the community to safely accept fire as a part of the surrounding landscape."²⁹ The Wildland-Urban Interface Mitigation Committee of the National Wildfire Coordinating Group defines a Fire-Adapted Community as "a human community consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire."³⁰

The primary goal of working toward fire adaptation is that wildfire preparedness and readiness efforts in a community become an ongoing and broadly supported part of living in, working in, and civically managing an area, and that all activities— from roadside fuels management and agriculture to development designs and community activities— work together to consistently and regularly support wildfire protection. This is opposed to the idea that wildfire preparedness is seasonal or can wait until the last minute, or that it is the responsibility of only one party (community association, fire department, etc.) to aid the community in wildfire preparedness. Generally across Hawai'i, wildfires are addressed on an as-needed, reactive basis. With the development of this and other CWPPs across Hawai'i, communities, organizations, and agencies are coming together to move toward becoming proactive, consistent, and collaborative. These all are aligned with the framework and objectives for Fire-Adapted Communities. Figure 4 depicts the roles and responsibilities of all members of society toward becoming fire-adapted.



Figure 4. Fire-Adapted Communities Infographic.³¹ There is a role for everyone when working toward a region becoming fire-adapted, as seen in this infographic from the Fire-Adapted Communities website, FireAdapted.org.

This CWPP was developed with a diversity of stakeholders with homes, businesses, personal interests, and jurisdictions in the Upcountry Maui CWPP planning area. The wildfire-related concerns and recommended actions demonstrate the range of responsible parties, timelines, and actions that need to be taken toward comprehensive wildfire prevention, preparedness, and protection of Upcountry Maui. These are the basic tenets of becoming fire-adapted. For the purposes of analyzing and presenting the Upcountry Maui CWPP stakeholder input, stakeholder concerns and recommendations related to the human side of fire adaptation are presented in this section. Managing vegetation and increasing fire suppression capacity are presented individually (See *Resilient Landscapes* and *Safe and Effective Wildfire Response* sections).

Figure 5 depicts the priorities determined by stakeholders pertaining to Fire-Adapted Communities.

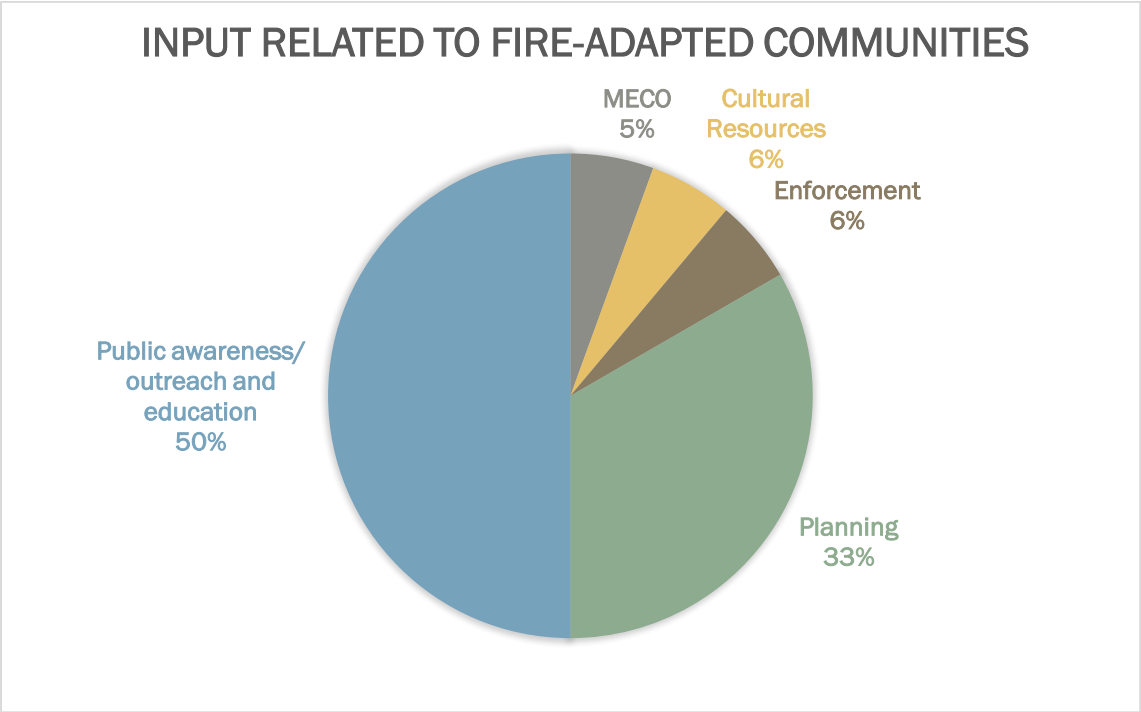


Figure 5. Community Concerns Related to the human side of wildfire preparedness and protection, as part of working toward Fire-Adapted Communities goals.

50% of all community-focused input was related to increasing community awareness. There was an urgency and emphasis from participants regarding the general lack of awareness of the threats and impacts of wildfire among all community members from residents to decision makers.

Further discussion and analysis resulted in suggested focal activities for bolstering wildfire awareness. The majority of focus was on community-based outreach, followed by targeted outreach to groups with shared interests, challenges, and habits, such as large landowners, recreationists, etc. (Table 6).

The next highest percentages of concerns related to the goals of Fire-Adapted Communities were the need for improved planning. This includes a need for fire management plans, the need for an established process to address wildfire related concerns and fuels management needs within residential areas, and increasing the participation of planners and policy makers in wildfire protection.

Enforcement-related concerns covered arson, vegetation management along highways and by large landowners, illegal dumping, and collaboration among decision makers and residents toward improved wildfire legislation.

The protection of cultural resources and Maui Electric (MECO) participation in fire prevention and mitigation were additional significant concerns shared by meeting participants.

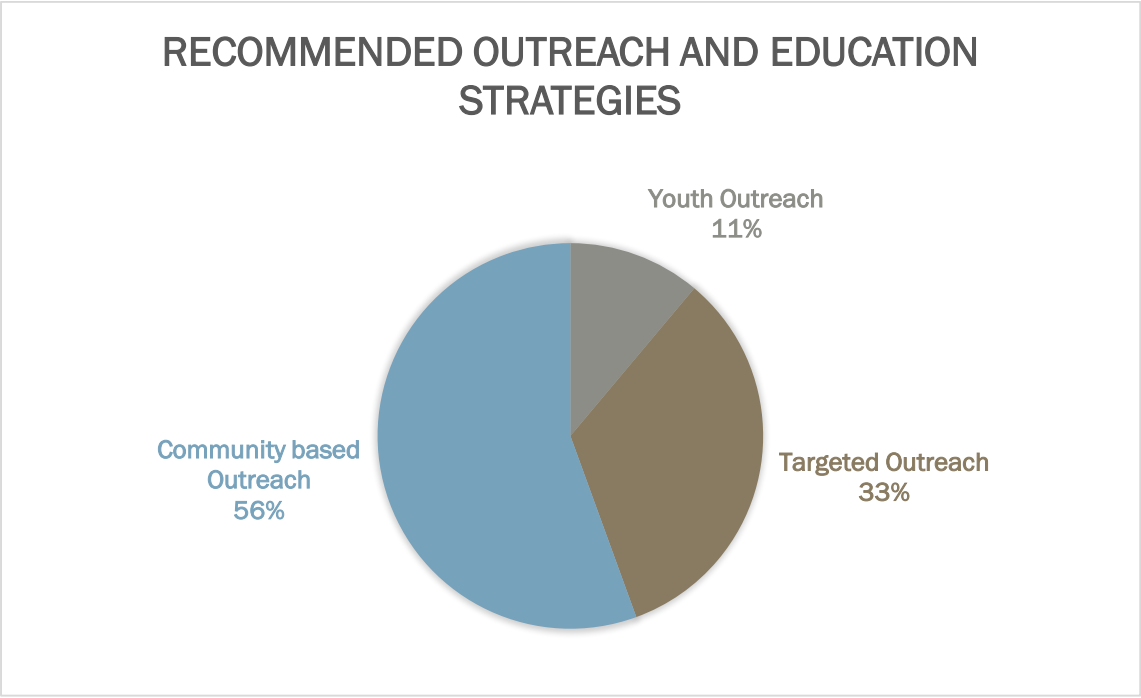


Figure 6. CWPP participant recommended methods for increasing public awareness regarding wildfire threats, impacts, and preparedness strategies.

RESILIENT LANDSCAPES

The Resilient Landscapes category of CWPP participant input focuses on all input related to restoring, protecting, or maintaining landscapes. For Upcountry Maui, this includes the protection native species and watersheds from wildfire impacts and the management of vegetation to reduce the ignition capacity and spread of wildfire. The concerns and recommended actions were focused as depicted in Figure 7, with vegetation management being the most frequently mentioned concern, followed by ecosystem protection and improved access and fuels management planning.

Among the concerns raised by Upcountry Maui participants, increased roadside fuels management, fuel reduction on the boundaries of large landholdings, and improved community participation of vegetation management within and around residential areas were highly discussed needs for the Upcountry Maui area. Of all fuels management related concerns, general fuels reduction projects and using agricultural and/or grazing methods to reduce fuels were the most frequently mentioned recommended courses of action. MECO involvement was the next highly prioritized action. Several other fuels management concerns were also recommended, including a need for greenwaste disposal options, invasive species removal, increased enforcement, and more outreach pertaining to the critical importance of vegetative fuels reduction. Figure 8 depicts the priorities for fuels management provided by participants.

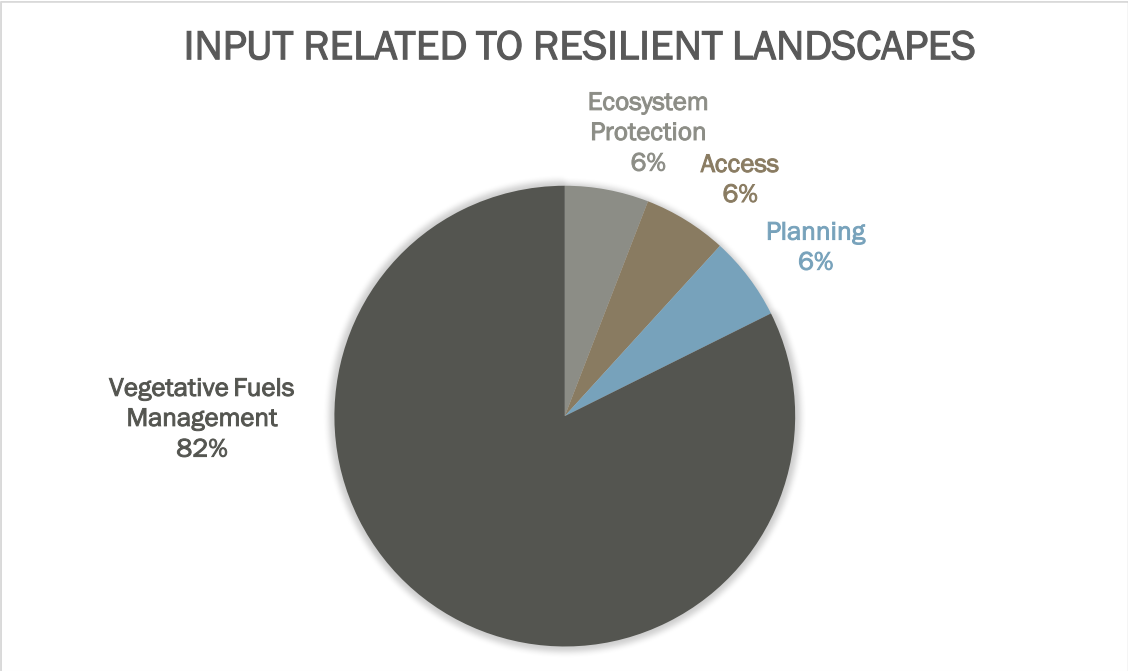


Figure 7. CWPP participant input related to restoring and maintaining landscapes to reduce wildfire threat/impact.

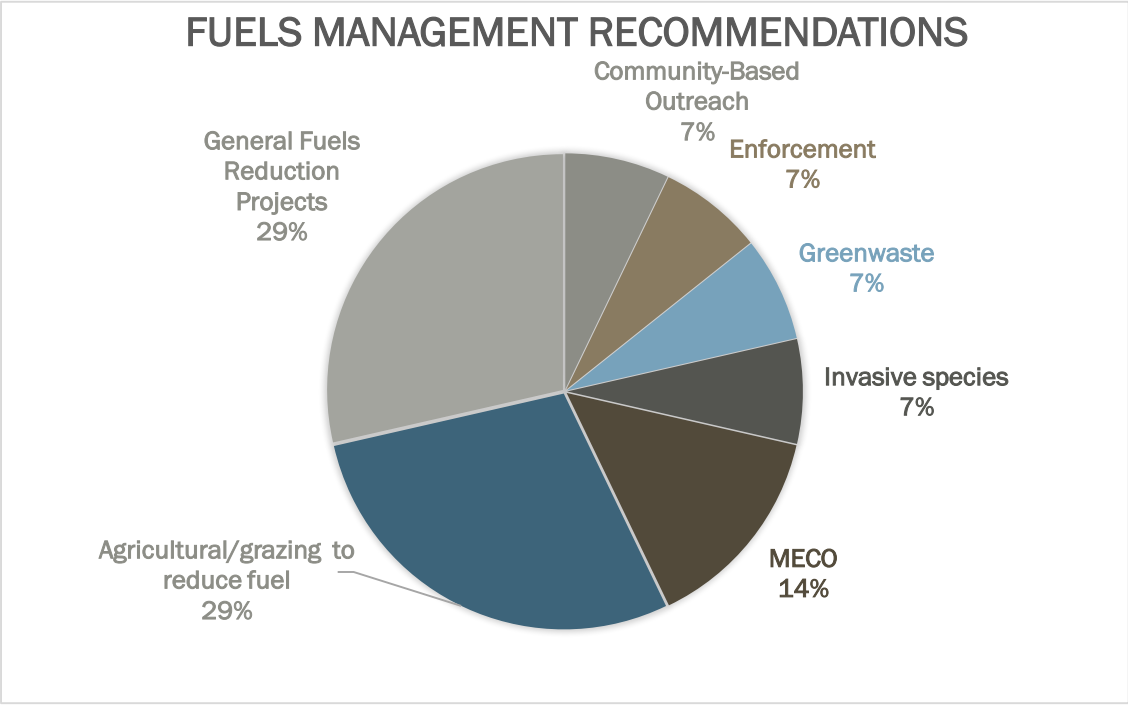


Figure 8. CWPP participant recommendations for addressing the need for greater fuels management across Upcountry Maui.

SAFE AND EFFECTIVE WILDFIRE RESPONSE

Comprehensive and effective wildfire preparedness and protection includes preventing ignitions, minimizing the ability of fire to travel across structures and landscapes, and maximizing the likelihood for fires to be suppressed quickly to keep them as small and minimally impacting as possible. Since the majority of all fires in Upcountry Maui (and Hawai'i in general) are human-caused, ignition prevention largely is a matter of community outreach and education (addressed in *Fire-Adapted Communities* section). Minimizing vegetative fuels and structural ignitability can minimize fire spread (see *Resilient Landscapes* section and *Reducing Structural Ignitability* section). Once a fire is ignited, however, the responsibility for taking action rests solely on fire suppression and emergency management departments and personnel. While prevention and preparedness are key to reducing the threats and impacts of wildfire, suppression is the final piece of the protection equation that needs to be proficient, equipped, effective, and adequately supported.

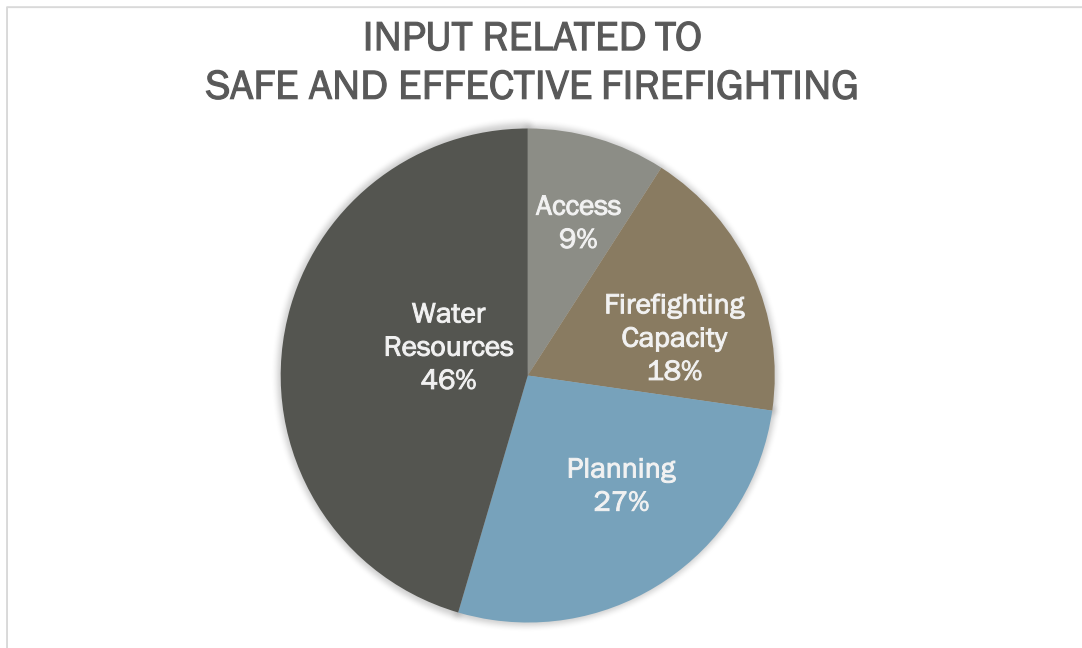


Figure 9. Public input related to safe and effective wildfire response.

Upcountry Maui CWPP participants provided their concerns priorities related to wildfire response (firefighting). The input was clustered into like categories and resulted in the following set of priorities (Figure 9):

1. Increase water resource infrastructure and availability for suppression.
2. Improve planning related to firefighting (pre-fire planning, fire plans for large landowners and large public areas).
3. Improve and increase firefighting access (through road and firebreak development and maintenance).
4. Increase capacity (such as personnel, training, and resources such as equipment and vehicles).

HAZARDOUS FUELS REDUCTION

A CWPP must identify and prioritize areas for hazardous fuel reduction treatments and recommend the types and methods of treatment that will protect one or more at-risk communities and essential infrastructure. Based on the fuel hazard ratings acquired during the hazard assessment, recommendations for the type and method of vegetative fuels reduction treatments for high fuel hazard areas are listed in Table 9.

Community Resource, Structure, or Value at Risk	Fuel Hazard Rating	Type of Treatment	Treatment Method Options
Mauka forested lands, parks, and reserves	HIGH OR EXTREME IF UNMANAGED	Mechanical, hand labor, chemical, animal, fuels conversion	Utilize well-managed grazing, weed whip, mow, hand-pull, herbicide where appropriate with follow-up vegetation removal. Reforestation and restoration. Fuels conversion and “living” or “shaded” fuelbreaks.
Homes and structures with large lots	MOD-EXTREME	Mechanical, hand labor, chemical, animal, fuels conversion	Firewise home ignition zones. Reduce fuel along property boundaries and roadsides. Convert fuels to drought-tolerant, fire-resistant (preferably native) plants. Reduce ladder fuels.
Densely arranged homes and structures	MOD-EXTREME	Mechanical, hand labor, chemical, fuels conversion	Firewise home ignition zones. Weed whip, mow, hand-pull, and herbicide where appropriate. Convert fuels to drought-tolerant, fire-resistant (preferably native) plants. Reduce ladder fuels.
Historical sites throughout Upcountry Maui	MOD-EXTREME	Hand labor, chemical, animal, fuels conversion	Weed whip, mow, hand-pull, well managed grazing, and herbicide where appropriate. Convert fuels to drought-tolerant, fire-resistant plants.
Roadsides	MOD-EXTREME IF UNMANAGED	Mechanical, chemical, animal, fuels conversion	Conduct roadside fuels treatments in accordance with fuel growth (keep low), maximize width of roadside reduction areas. Convert roadside fuels to fire-resistant plants that require little or no maintenance and are less ignitable.
Resorts	LOW-MOD	Mechanical, hand labor, chemical, fuels conversion	Continue regular maintenance and irrigation. Convert fuels to drought-tolerant, fire-resistant plants.
Fallow Agricultural lands	HIGH OR EXTREME IF UNMANAGED	Mechanical, animal, chemical, re-establish active agriculture	Install fuelbreaks along roads and property boundaries, or in lines perpendicular to slope to provide access and minimize erosion. Reduce fuels in patches to create fuel mosaics. Utilize well-managed grazing. Re-establish active agriculture. Initiate reforestation and/or restoration while also maintaining fuels.

Table 9. Hazardous Fuels Treatment Recommendations.

REDUCING STRUCTURAL IGNITABILITY

A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures. Individuals and community associations can reduce structural ignitability throughout their community by taking the following measures recommended by the Firewise, Ready, Set, Go!, and HWMO outreach programs, summarized below. ^{32, 33, 34}

The following pages are written with the resident in mind, and can be removed and used independently from the CWPP as a general set of guidelines for reducing hazards in the home ignition zone. It is highly recommended that individuals and communities conduct a simple native vegetation assessment and/or consult with appropriate biologists or foresters before clearing trees and significant amounts of vegetation that may be important to protect.

Creating defensible space does not necessarily mean eliminating the presence of greenery on your property. You can still landscape around your home to make it fire-safe without compromising beauty and aesthetics. By planting native, drought-tolerant plants (xeriscaping) around your home, you can:

- Protect your home from wildland fire ignition and spread
- Beautify your property
- Perpetuate an important natural and cultural resource
- Decrease the maintenance needs of your landscaping

For the drier areas of Hawai'i, consider that native dryland plants are specially adapted to local conditions and require less upkeep, water, and fire maintenance, saving yourself a great deal of time, money, and resources. Non-native, lush plants often drop hazardous debris and can become fire-prone in drought conditions.

DEFENSIBLE SPACE ZONES AROUND STRUCTURES

To reduce structural ignitability, it is recommended that residents think in zones around their home, and begin addressing risk reduction activities in Zone 1, working out from there to Zone 2 and beyond.

The following actions are recommended per zone:

Zone One extends 30 feet out from buildings, structures, decks, etc.

- Remove all dead or dying vegetation.
- Remove “ladder fuels” (low-level vegetation that allows the fire to spread from the ground to the tree canopy, see Figure 11). Create at least 6 feet of separation between low-level vegetation and tree branches. This can be done by reducing the height of low-level vegetation and/or trimming low tree branches.
- Create “fire-free” area within 5 feet of home, using non-flammable landscaping materials and/or high-moisture content, drought-resistant vegetation.
- Trim tree canopies regularly to keep their branches a minimum of 10 feet from structures and other trees.
- Remove leaf litter (dry leaves/pine needles) from yard, roof and rain gutters.
- Relocate woodpiles or other combustible materials into Zone Two.
- Remove combustible material and vegetation from around and under decks, lanai, or the entire house if foundation is post-and-pier.
- Remove or prune vegetation near windows.

Zone Two extends 30 to 100 feet out from buildings, structures and decks. You can minimize the chance of fire jumping from plant to plant by removing dead material and removing and/or thinning vegetation. The minimum spacing between vegetation is three times the dimension of the plant.

- Remove “ladder fuels” (see Figure 11).
- Cut or mow annual grass down to a maximum height of 4 inches.
- Trim tree canopies regularly to keep their branches a minimum of 10 feet from other

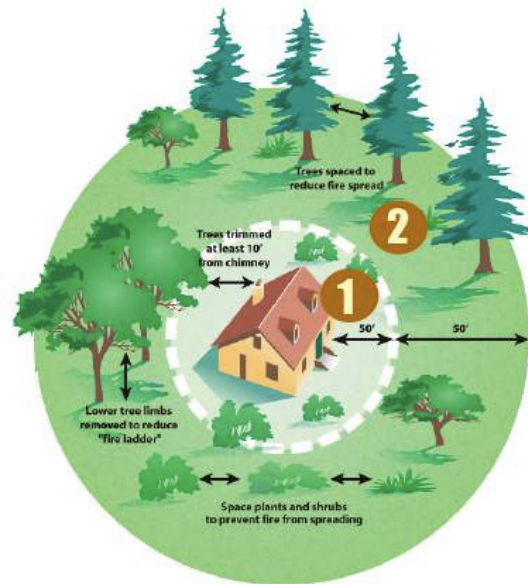


Figure 10. Defensible space zones around structures.²⁸

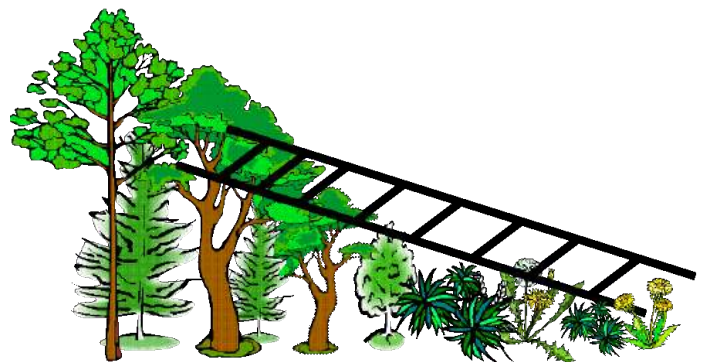


Figure 11. Ladder Fuels Diagram.¹ Ladder fuels form a pathway for ground fires to climb vegetation and become crown fires, which are much more difficult to suppress. It is important to limb low hanging branches and keep ground vegetation short so that vegetation is separated inhibiting fire from easily “climbing” up to canopy where wind is often stronger.

trees/cluster of trees.

- For larger properties, consider areas outside of Zone Two as a third zone to address. Continue reducing ladder fuels, managing fuels, hardening structures, and properly storing combustible materials.

GENERAL DEFENSIBLE SPACE RECOMMENDATIONS

- As stated above, ensure you have at least a 100-foot radius of defensible space (cleared, managed, and maintained vegetation) around your home. Note that even more clearance may be needed for homes in severe hazard areas. This means looking past what you own to determine the impact a common slope or neighbors' yard will have on your property during a wildland fire.
- Cut dry weeds and grass before noon when temperatures are cooler to reduce the chance of sparking a fire.
- Landscape with drought-resistant plants that have a high moisture content and are low-growing.
- Keep woodpiles, propane tanks and combustible materials away from your home and other structures such as garages, barns and sheds.
- Ensure that trees are far away from power lines.
- Weed around the property regularly, especially areas that a lawn mower is not appropriate for (tall dry grasses, rocky terrain, etc.)
- Remove leaf litter and other debris that accumulate around the building, under vegetation, and other collection areas.
- Remove leaf litter, straw and other debris from under and around propane tanks to create 10 feet of clearance around it.
- Eliminate ladder fuels by pruning tree branches on trees around the property to within at least 6 feet of the ground, using a bypass lopper, pruner saw, or long reach/hand pruner.
- Remove flammable materials from underneath the house, decks, porches, and lanai.
- Common flammables include scrap-wood, firewood, and combustible furniture.
- Mow the lawn regularly to keep grasses shorter than 4 inches tall around the home. Do not mow in the heat of the day or when the wind is blowing. Never mow in dry vegetation.
- Non-native trees, such as ironwood constantly drop needles, leaves, branches, and other debris, so it's best to stay on top of removing them from the ground before the pile becomes a major project. Consider reforesting these areas with native trees that don't drop large amounts of debris.
- Invasive grasses such as guinea and fountain grass grow rapidly when un-managed and can dry out very quickly, creating a major fire hazard. Weed them often and consider replanting with low-lying, drought-tolerant, native ground cover.

HARDEN YOUR HOME

Creating defensible space, as detailed above, decreases the likelihood of wildfire spreading through vegetation that surrounds structures on the home site or yard. The second and equally important set of actions to reduce wildfire-caused ignitions of residences and structures is to harden the home or structure with non-combustible building materials and ignition-reducing strategies. The following is a step-by-step list of recommended actions per component of a structure or home. Some of these actions are inexpensive and some are costly. All are important. It is recommended that residents take the simple and easier steps right away, and prioritize hardening the rest of the home or structure as soon as possible. Note: relying on the ability to water the roof when fire is approaching will not necessarily provide adequate structural protection, and it puts you in danger. It also takes water and personnel resources away from firefighters, who need the water and full attention toward firefighting rather than search and rescue for late evacuees. Preparation and early evacuation are key actions recommended by the national Ready, Set, Go! Program. Prepare your home as follows:

Roof: Your roof is the most vulnerable part of your home because it can easily catch fire from wind-blown embers. Homes with wood-shake or shingle roofs are at high risk of being destroyed during a wildland fire. Build your roof or re-roof with fire-resistant materials such as composite, metal, or tile. Block any spaces between roof decking and covering to prevent ember intrusion. Clear leaves and other debris from your roof and gutters. Cut any tree branches within 10 feet of your roof.

Vents: Vents on homes are particularly vulnerable to flying embers. All vent openings should be covered with 1/8-inch or smaller metal mesh. Do not use fiberglass or plastic mesh because they can melt and burn. Attic vents in eaves or cornices should be baffled or



Figure 12. Covering vents with 1/8-inch or smaller metal mesh blocks embers from entering a home or structure.



Figure 13. Keep windows free of vegetation to reduce likelihood of heat-caused breakage that lets embers into your home.



Figure 14. Make sure your eaves are enclosed with non-combustible materials to prevent ember entry.



Figure 15. Rain gutters should have screens to keep leaf debris from accumulating. Maintain gutters to keep them clear and clean.

otherwise protected to prevent ember intrusion (mesh is not enough).

Deck/Patio Cover: Use heavy timber or non-flammable construction material for decks. Enclose the underside of balconies and decks with fire-resistant materials to prevent embers from blowing underneath. Keep your deck clear of combustible items, such as baskets, dried flower arrangements and other debris. The decking surface must be ignition resistant if it's within 10 feet of the home.

Windows: Heat from a wildland fire can cause windows to break even before the home ignites. This allows burning embers to enter and start internal fires. Single-paned and large windows are particularly vulnerable. Install dual-paned windows with the exterior pane of tempered glass to reduce the chance of breakage in a fire. Limit the size and number of windows in your home that face large areas of vegetation.

Non-Combustible Enclosed Eaves: Box in eaves with non-combustible materials to prevent accumulation of embers.

Walls: Wood products, such as boards, panels or shingles, are common siding materials. However, they are combustible and not good choices for fire-prone areas. Build or remodel with fire-resistant building materials, such as plaster, cement, masonry or stucco. Be sure to extend materials from foundation to roof.

Rain Gutters: Screen or enclose rain gutters to prevent accumulation of plant debris.

Chimney: Cover your chimney and stovepipe outlets with a non-flammable screen of 1/4-inch wire mesh or smaller to prevent embers from escaping and igniting a fire. Make sure that your chimney is at least 10 feet away from any tree branches.

Garage: Have a fire extinguisher and tools such as a shovel, rake, bucket and hoe available for fire emergencies. Install a solid door with self-closing hinges between living areas and the garage. Install weather stripping around and under door to prevent ember intrusion. Store all combustibles and flammable liquids away from ignition sources.

Non-Combustible Fencing: Make sure to use non-combustible fencing materials, and to keep combustible fences away from homes. Wooden fences leading straight to the home act as wicks and bring the fire straight to the structure, greatly increasing the likelihood of the home igniting.



Figure 16. Wood fencing can act like a fire wick straight to a home. Use non-combustible materials for all fencing and yard structures.

Driveways and Access Roads: Driveways should be designed to allow fire and emergency vehicles and equipment to reach your house. Access roads should have a minimum 10-foot clearance on either side of the traveled section of the roadway and should allow for two-way traffic. Ensure that all gates open inward and are wide enough to accommodate emergency equipment. Trim trees and shrubs overhanging the road to a minimum of 13 1/2 feet to allow emergency vehicles to pass.

Address: Make sure your address is clearly visible from the road.

Water Supply: Have multiple garden hoses that are long enough to reach any area of your home and other structures on your property. If you have a pool or well, consider getting a pump.

Inside: Keep fire extinguishers on hand and in good working order. Install smoke alarms on each level of your home and near bedrooms. Test them monthly and change the batteries twice a year.

ACTION PLAN

UPCOUNTRY MAUI COMMUNITY WILDFIRE PROTECTION PLAN

The Upcountry Maui CWPP Action Plan follows the guidelines of the HFRA, which includes developing an action plan along with an implementation and maintenance strategy.

The Upcountry Maui CWPP Action Plan was developed through an analysis of the issues identified in the hazard assessments and overall risk assessment, public and agency meetings, and through a review of other Community Wildfire Protection Plans throughout Hawai'i. Federal, state, and county fire and land management agencies, private entities and landowners, and area residents and homeowners were invited to submit projects that provide protection and reduce risk. Public concerns and input served as the basis for the projects listed below that will guide hazard reduction efforts in the future. Landowners and agencies are invited to continue to submit projects that provide community protection and mitigate wildfire risk. The Maui Wildfire Coordinating Group and HWMO intend to regularly evaluate progress on projects. Additional projects and project ideas can be attached as appendices.

NEAR-TERM ACTION PLAN

The following table details the projects that have been prioritized for the next five years.

Project	Anticipated Cost	When	Lead
Smokey Bear signage – Install and maintain “Smokey Bear, Prevent Wildfire Signs” throughout project area	\$10,000/year	ASAP	DLNR-DOFAW
Assist interested communities in completing Firewise Communities certification process	\$5,000/community	Ongoing	HWMO
Provide outreach to students at schools in fire prone communities	Varies, part of broader work plan and set of expenses	Ongoing	HWMO
Develop wildfire prevention and drought awareness and preparedness materials	Variable	In Initial Phases	HWMO, DLNR
Launch wildfire and drought awareness campaign	Variable	In Initial Phases	HWMO, MFD, DLNR-DOFAW
Host wildfire preparedness information and materials for residents and decision makers on website	Variable	Ongoing	HWMO, MFD, DLNR-DOFAW
Utilize social media to promote wildfire awareness	Variable	Ongoing	HWMO, MFD, DLNR-DOFAW
Maintain firebreaks/fuelbreaks in State Forest Reserves (Kula State Forest Reserve) and private ranch parcels		Planning , Early Scoping	DLNR-DOFAW

Fuel Reduction project in Waihou Springs State Forest Reserve		Planning, Early Scoping	DLNR-DOFAW
Maintain and add RAWS		ASAP	DLNR-DOFAW
Green waste removal and recycle program	Variable on area and frequency of pickup	ASAP	TBD

Table 10. Near-term action plan and projects.

LONGER-TERM ACTION PLAN

In addition to projects that are ongoing or being initiated at the time of writing this CWPP, numerous other longer-term priority projects were proposed by participating agencies and organizations involved in the CWPP planning process. Table 11 details the proposed longer term (5+ years) projects in no priority order. Projects are to be completed as funding, personnel, and opportunities become available to implement them.

Proposed Project	Anticipated Cost	Lead
Improve national reporting of wildfires in Hawai'i	TBD	DLNR-DOFAW, USFS, HWMO
Improve initial attack capacity	Project dependent	TBD
Work to appropriately graze fallow areas where fuels are building, Fund fencing and water troughs to make lease areas more economically feasible to graze	200,000 for fencing multiple areas	TBD
Install water tanks around margins of communities to serve as dip tanks for helicopter fire suppression. Have tanks double as water troughs for ranching and conservation/restoration efforts	\$20-60,000 per diptank	TBD
Increase outreach to community associations	Variable	HWMO, DLNR-DOFAW, MFD
Provide Wildfire Education for Decision Makers	TBD	HWMO, DLNR-DOFAW, MFD
Seed Collection and Storage for Post Fire Replanting	TBD	DLNR-DOFAW
Work with large landowners to encourage fuels management	TBD	HWMO, DLNR-DOFAW, MFD
Maintain and add RAWS	TBD	DLNR-DOFAW
Work with partners and residents to garner support for increasing DLNR-DOFAW's budget for fire response	TBD	HWMO, DLNR-DOFAW, MFD, Public
Submit WUI proposals for projects in the CWPP area	TBD	DLNR-DOFAW
Work with State and federal land-owner assistance programs to incorporate wildland fire concerns	TBD	TBD, Possibly DLNR-DOFAW
Work with large landowners to encourage access management	TBD	TBD, various
Forest health improvement thru timber vegetation thinning project	Early scoping	DLNR-DOFAW

Table 11. Proposed future projects.

In addition to projects and action steps submitted by public and agency participants (Tables 10 and 11 above), a list of proposed wildfire-related next steps for large landowning partners within the Leeward Haleakalā Watershed Restoration Partnership was provided. This is included as Appendix E.

CWPP IMPLEMENTATION AND MAINTENANCE

HFRA requires that the MFD, County of Maui Civil Defense Agency, and DLNR-DOFAW all agree on the final contents of the Upcountry Maui CWPP. The plan is signed by each agency in order to meet HFRA and FEMA requirements. Because of the non-regulatory nature of the CWPP, the relevance and effectiveness of the Upcountry Maui CWPP will rely heavily upon community initiative and involvement. Expertise, technical support, and implementation assistance will be provided by the appropriate agencies and organizations involved in fire issues in the Upcountry Maui area. Area residents are urged to contribute time and effort toward creating defensible space, reducing structural ignitability, and working at the community level to initiate and maintain wildfire protection projects.

HWMO, in cooperation with the Maui Wildfire Coordinating Group, will provide technical support, identify and coordinate funding when possible, and serve as a centralized resource for wildfire risk reduction efforts in Upcountry Maui. Together, representatives will identify sources of funding for projects, document the successes and lessons learned from those projects, and evaluate and update the CWPP as needed and as possible.

HWMO will provide outreach and educational programs to youth and adults through school programs, community events, homeowners/community association programs, and workshops in the coming year to kickstart community involvement in implementing the actions identified in this plan. Additionally, HWMO will be working with interested communities to go through the Firewise certification process, to include forming local Firewise committees and action teams and completing comprehensive hazard assessments and plans specific to their subdivisions.

Many Upcountry Maui CWPP action items will require continuing support for wildfire risk mitigation projects. This will involve actively pursuing funding for projects, staying informed and in contact with one another, and updating the CWPP regularly so that it remains a “living” document. Continuing to build community awareness of these issues and actions will assist with fostering individual and community investment in projects.

SIGNATORY CONTACT INFORMATION

The following county, state, and federal representatives have a high level of interest in the protection of the Upcountry Maui area from wildfire, and have reviewed and support this CWPP. Contact information for principal government stakeholders is listed below.

Maui Fire Department

Jeffrey Murray, Fire Chief
200 Dairy Road
Wailuku, HI 96793



Civil Defense Agency, County of Maui

Anna M. Foust, Emergency Management Officer
200 S. High Street
Wailuku, HI 96793



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

David G. Smith, Administrator
Kalanimoku Building
1151 Punchbowl St. Room 325
Honolulu, HI 96813



The Signature Page presented at the beginning of this document demonstrates the required multi-agency participation and acknowledgement of this plan.

For inquiries related to the development of this plan, to add action plan projects, or for printed copies, please contact:

Hawai'i Wildfire Management Organization
65-1279 Kawaihae Rd. Ste 211
Kamuela, HI 96743
Email: admin@hawaiiwildfire.org
Website: Hawaiiwildfire.org



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APPENDICES

Appendix A: Upcountry Maui Community Wildfire Protection Plan Participant Input

Appendix B: Photos of WUI Communities in the Upcountry Maui CWPP planning area

Appendix C: Wildfire Hazard Assessment Maps for Upcountry Maui

Appendix D: Maui Fire Department 2016 Apparatus and Vehicle Inventory

Appendix E: Leeward Haleakalā Watershed Restoration Partnership Proposed Priority Projects

Appendix A
Upcountry Maui Community Wildfire Protection Plan Participant Input
Wildfire-Related Concerns and Recommended Actions

COMMUNITY INPUT RELATED TO FIRE ADAPTED COMMUNITIES	
CONCERN	RECOMMENDED ACTION
General Outreach	
Lack of community awareness	Education to reduce ignitions: kids, schools, County Fair (Sept/Oct), Ag Fest (Mar), newspaper, airport screens, radio, movie theater screens
Lack of fire awareness & public outreach	Increase fire awareness and public outreach
Lack of public education/Info (ignitions)	Outreach programs
Lack of resilience planning	Increase community awareness
Large landowners (state, etc.)	Reduce ignitions
Targeted Outreach	
Fire's not sexy & controversial - Out of sight, out of mind!	Package outreach with sustainability & other popular topics (drought)
Elderly communication if fire	Establish a buddy system for elderly (2-3 neighbors)
Large landowners (state, etc.)	Map of landowners - go to 10 biggest landowners & watershed partners and educate/get input about wildfires (focus on leeward sides)
Community awareness - Kihei is very aware but Kula is not	Wildfire education in schools - 6th grade
Cultural Resources	
Cultural resources have burned	Need fire protection/management of cultural resources
Fireworks Enforcement	
Firework ignited fires	Legislative/County wide ban on fireworks; Promote large firework events instead of personal use
Planning	
A DHHL Firewise program needs to be included in overall community plans	Develop and include DHHL Fire mitigation projects in community plans
No fire plan	Fire break plans needed with details, materials, width
Lack of political support for fire mitigation planning	Educate local politicians on issues to support bills to help with issue
Lack of Resilience Planning	Research how to get it into Community Development Plans
No fire plan	Need fire cameras to spot fires
	Need notification system
MECO Easements: Vegetation Management; Infrastructure Improvement	MECO to upgrade infrastructure - work with PUC to help facilitate upgrade

All concerns and recommended actions were taken directly from handwritten posters developed by CWPP meeting participants in small groups at CWPP input meetings.

Appendix A
Upcountry Maui Community Wildfire Protection Plan Participant Input
Wildfire-Related Concerns and Recommended Actions

COMMUNITY INPUT RELATED TO RESILIENT LANDSCAPES	
CONCERN	RECOMMENDED ACTION
Access	
Polipoli State Forest Reserve is a fire hazard (also tree hazard, road closures)	Maintain roads for better fire access and keep roads open; Cut trees off the road; Trim trees so less fire prone
Ecosystem/Environmental Protection	
Invasive plants in Kaupo	Eradicate invasives (xmas berry) and increase grazing area to reduce invasives and fire
Lack of native reforestation efforts	Fund Leeward Haleakala Restoration to reforest landscape with native vegetation
Lack of vegetative recovery program	Centralized seed storage equipment @DLNR-DOFAW base yard; Allows all resource management entities access to seeds
Post-fire Rehabilitation of native veg.	Increase seed collection/storage & broadcast vectors to revegetate
Fuels Management	
Fallow Lands (former pineapple, sugar cane)	Need to be managed before/after sale
Overgrown vegetation	Graze areas near active grazing sites
Invasive plants in Kaupo	Eradicate invasives (xmas berry) and increase grazing area to reduce invasives and fire
Abundance of kiawe in wildland	Prescriptive debris removal program with landowners
Brush abatement enforcement	See if Maui Fire Dept. able to work with landowners to mitigate
Polipoli State Forest Reserve is a fire hazard (also tree hazard, road closures)	Maintain roads for better fire access and keep roads open; Cut trees off the road; Trim trees so less fire prone
Vegetation management issues	Manage vegetation
Overgrown vegetation in gulches	Green waste pickup program to encourage landowners to not dump vegetation into gulches.
Wildfires as a vector for spreading GMO seeds to other areas	Conduct research on GMO spread
Lack of MECO vegetation management in easements	Work with MECO to restart vegetation control program; PUC enforcement needed
Lack of grazing buffer around DHHL	Create grazing buffer around DHHL lands
Makawao Fire Station - threatened by nearby road ignitions	Remove/manage vegetation/brush adjacent to station
MECO Easements: vegetation management; infrastructure improvement	Reestablish vegetation control/brush abatement program
Large landowners (state, etc.) are not managing fuels	Fire break/buffer between subdivision & large landowners
Planning	
No firebreak plans for areas	Firebreak plans needed with details, materials, width

All concerns and recommended actions were taken directly from handwritten posters developed by CWPP meeting participants in small groups at CWPP input meetings.

Appendix A
Upcountry Maui Community Wildfire Protection Plan Participant Input
Wildfire-Related Concerns and Recommended Actions

COMMUNITY INPUT RELATED TO SAFE AND EFFECTIVE RESPONSE	
CONCERN	RECOMMENDED ACTION
Access	
Bad access to community areas	Improve access to communities. Repair and maintain access roads
Firefighting Capacity	
Decrease in firefighting resources (MLP sold off equip and cut personnel)	Get more equipment & personnel for DLNR and County
Nationwide 70% of firefighters are volunteers - very few in HI (Big Island only)	Need volunteer FD
Planning	
Wind direction changes - fire spread concern	Create a Fire Evacuation Plan street by street with safety zones
	Civil defense alarms/notification systems; entity to generate emails/messages for evacuation purposes; Communication with schools & parents
No fire plan that dictates how the public will know	Need notification system
Water Resources	
Water access and availability	Involve County, State, Federal decision makers to extend incomplete 8" Ag pipeline & make it more functional
Access to water	Additional water tanks needed; Catalogue all reservoirs and map where they are to delineate ones helicopters can dip into - HTNS reservoirs - owned by E. Maui Sugar Company
	Run pipes up to mauka areas, turn on pump down below, and connect to hydrants above (which can be accessed)
	Frog ponds - dig ponds to be temporarily filled
Lack of water resources for fire suppression	Increase number of reservoirs in remote areas

All concerns and recommended actions were taken directly from handwritten posters developed by CWPP meeting participants in small groups at CWPP input meetings.

Appendix A
Upcountry Maui Community Wildfire Protection Plan Participant Input
Wildfire-Related Concerns and Recommended Actions

Natural Resource Manager and Large Landowner Input	
CONCERN	RECOMMENDED ACTION
Fires move from roads toward remote areas and the landowners have land where the fires spread the most, so they get the most media attention	Roadside signs to minimize ignitions, roadside fuels management
Ranchers are managing with fuel and fire in mind, others without grazing and relevant tools/resources don't have the capacity to manage fuel load	Landowner assistance, focus on ignition prevention and increased water resources for firefighter to keep fires smaller and more quickly contained
Lack of water resources for firefighting	Increased money for additional reservoirs and diptanks, water resources on site for when fires happen
Need to increase communication with the public along the highway	More signage re ecological and cultural sensitivity and fire hazard signage
Fires start on the highway	Better fuel control along highway- maintaining vegetation on road, enforce or get more funding for the County, mow further, consider grazed buffers and corridors
Need to address post-fire rehabilitation	Seed storage and response after fires so can respond, turn former ag land into seed farms, incentive for landowners
	PFR lessons learned for methods and establishment rate (which species, combos, trials)
Need more and better coordinated fuels management	Create grazed firebreaks and firebreaks around communities, green breaks (drought tolerant, fire resilient) along roads, in conjunction with each other
Few roads, lack of access	Develop evacuation routes, and secondary access roads

All concerns and recommended actions were taken directly from handwritten posters developed by CWPP meeting participants in small groups at CWPP input meetings.

Appendix B

Photos of WUI Communities in the Upcountry Maui CWPP planning area

The following photos were taken during a visual assessment of Upcountry Maui, during which we documented community resources at risk, hazards, and examples of existing protective features in the Upcountry Maui CWPP planning area.

Photo assessments were completed for the following areas:

- Hali'imaile
- Keokea Hawaiian Homesteads
- Kula (Upper and Lower)
- Kula Hawaiian Homesteads
- Makawao
- Pā'ia
- Piholo/Olinda
- Pukalani
- Sprecklesville
- Waiakoa

Hali'imaile



Agricultural land between Hali'imaile and Hwy 37 subject to erosion



Apartment complex with good defensible space



Hali'imaile General Store



Cars parked in tall grass across from Hali'imaile Park are ignition hazard



Overgrown roadside residential vegetation need to be managed



Overgrown guinea grass is a prevalent fire fuel



Example of home with hazardous vegetation on fenceline



Example of home with good defensible space



Example of home with hazardous fuels surrounding primary structure



Vegetation overgrowing powerlines is a high hazard



Hali'imaile Park is surrounded by unmanaged dense fuels



Hazardous unmanaged wildland fuels are growing up to residential boundary

Keokea Hawaiian Homelands



Typical vegetation in wildland areas of Keokea



Main commercial area of Keokea



Roadside fuels are a high hazard in Keokea; Example 1



Example 2 of roadside fuels



Wildland fuels contiguous from upland Keokea to coastal Kihei



Keokea Farm Lots and view of Haleakala. Abundant vegetation is high hazard in dry periods



Example 3 of overgrown roadside fuels



Example of home with good defensible space- Lauie Drive. Grasses kept short.



Example of home with hazardous fuels surrounding primary structure



Pueo Drive- tall grasses between properties



Wide road and shoulders provide good access but some roads have tall roadside fuels



Pueo Drive with wildland-urban interface in background

Kula



Example of typical unmanaged grass fuels with homes in background



Hazardous vegetation growing on powerline



Aapueo Way tall grasses and shrubs with subdivision in background



Hazardous vegetation growing between properties



Good example of using groundcovers along edge of road and non combustible fencing/roof



Many gulches have unmanaged hazardous fuels



Example of vacant lot with unmanaged fuels



Kaalele PI WUI with grassland and forest



Farm on Kimo Drive. Active agriculture creates low fire hazard.



Example of home along wildland boundary



Example of home with good defensible space



Example of home with low hazard and good access

Kula Cont'd



Farm



Haleakala Waldorf School



Highway 377 gulch near Botanical Gardens



Highway 377



Example of well-maintained landscaping



Kula Botanical Gardens driveway



Kula Botanical Gardens gulch



Kula Community Center



Pulehuiki Rd grass lawn and tall fuels



Orchard



Pulehuiki Rd Wildland-Urban Interface



View of homes next to Wildland-Urban Interface

Kula Hawaiian Homesteads



Kealakupu Drive dead tree on roadside and common vines



Kealakupu Drive paved road with cleared shoulders



Kealakupu Drive narrow road with roadside fuels



Kealakupu Drive unpaved road adjacent to dense fuels



Kealakupu Drive view of wildland environment down toward coast



Kealakupu Drive water tank



Sun Yat Sen Park entrance demonstrates dryness of environment



Sun Yat Sen Park has heavy fuels adjacent to road

Makawao



Baldwin Avenue storefronts



Eddie Tam Memorial Center Park



Typical neighborhood in Makawao



Example of home with vegetation overgrowing roofs and walls



Homes along grassy WUI



Homes close together with hazardous grassy fuels



Hazardous roadside fuels at edge of subdivision



Hazardous grasses next to powerlines



Unmanaged hazardous grasses adjacent to main road



Makawao Elementary School



Hazardous roadside fuels on Makawao-Olinda Rd. near Seabury Hall



Seabury Hall, example of debris on roof

Pā'ia



Baldwin Ave near Pā'ia tall grass on roadsides with telephone pole



Baldwin Ave near Pā'ia tall grasses encroach road



Baldwin Beach Park fuels



Baldwin Beach Park



Ballpark at Wildland-Urban Interface



Hoe St view of wildland



Ho'okipa Lookout tall grasses



Pā'ia commercial area



Pā'ia Fire Station



Pa'ia School fuels near front entrance



Traffic between Pa'ia and Spreckelsville



Hazardous fuels near post office

Piholo/ Olinda



Bamboo commonly found on roadsides in area



Cattle grazing near main road



Common succulents found on roadsides and near homes



Dense forest with high wildfire hazard (Waihou Reserve)



Dense stands of eucalyptus at end of county road



Eucalyptus and grass/shrub ladder fuels along roadsides



Fuelbreak along west side of main road



Grasses and eucalyptus overgrowing road



Example of heavy buildup of fuel around and over home



Example of property with good defensible space



The road gets messier with more downed fuel the further away from Makawao



Wildfire hazards along roadside and on telephone poles

Pukalani



Example of home with hazardous tall grasses and shrubs near windows



Some homes are close together with small lot sizes



Hwy 37 between Makawao and Kula



Example of homes surrounded by dense fuels



Example of vacant lot with unmanaged hazardous fuels



King Kekualike High School adjacent to hazardous tall grassy fuels



Makawao Fire Station



Mayor Hannibal Tavares Community Center



Example of tall grasses in vacant lot near homes



Various hazardous fuels growing along road



Pukalani Elementary School



Wildfire hazards along roadside and on telephone poles

Spreckelsville



Well maintained golf course



Kaunoha Senior Center



Makahiki Street unmanaged empty lot with high fuel load



Homes adjacent to grassland



Tall grasses along highway, high hazard



Ulupua Road, well-maintained landscaping, low hazard



Road and powerlines- potential ignition sources adjacent to fuels



View of fuels, agricultural lands, upland residential areas, and WUI



Example of well-maintained landscaping



Example 2 of well-maintained landscaping



Waipua Street, wide and maintained residential road



Example of tree hazard next to home windows

Waiakoa



Holopuni Road, ladder fuels adjacent to highway



Hwy 37, dead trees near power lines and power poles



Roadside fuels near USPS



Kula Park



Kula Elementary School



Kula Fire Station



Kula Glen- example of fuels along road and driveway



Kula Glen- example of maintained lawn and non-combustible siding



Heavy, hazardous unmanaged roadside fuels



Holopuni Road view of WUI



Grasses and ladder fuels along roadsides



Kula Hospital courtyard, well maintained

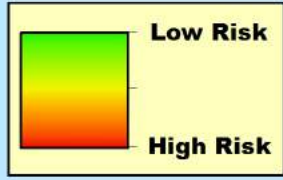
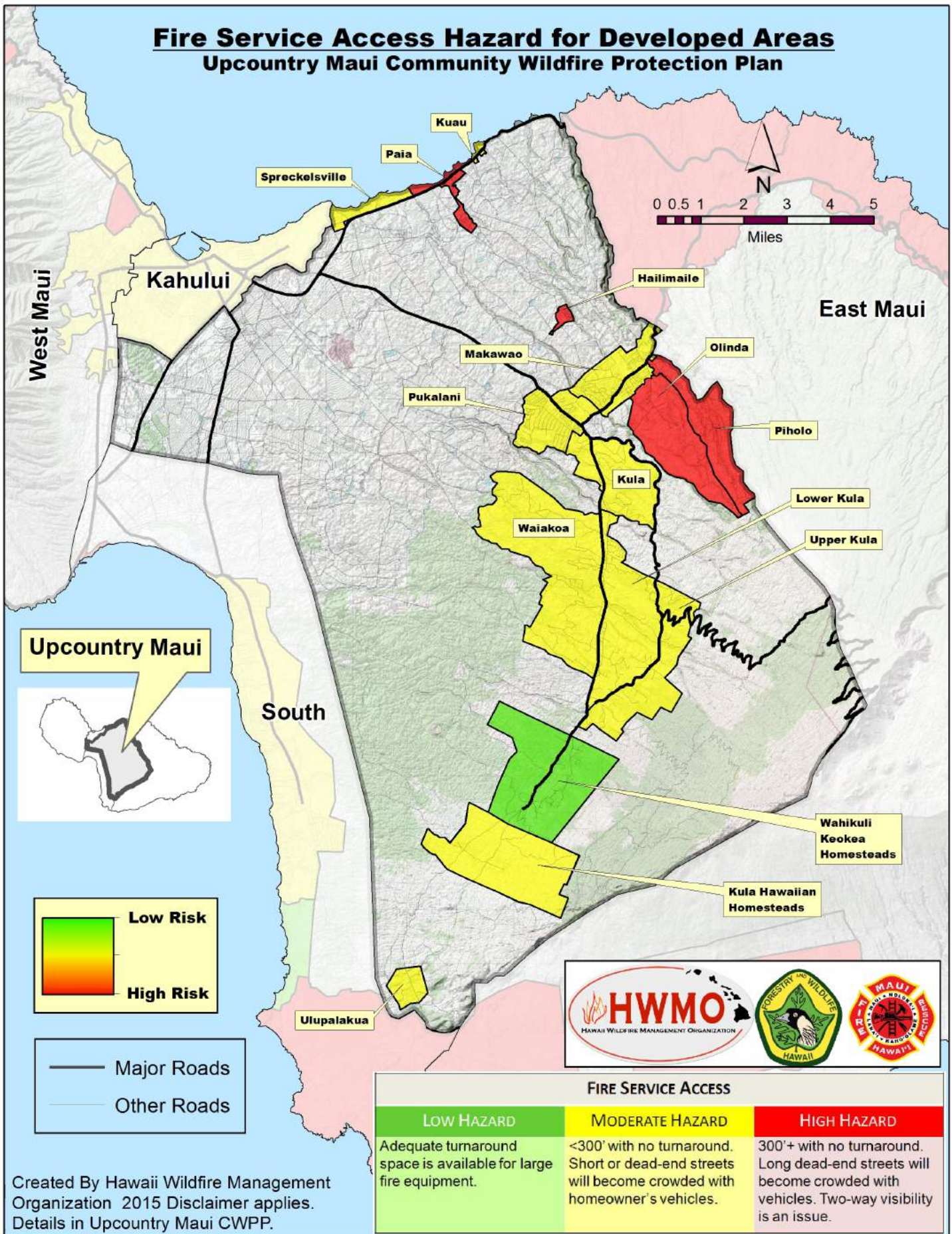
APPENDIX C
UPCOUNTRY MAUI COMMUNITY WILDFIRE PROTECTION PLAN
WILDFIRE HAZARD ASSESSMENT MAPS

Hazard Category (Maps provided in CWPP main document)	Individual Hazard Maps (Maps provided below in the following order)
Subdivision Hazard Total	<ul style="list-style-type: none"> • Fire Service Access • Home Setbacks • Ingress/Egress • Private Landowner Firewise Landscaping & Defensible Space • Proximity of Subdivision to Wildland Areas • All Season Road Condition • Road Maintenance • Road Width • Street Signs • Structure Density • Unmanaged, Untended, Undeveloped Lands
Vegetation Hazard Total	<ul style="list-style-type: none"> • Defensible Space: Fuels Reduction Around Homes & Structures • Fuel Loading • Fuel Structure & Arrangement • Proximity of Flammable Fuels Around Subdivision • Vegetation Within 300' Of Homes
Building Hazard Total	<ul style="list-style-type: none"> • Siding/Soffits • Roofing Assembly • Structural Ignitability • Under Skirting Around Decks, Lanais, Post & Pier Structures • Utilities Placement; Gas & Electric
Fire Environment Hazard Total	<ul style="list-style-type: none"> • Average Rainfall • Prevailing Wind Speeds & Direction • Slope • Topographic Features That Adversely Affect Wildland Fire Behavior • Seasonal or Periodic High Hazard Conditions • Ignition Risk
Fire Protection Hazard Total (high capacity and capability= low hazard)	<ul style="list-style-type: none"> • Response Time • Community Planning Practices & Ordinances • Community Fire Safe Efforts & Programs Already In Place • Fire Department Structural Training & Expertise • Local Emergency Operations Group or Citizen Group • Proximity to Fire Stations • Water Source Availability • Wildland Firefighting Capacity of Initial Response Agency • Interagency Cooperation

SUBDIVISION HAZARD FOR DEVELOPED AREAS

Fire Service Access Hazard for Developed Areas

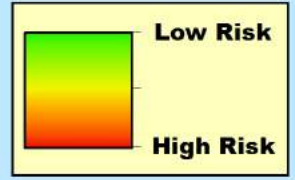
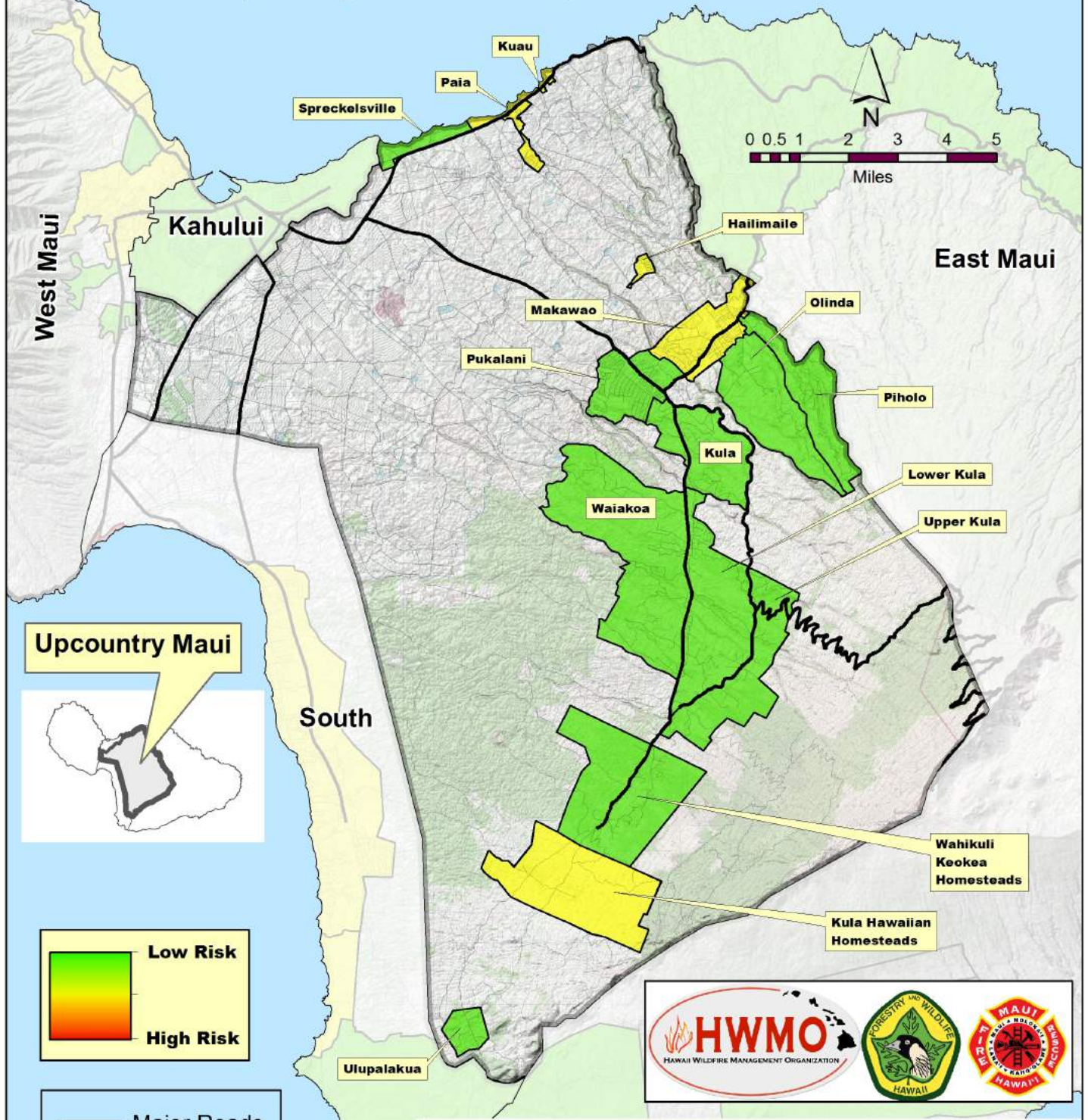
Upcountry Maui Community Wildfire Protection Plan



FIRE SERVICE ACCESS		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Adequate turnaround space is available for large fire equipment.	<300' with no turnaround. Short or dead-end streets will become crowded with homeowner's vehicles.	300'+ with no turnaround. Long dead-end streets will become crowded with vehicles. Two-way visibility is an issue.

Created By Hawaii Wildfire Management Organization 2015 Disclaimer applies. Details in Upcountry Maui CWPP.

Home Setbacks Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan

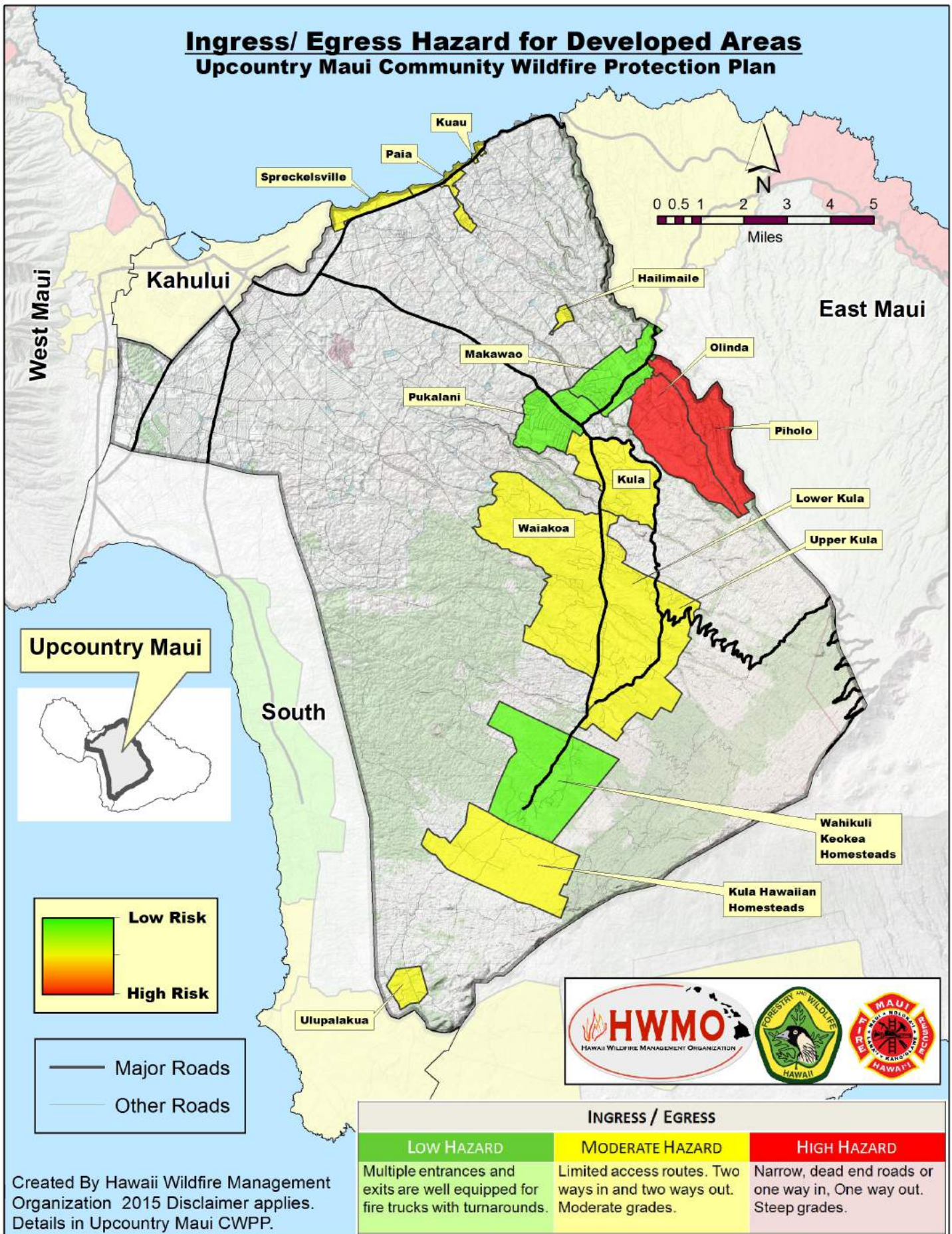


HOME SETBACKS		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Majority (50%+) of homes are set back from property lines and slopes by at least 30 feet.	10-50% of homes have defensible setbacks from property lines and sloped areas.	<10% of homes have defensible setbacks from property lines. Buildings located close to dangerous topographic features such as the tops of slopes.

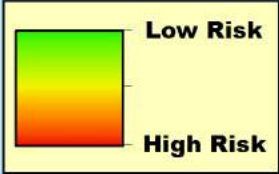
Created By Hawaii Wildfire Management Organization 2015 Disclaimer applies. Details in Upcountry Maui CWPP.

Ingress/ Egress Hazard for Developed Areas

Upcountry Maui Community Wildfire Protection Plan



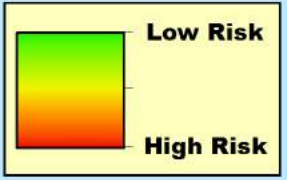
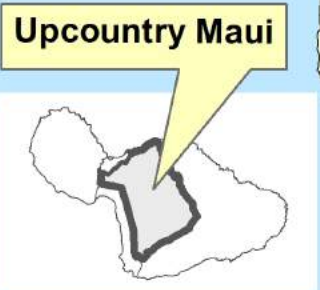
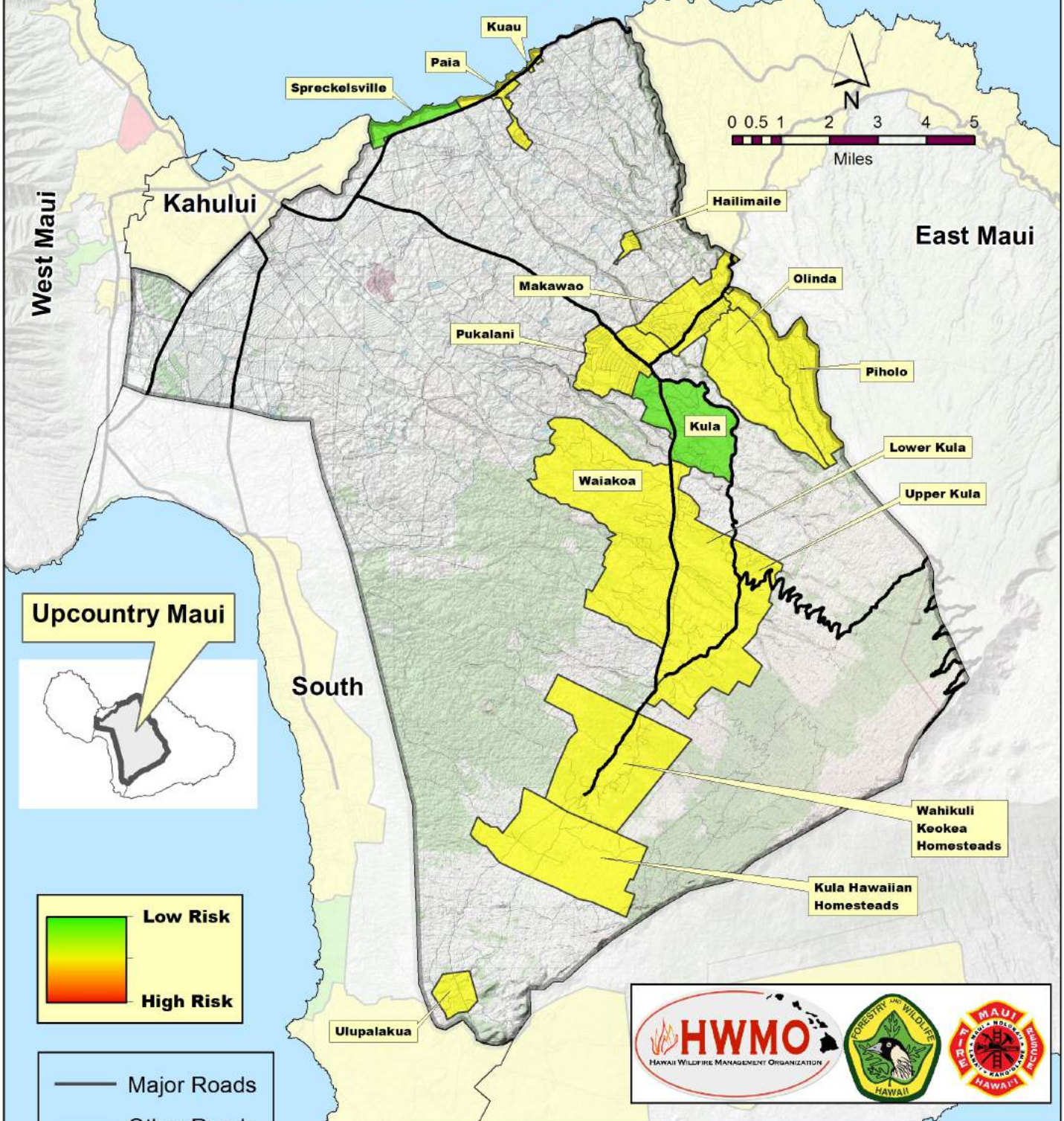
Upcountry Maui



INGRESS / EGRESS		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Multiple entrances and exits are well equipped for fire trucks with turnarounds.	Limited access routes. Two ways in and two ways out. Moderate grades.	Narrow, dead end roads or one way in, One way out. Steep grades.

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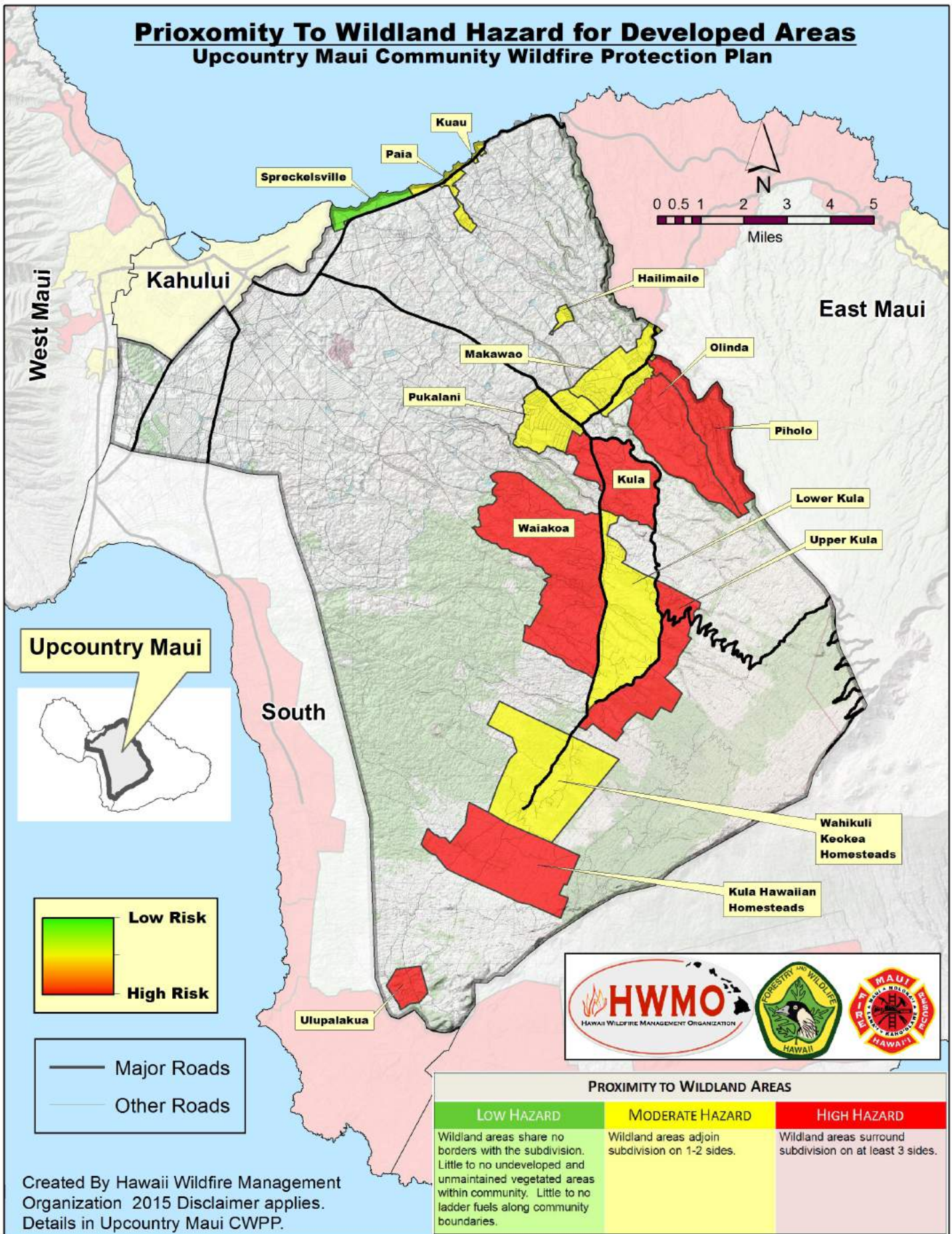
Private Landowner Firewise Landscaping/ Defensible Space Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



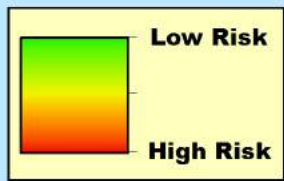
PRIVATE LANDOWNER FIREWISE LANDSCAPING/ DEFENSIBLE SPACE		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
70% of homes have improved survivable space around property, reduced ignition risk, hardened homes, and no ladder fuels.	30-70% homes have improved survivable space around property and well-maintained landscapes.	<30% of homes have defensible space, hardened home features, or Firewise landscaping

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Proximity To Wildland Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui

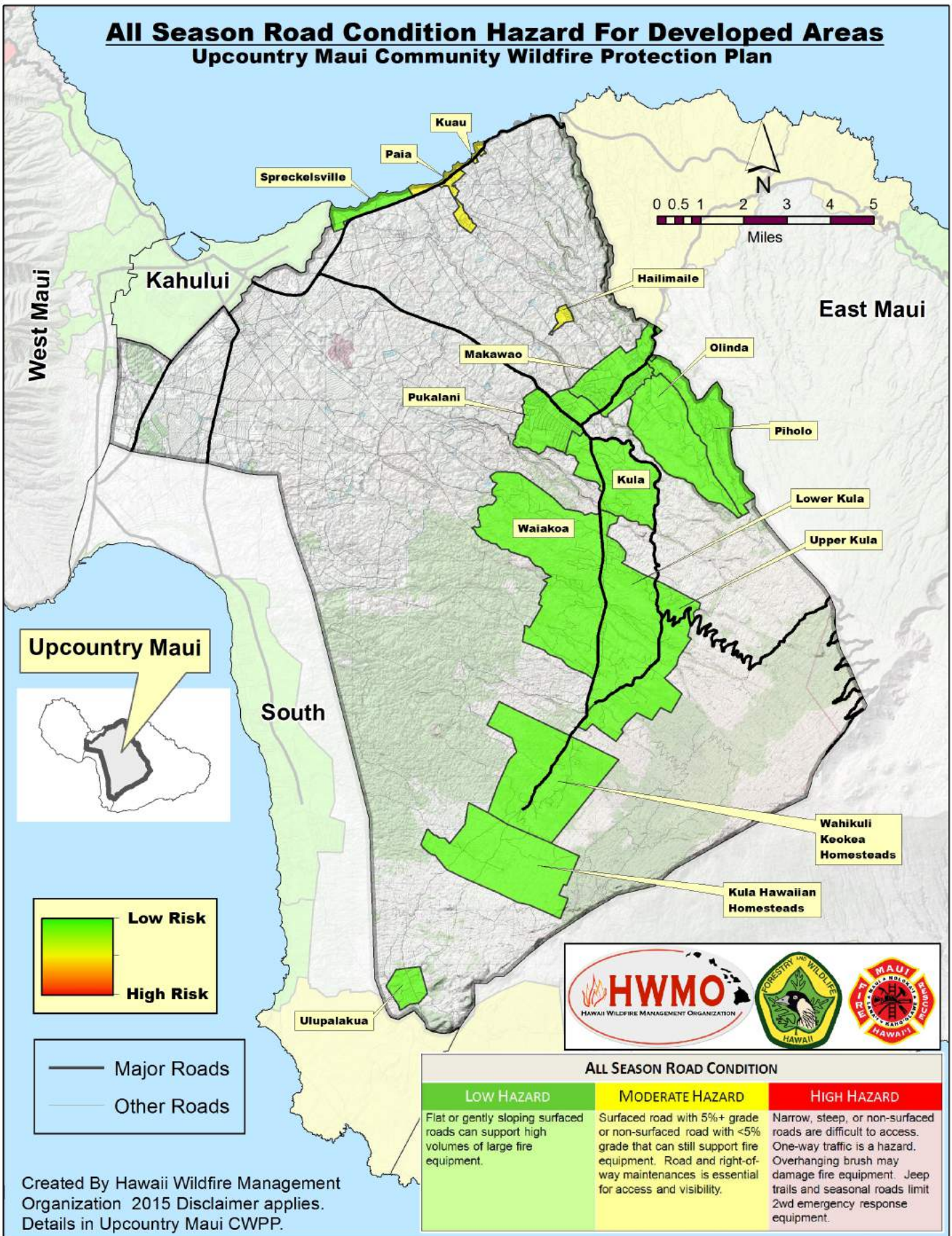


PROXIMITY TO WILDLAND AREAS		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Wildland areas share no borders with the subdivision. Little to no undeveloped and unmaintained vegetated areas within community. Little to no ladder fuels along community boundaries.	Wildland areas adjoin subdivision on 1-2 sides.	Wildland areas surround subdivision on at least 3 sides.

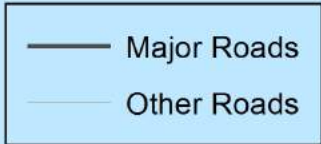
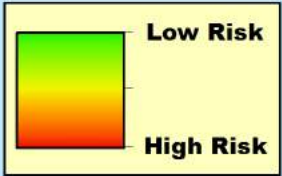
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All Season Road Condition Hazard For Developed Areas

Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui



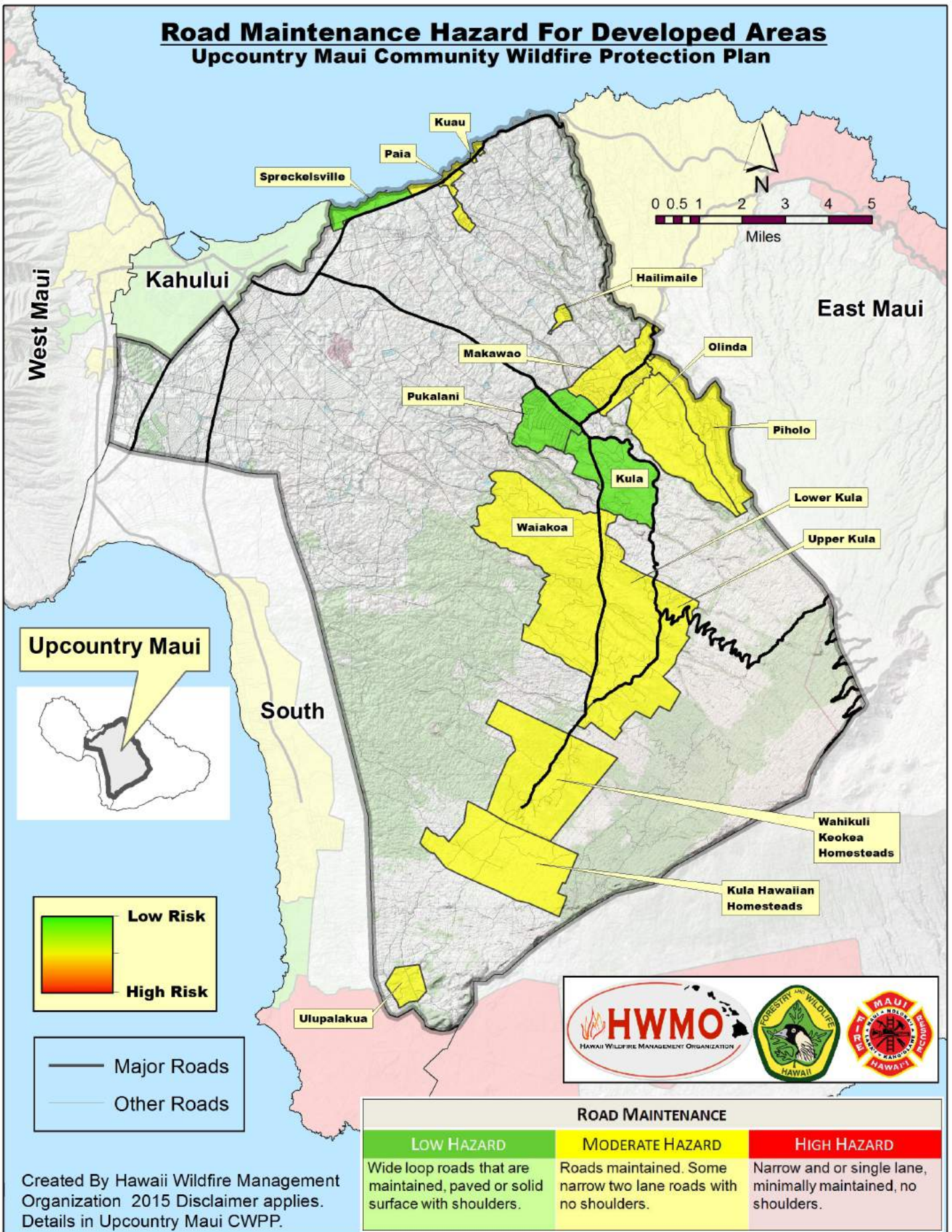
ALL SEASON ROAD CONDITION

LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Flat or gently sloping surfaced roads can support high volumes of large fire equipment.	Surfaced road with 5%+ grade or non-surfaced road with <5% grade that can still support fire equipment. Road and right-of-way maintenances is essential for access and visibility.	Narrow, steep, or non-surfaced roads are difficult to access. One-way traffic is a hazard. Overhanging brush may damage fire equipment. Jeep trails and seasonal roads limit 2wd emergency response equipment.

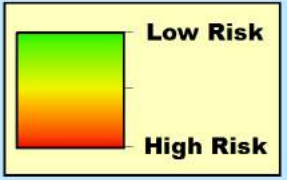
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Road Maintenance Hazard For Developed Areas

Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui

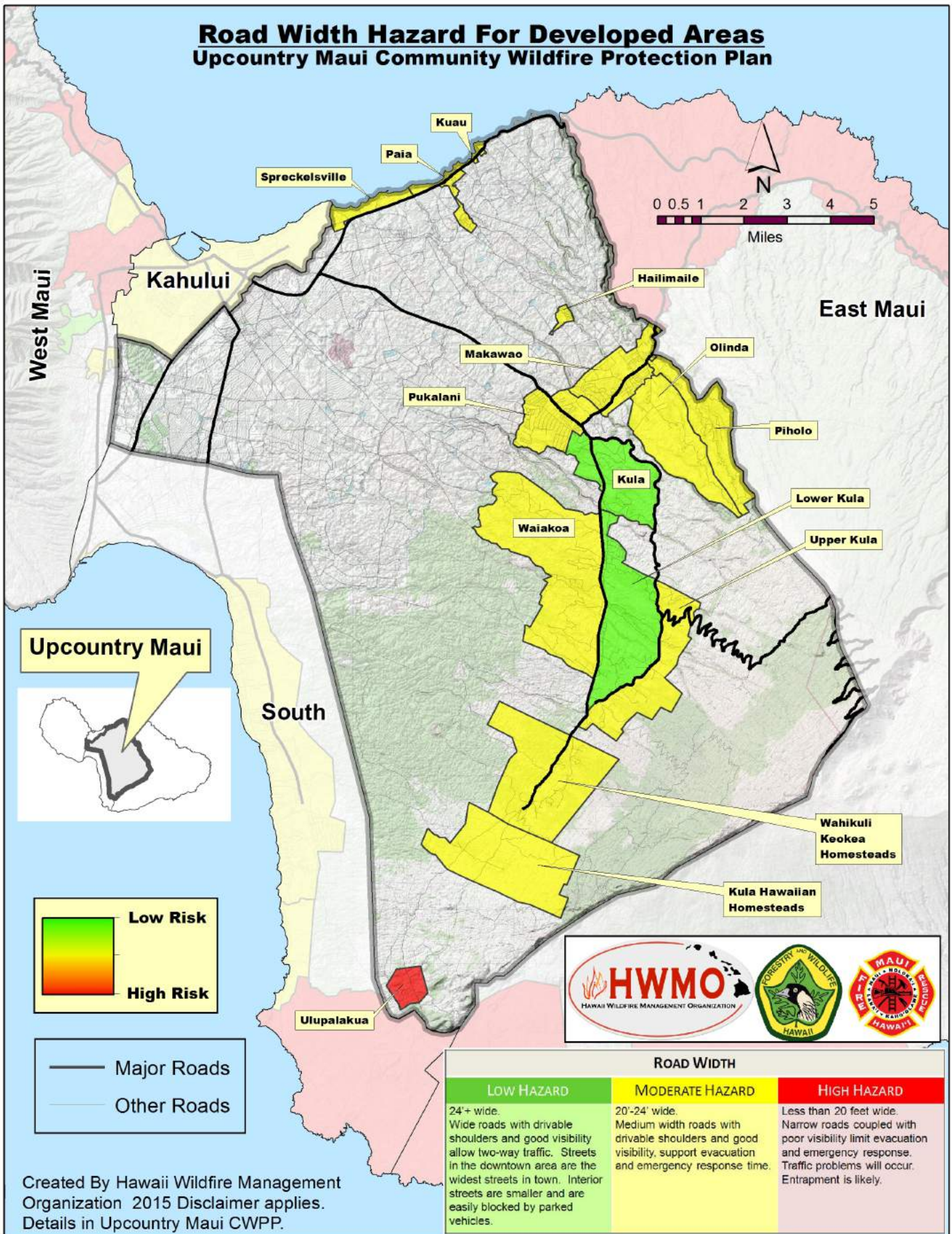


ROAD MAINTENANCE		
<p>LOW HAZARD</p> <p>Wide loop roads that are maintained, paved or solid surface with shoulders.</p>	<p>MODERATE HAZARD</p> <p>Roads maintained. Some narrow two lane roads with no shoulders.</p>	<p>HIGH HAZARD</p> <p>Narrow and or single lane, minimally maintained, no shoulders.</p>

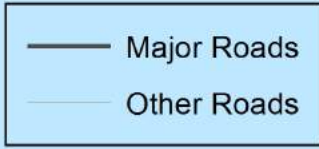
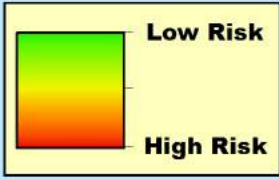
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Road Width Hazard For Developed Areas

Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui

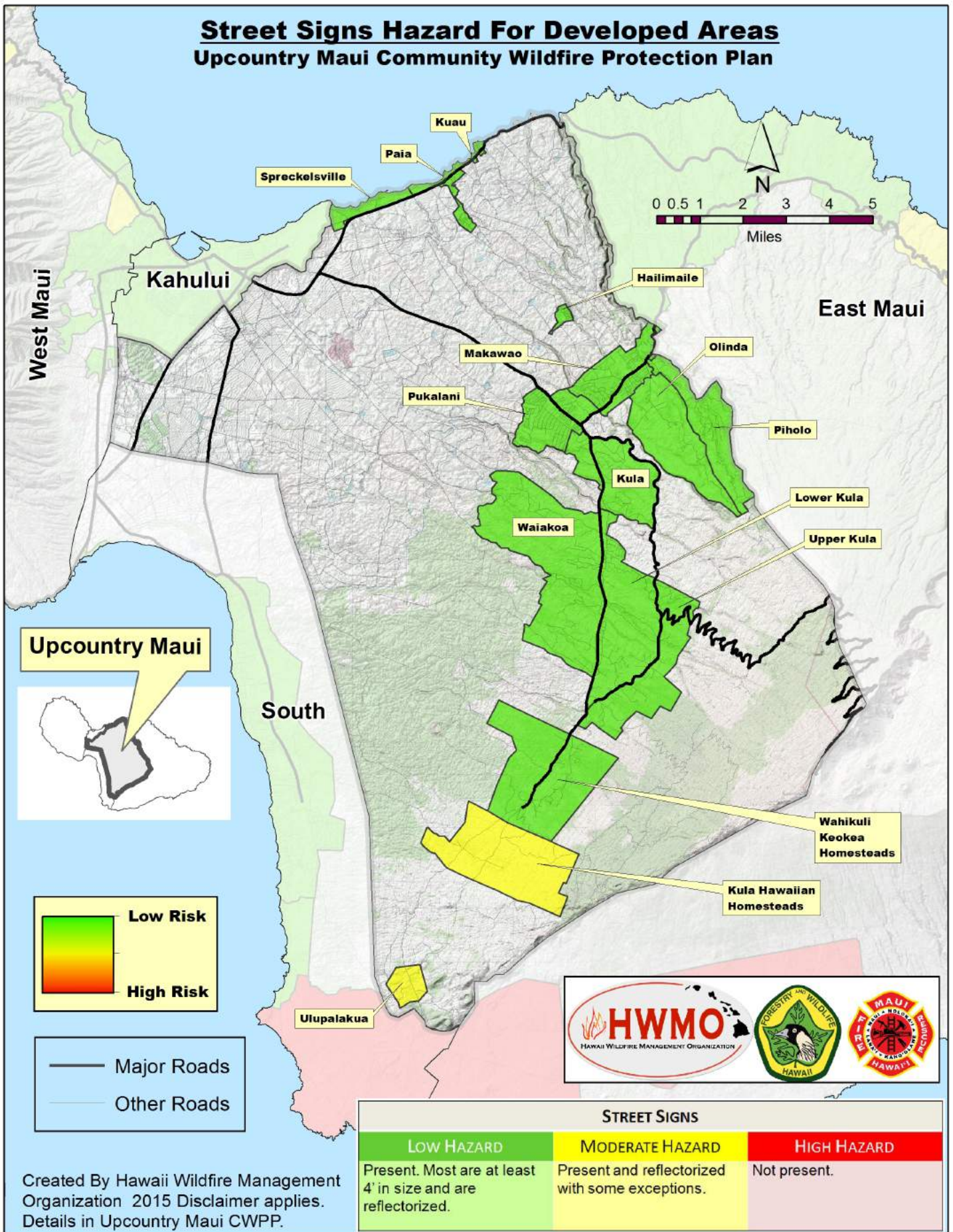


ROAD WIDTH		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
24'+ wide. Wide roads with drivable shoulders and good visibility allow two-way traffic. Streets in the downtown area are the widest streets in town. Interior streets are smaller and are easily blocked by parked vehicles.	20'-24' wide. Medium width roads with drivable shoulders and good visibility, support evacuation and emergency response time.	Less than 20 feet wide. Narrow roads coupled with poor visibility limit evacuation and emergency response. Traffic problems will occur. Entrapment is likely.

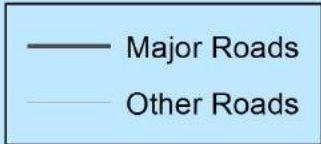
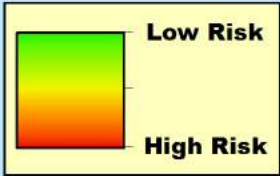
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Street Signs Hazard For Developed Areas

Upcountry Maui Community Wildfire Protection Plan



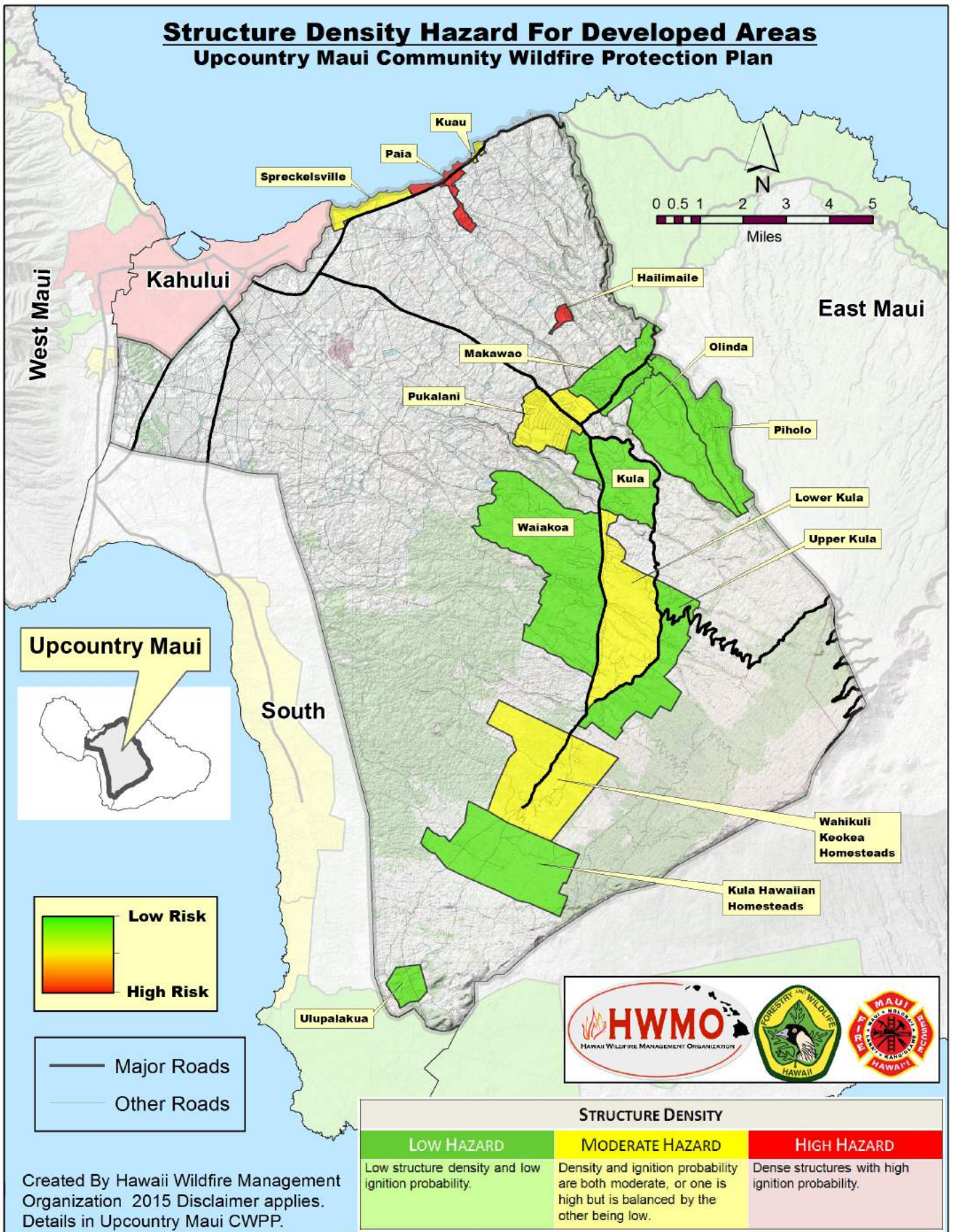
Upcountry Maui



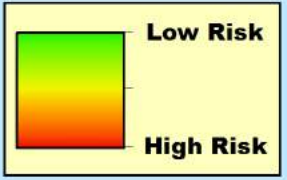
STREET SIGNS		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Present. Most are at least 4' in size and are reflectorized.	Present and reflectorized with some exceptions.	Not present.

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Structure Density Hazard For Developed Areas Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui

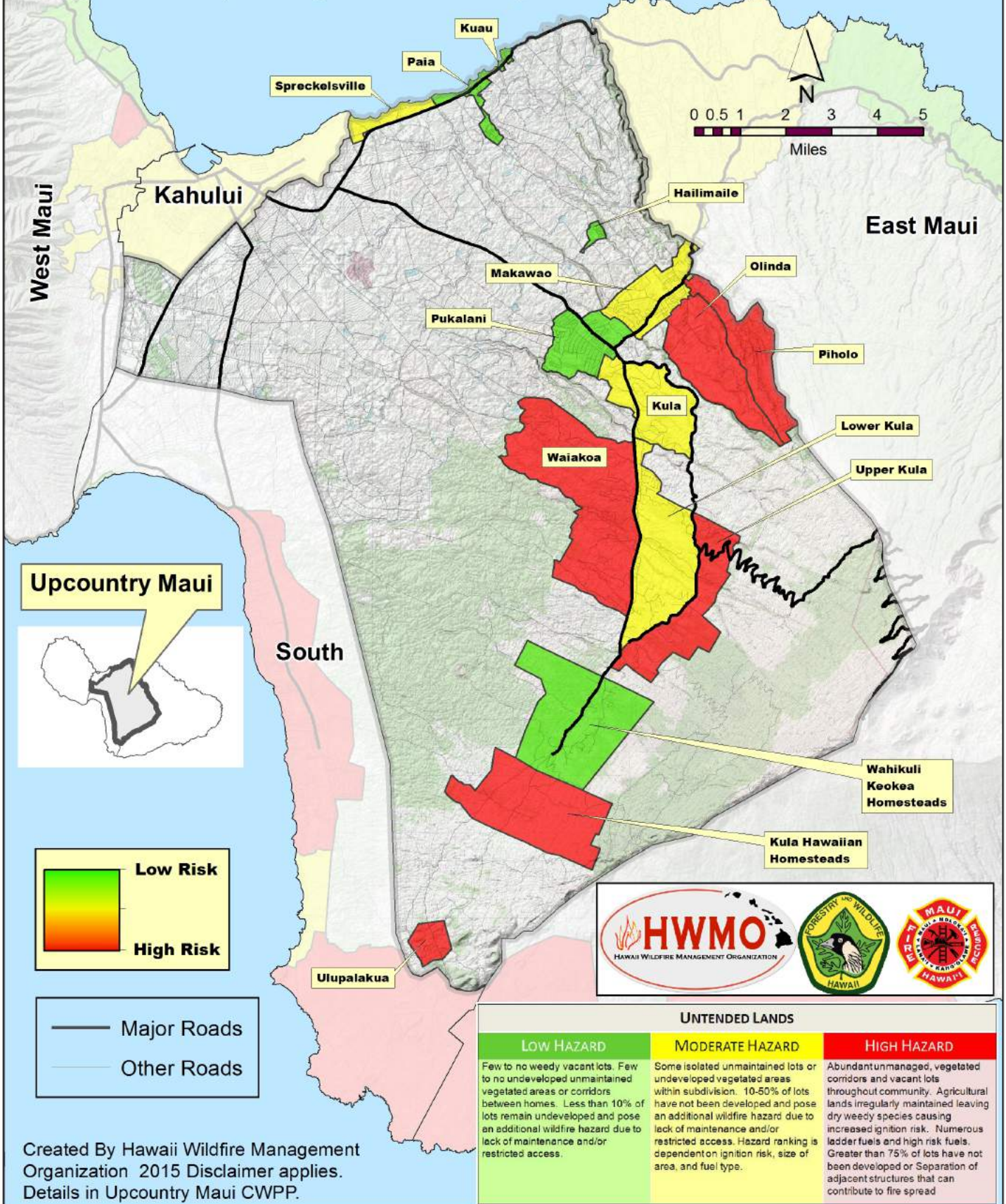


STRUCTURE DENSITY		
LOW HAZARD Low structure density and low ignition probability.	MODERATE HAZARD Density and ignition probability are both moderate, or one is high but is balanced by the other being low.	HIGH HAZARD Dense structures with high ignition probability.

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Unmanaged, Untended & Undeveloped Lands Hazard For Developed Areas

Upcountry Maui Community Wildfire Protection Plan



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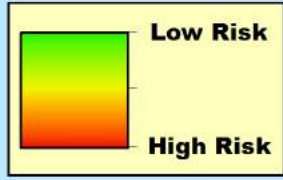
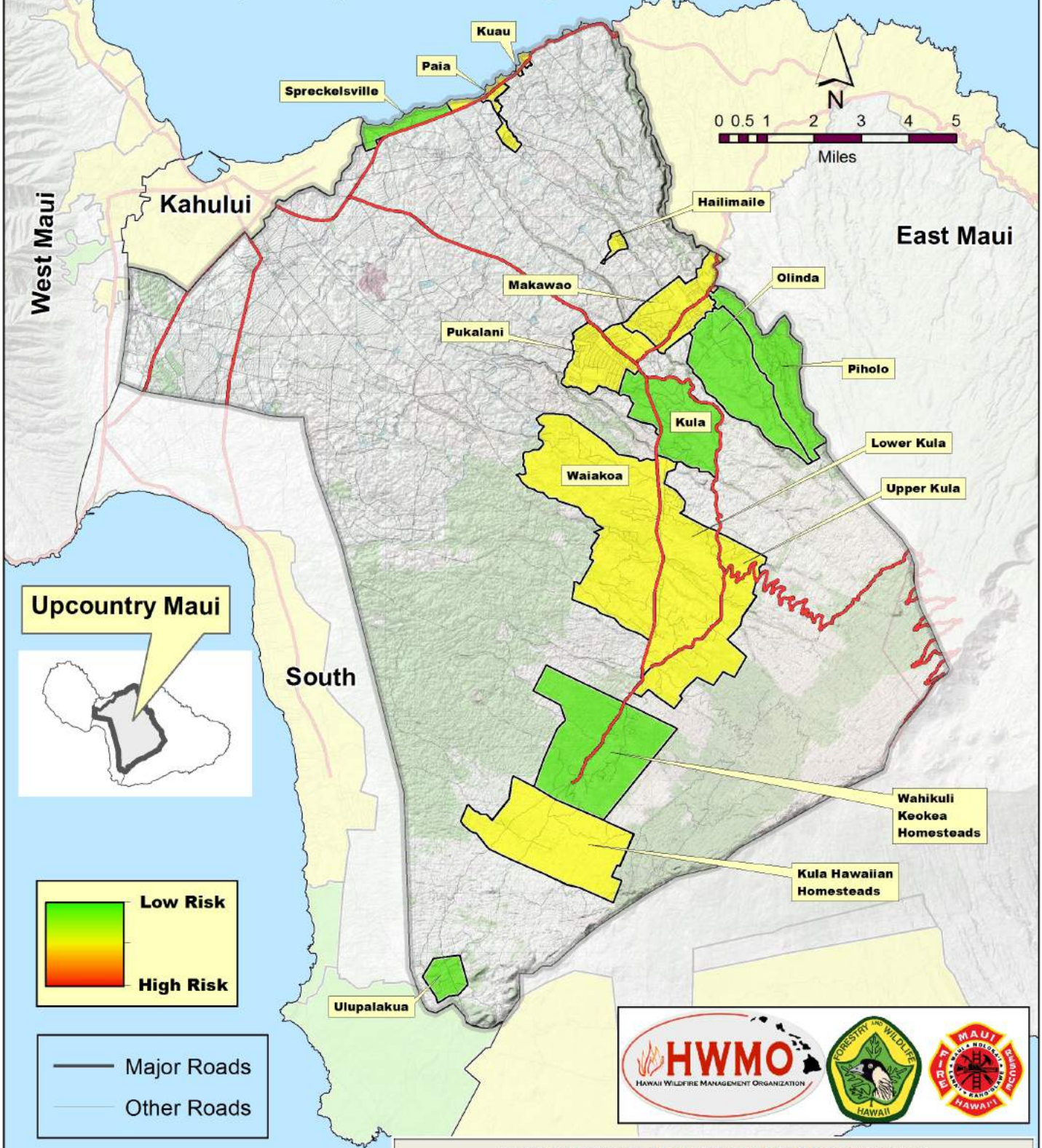
UNTENDED LANDS		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
<p>Few to no weedy vacant lots. Few to no undeveloped unmaintained vegetated areas or corridors between homes. Less than 10% of lots remain undeveloped and pose an additional wildfire hazard due to lack of maintenance and/or restricted access.</p>	<p>Some isolated unmaintained lots or undeveloped vegetated areas within subdivision. 10-50% of lots have not been developed and pose an additional wildfire hazard due to lack of maintenance and/or restricted access. Hazard ranking is dependent on ignition risk, size of area, and fuel type.</p>	<p>Abundant unmanaged, vegetated corridors and vacant lots throughout community. Agricultural lands irregularly maintained leaving dry weedy species causing increased ignition risk. Numerous ladder fuels and high risk fuels. Greater than 75% of lots have not been developed or separation of adjacent structures that can contribute to fire spread</p>

VEGETATION HAZARD FOR DEVELOPED AREAS

Defensible Space: Fuels Reduction Around Homes

Hazard for Developed Areas

Upcountry Maui Community Wildfire Protection Plan



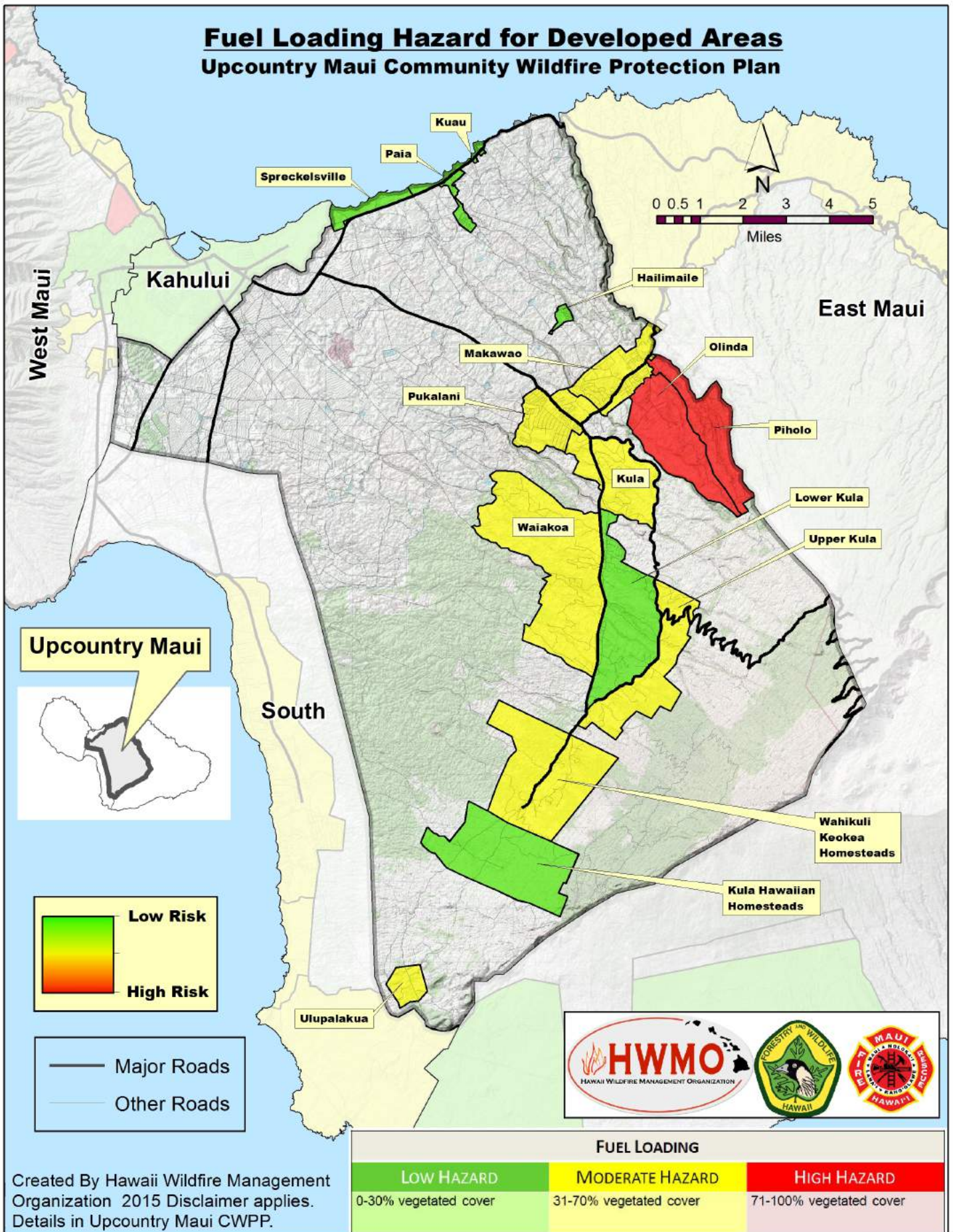
DEFENSIBLE SPACE- FUELS REDUCTION AROUND HOMES

LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Vegetation is treated 100 feet or more from structures.	31-100 ft. of vegetation treatment from structures.	Less than 30 ft. of vegetation treatment from structures.

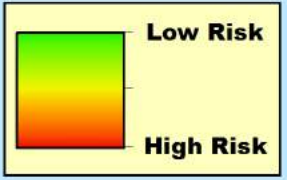
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Fuel Loading Hazard for Developed Areas

Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui



— Major Roads
 - - - Other Roads

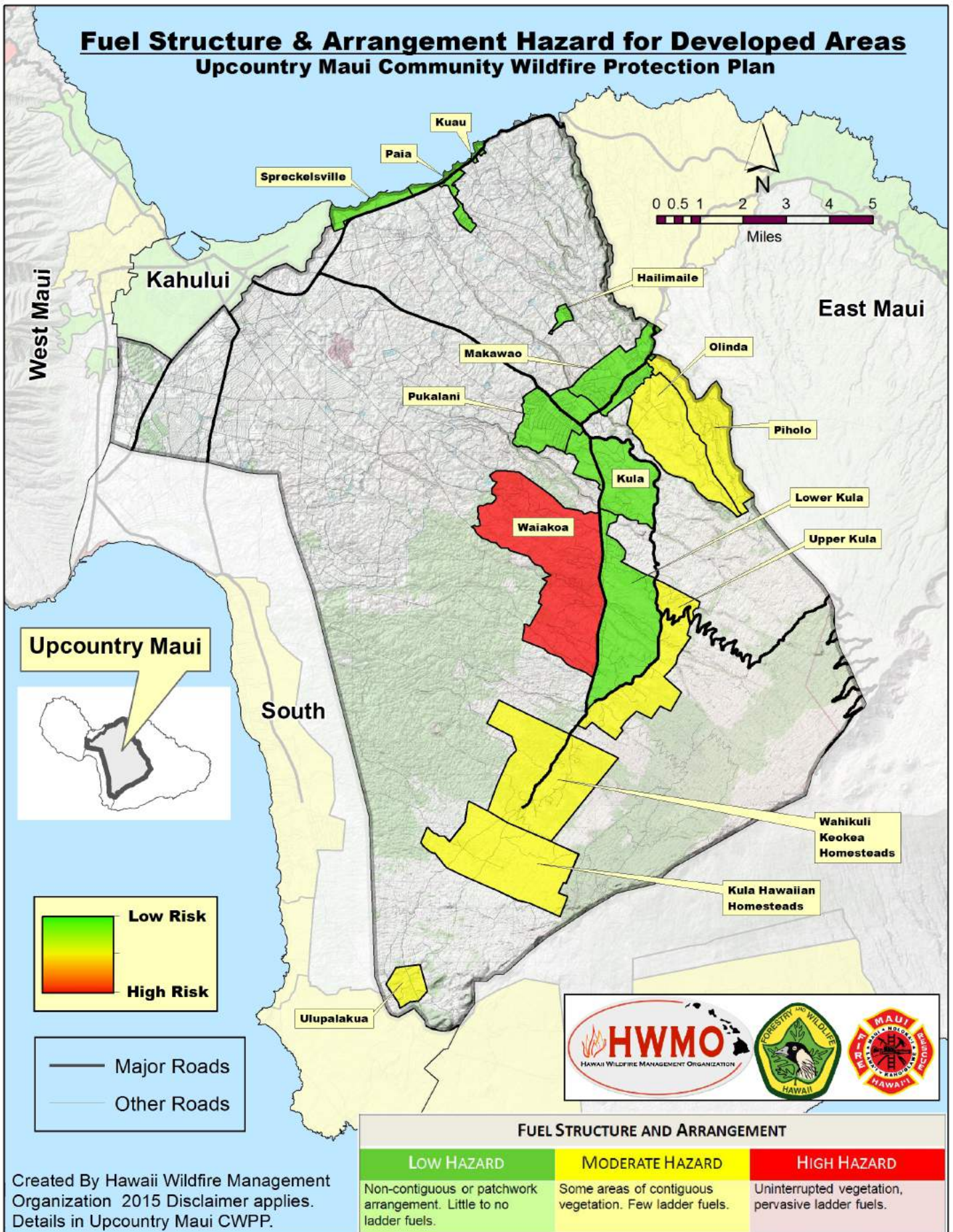


FUEL LOADING

LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
0-30% vegetated cover	31-70% vegetated cover	71-100% vegetated cover

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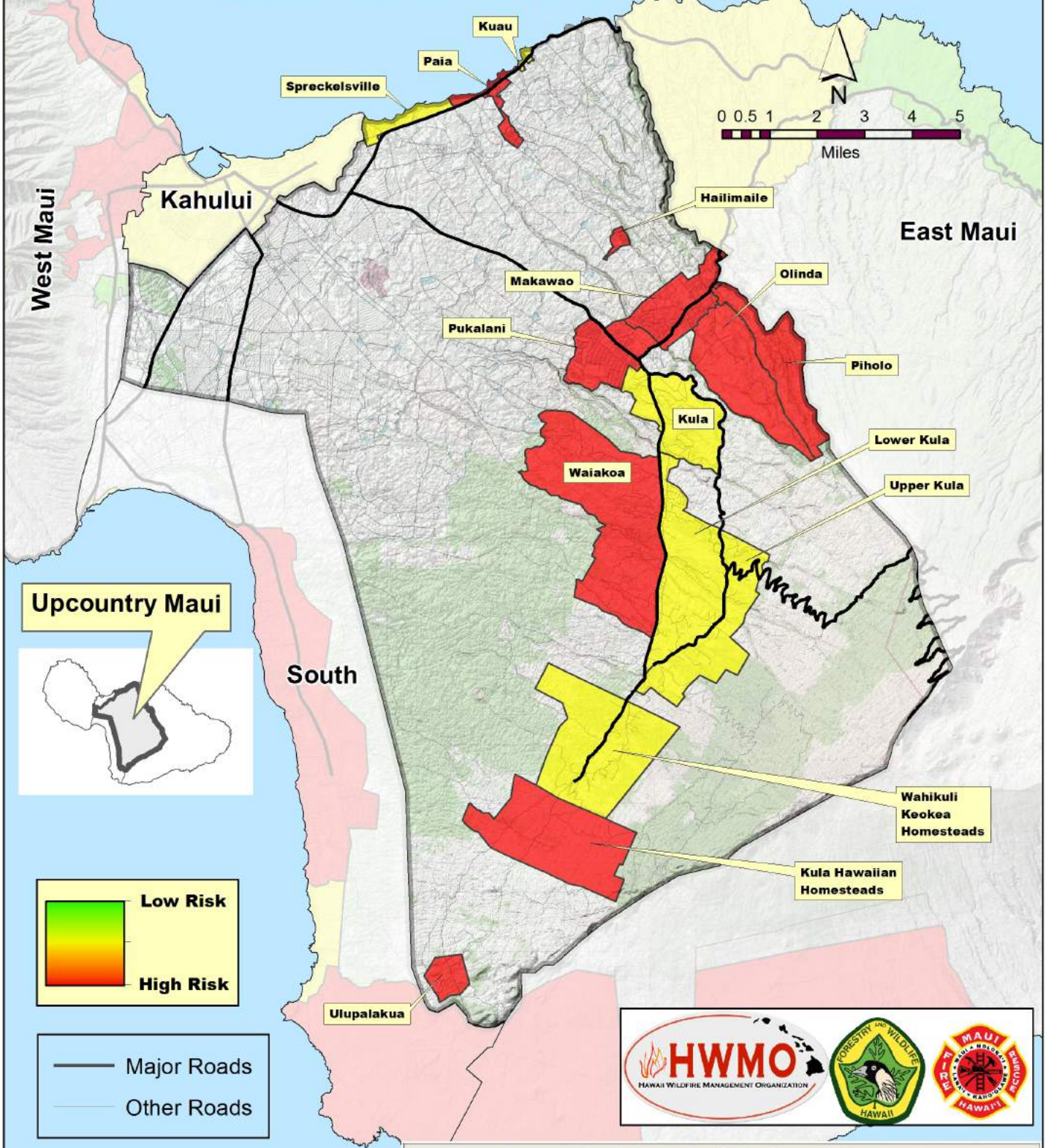
Fuel Structure & Arrangement Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



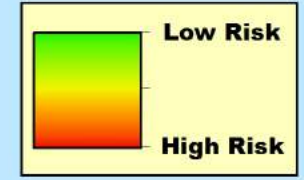
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Proximity of Flammable Fuels Around Subdivision Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui



— Major Roads
— Other Roads



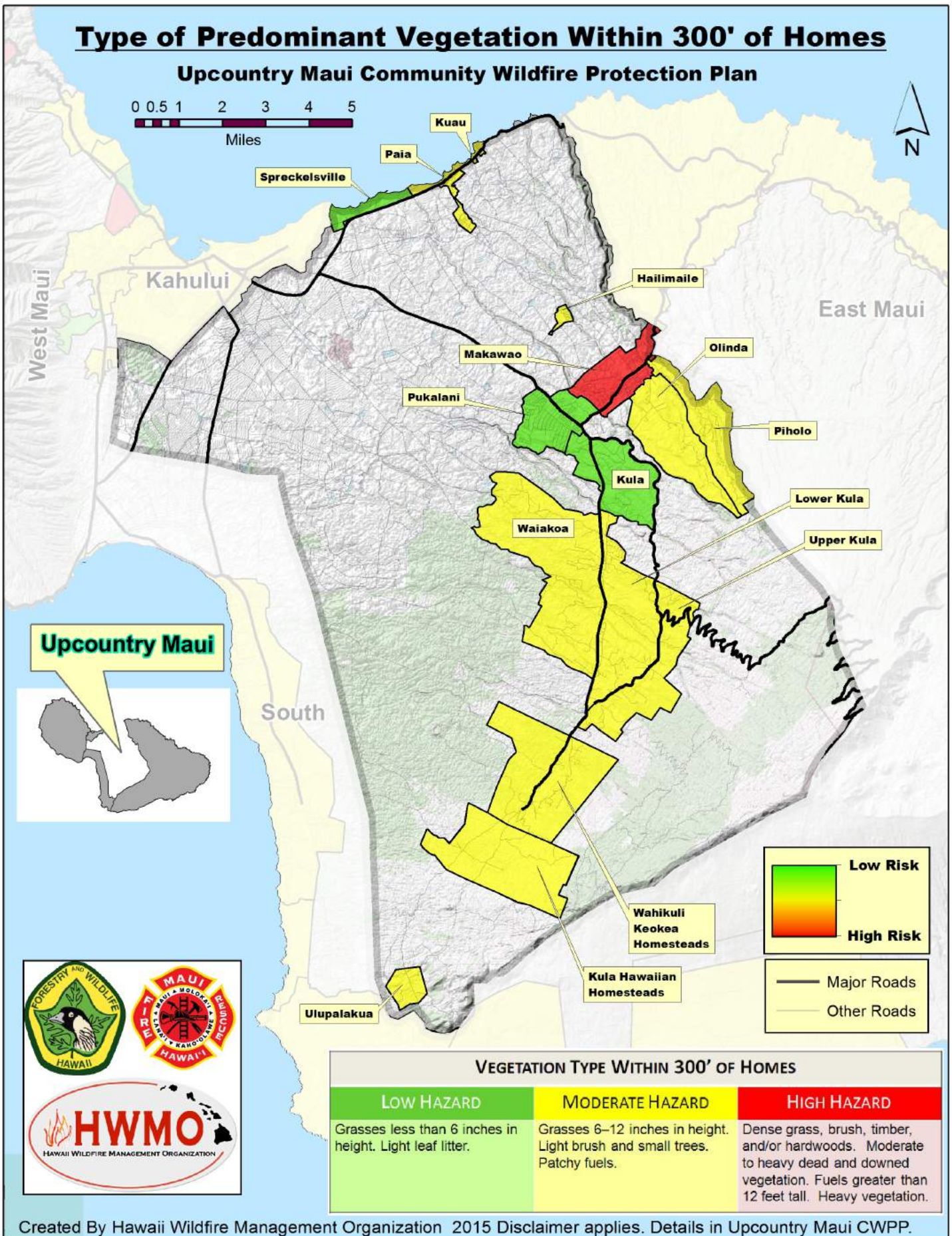
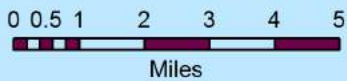
PROXIMITY OF FLAMMABLE FUELS AROUND SUBDIVISION

LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Greater than 100'	40-100'	Less than 40'

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Type of Predominant Vegetation Within 300' of Homes

Upcountry Maui Community Wildfire Protection Plan



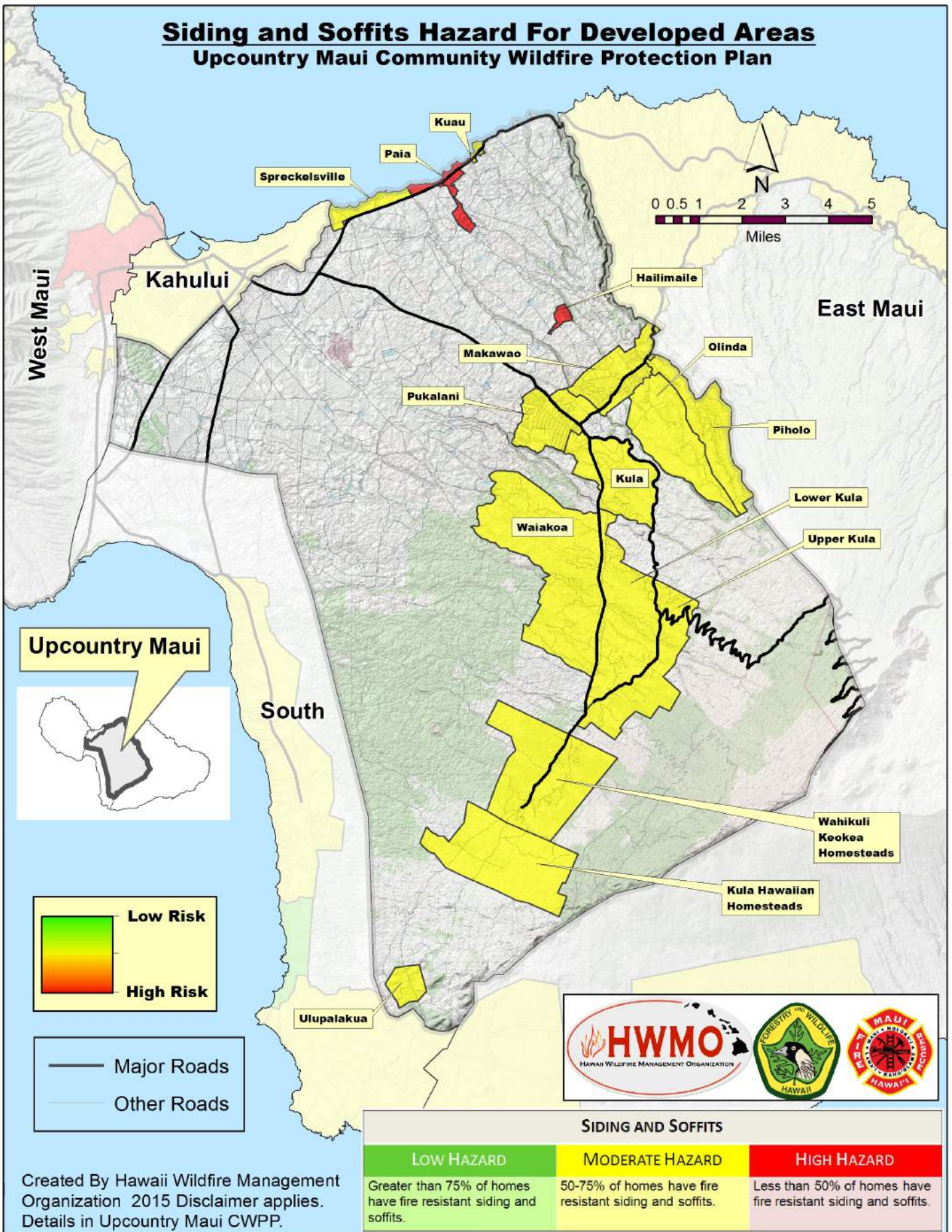
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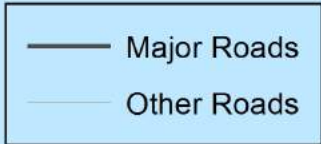
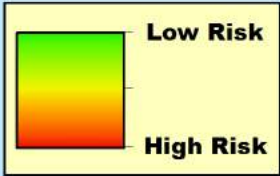
VEGETATION TYPE WITHIN 300' OF HOMES		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Grasses less than 6 inches in height. Light leaf litter.	Grasses 6–12 inches in height. Light brush and small trees. Patchy fuels.	Dense grass, brush, timber, and/or hardwoods. Moderate to heavy dead and downed vegetation. Fuels greater than 12 feet tall. Heavy vegetation.

BUILDING HAZARD FOR DEVELOPED AREAS

Siding and Soffits Hazard For Developed Areas Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui



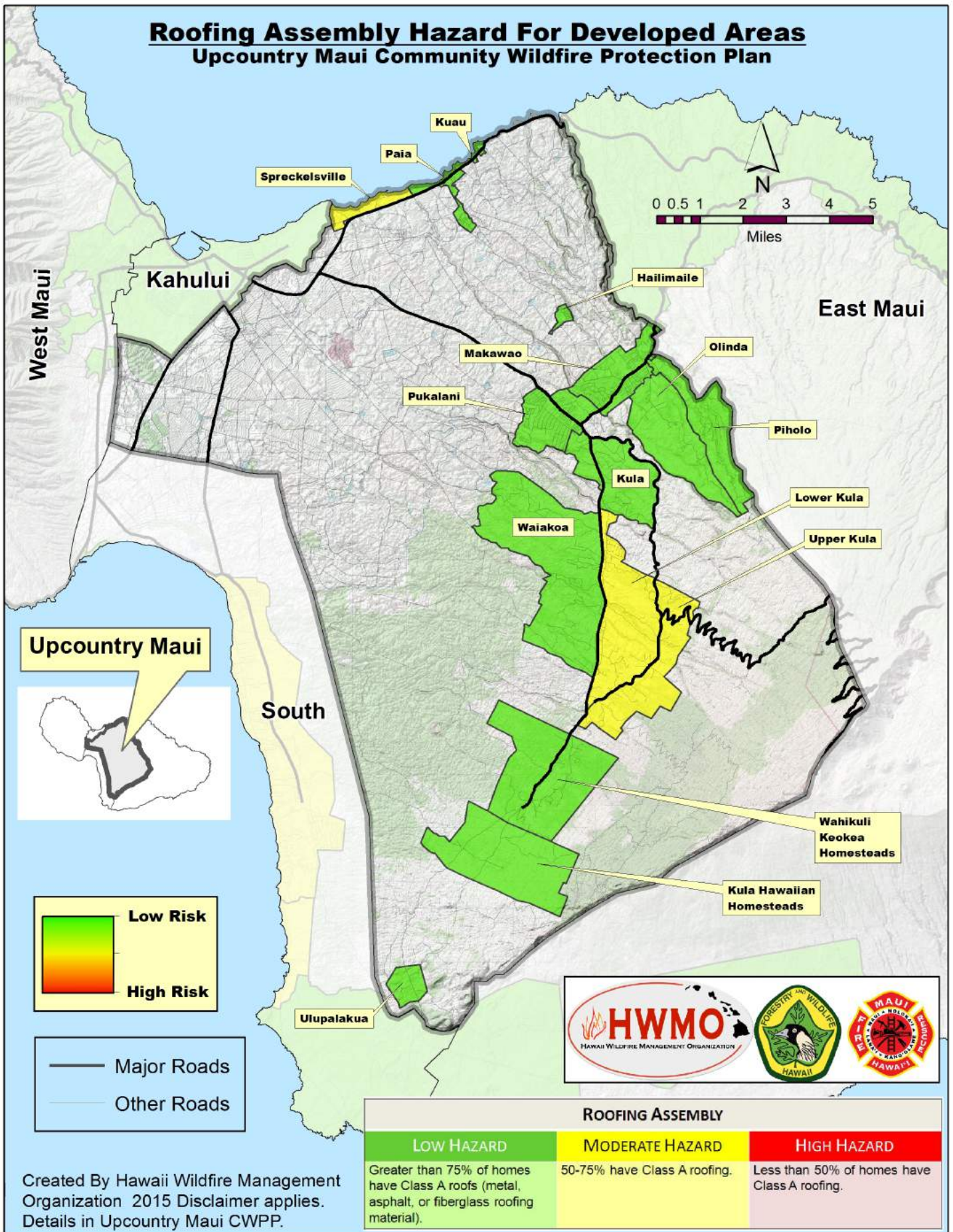
SIDING AND SOFFITS

LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Greater than 75% of homes have fire resistant siding and soffits.	50-75% of homes have fire resistant siding and soffits.	Less than 50% of homes have fire resistant siding and soffits.

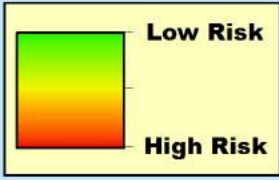
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Roofing Assembly Hazard For Developed Areas

Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui

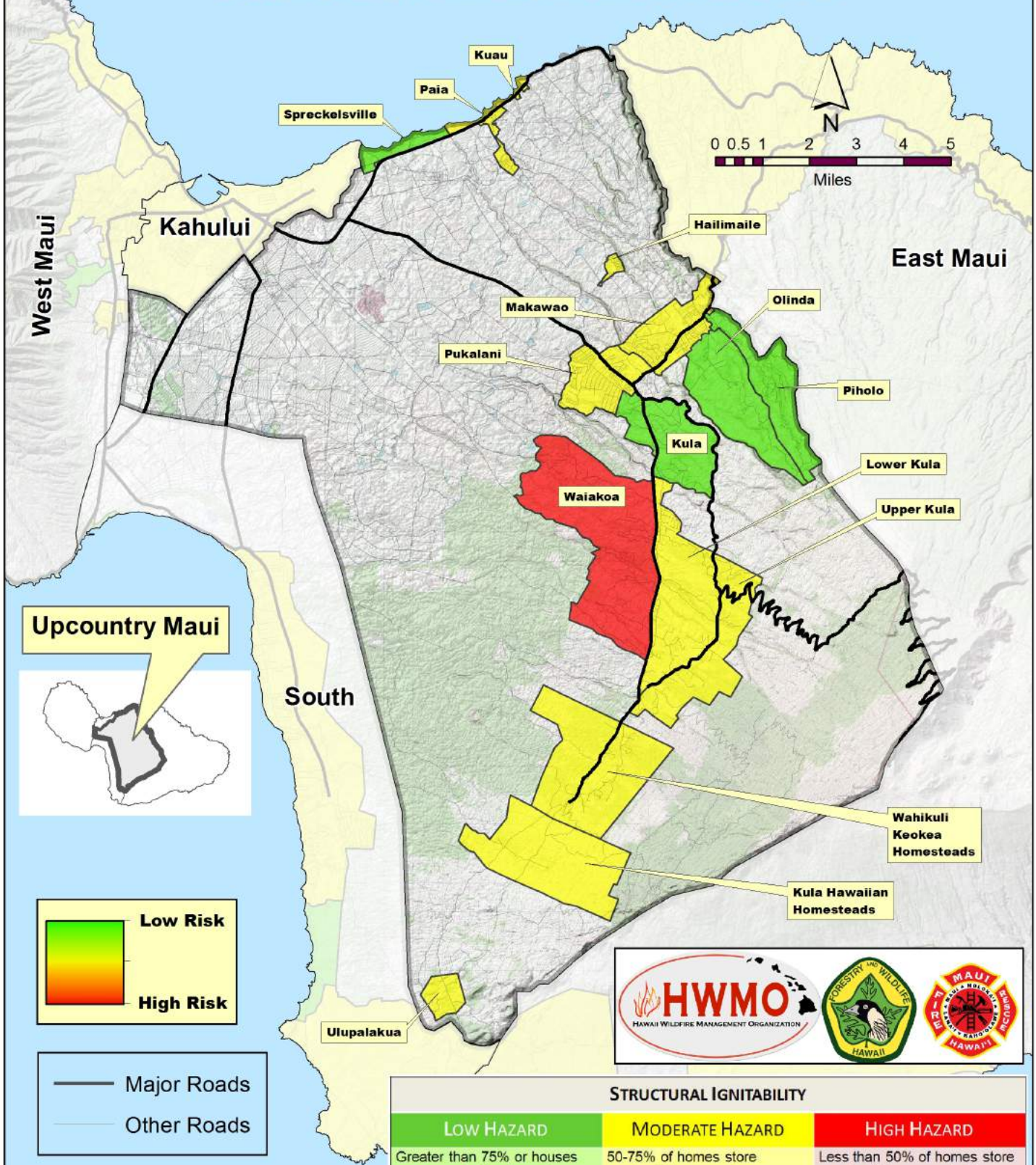


ROOFING ASSEMBLY		
LOW HAZARD Greater than 75% of homes have Class A roofs (metal, asphalt, or fiberglass roofing material).	MODERATE HAZARD 50-75% have Class A roofing.	HIGH HAZARD Less than 50% of homes have Class A roofing.

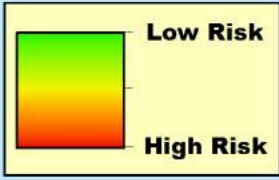
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Structural Ignitability Hazard For Developed Areas

Upcountry Maui Community Wildfire Protection Plan



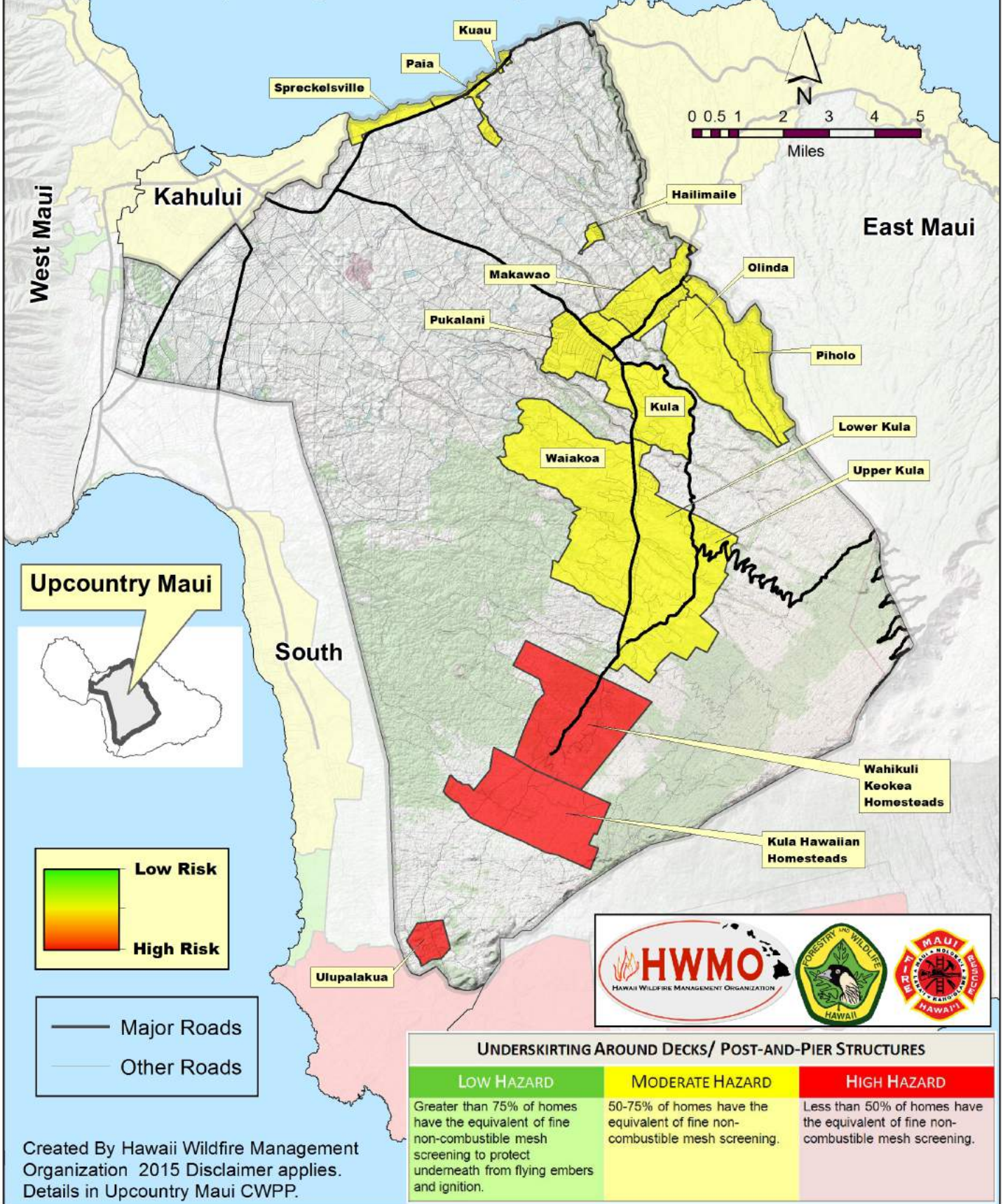
Upcountry Maui



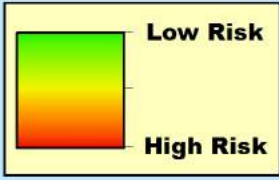
STRUCTURAL IGNITABILITY		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Greater than 75% of houses are spaced with cleared boundaries. Flammables and combustible materials stored according to fire-safe principles.	50-75% of homes store combustibles properly.	Less than 50% of homes store combustibles properly. Houses close to each other.

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Underskirting Around Decks, Post & Pier Structures Hazard For Developed Areas Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui



— Major Roads

— Other Roads



UNDERSKIRTING AROUND DECKS/ POST-AND-PIER STRUCTURES

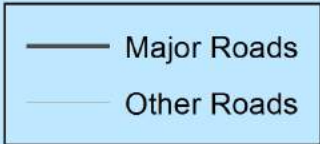
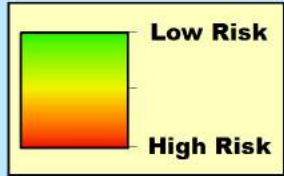
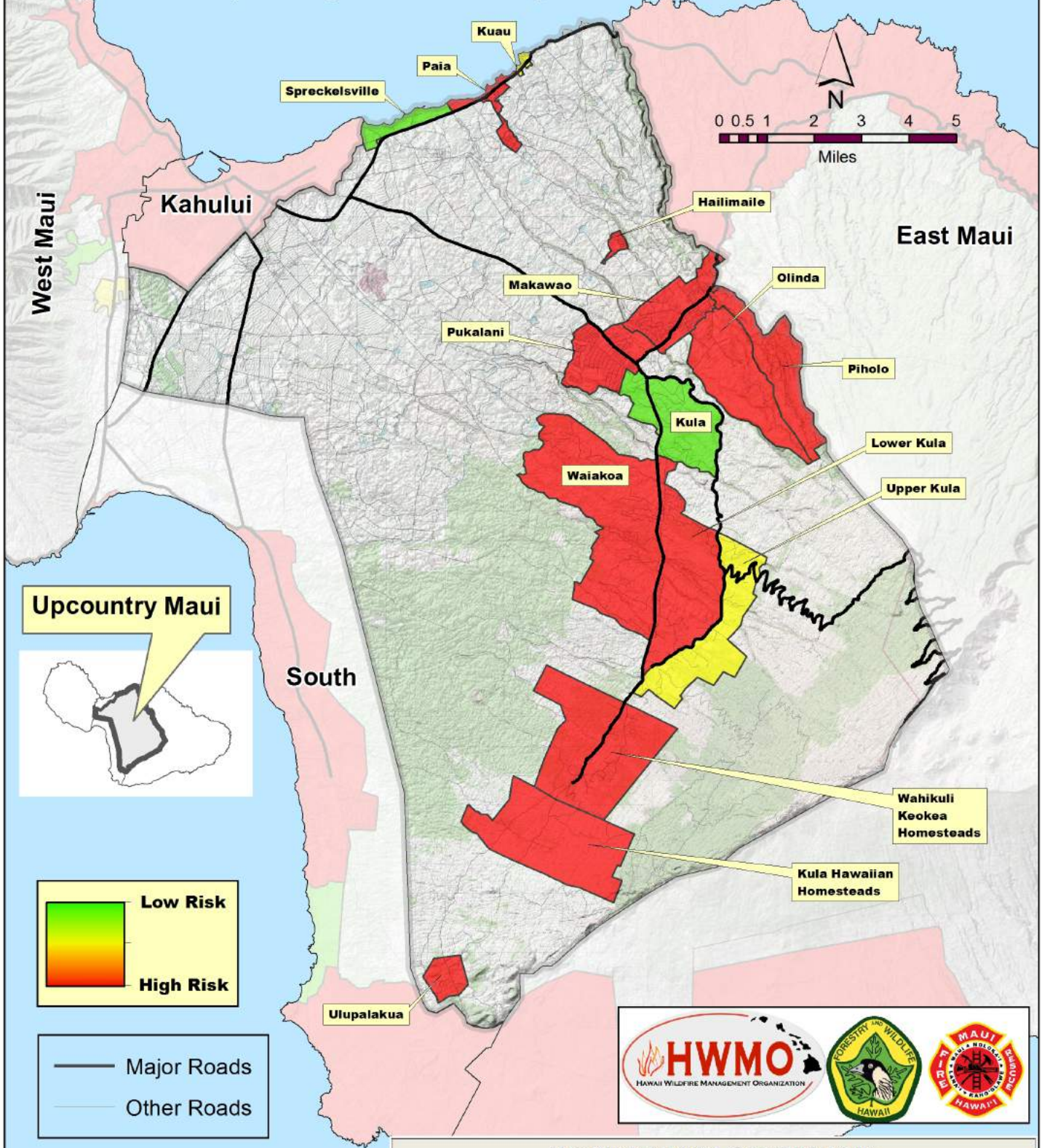
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Greater than 75% of homes have the equivalent of fine non-combustible mesh screening to protect underneath from flying embers and ignition.	50-75% of homes have the equivalent of fine non-combustible mesh screening.	Less than 50% of homes have the equivalent of fine non-combustible mesh screening.

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Utilities Placement: Gas & Electric

Hazard For Developed Areas

Upcountry Maui Community Wildfire Protection Plan



UTILITIES PLACEMENT- GAS AND ELECTRIC

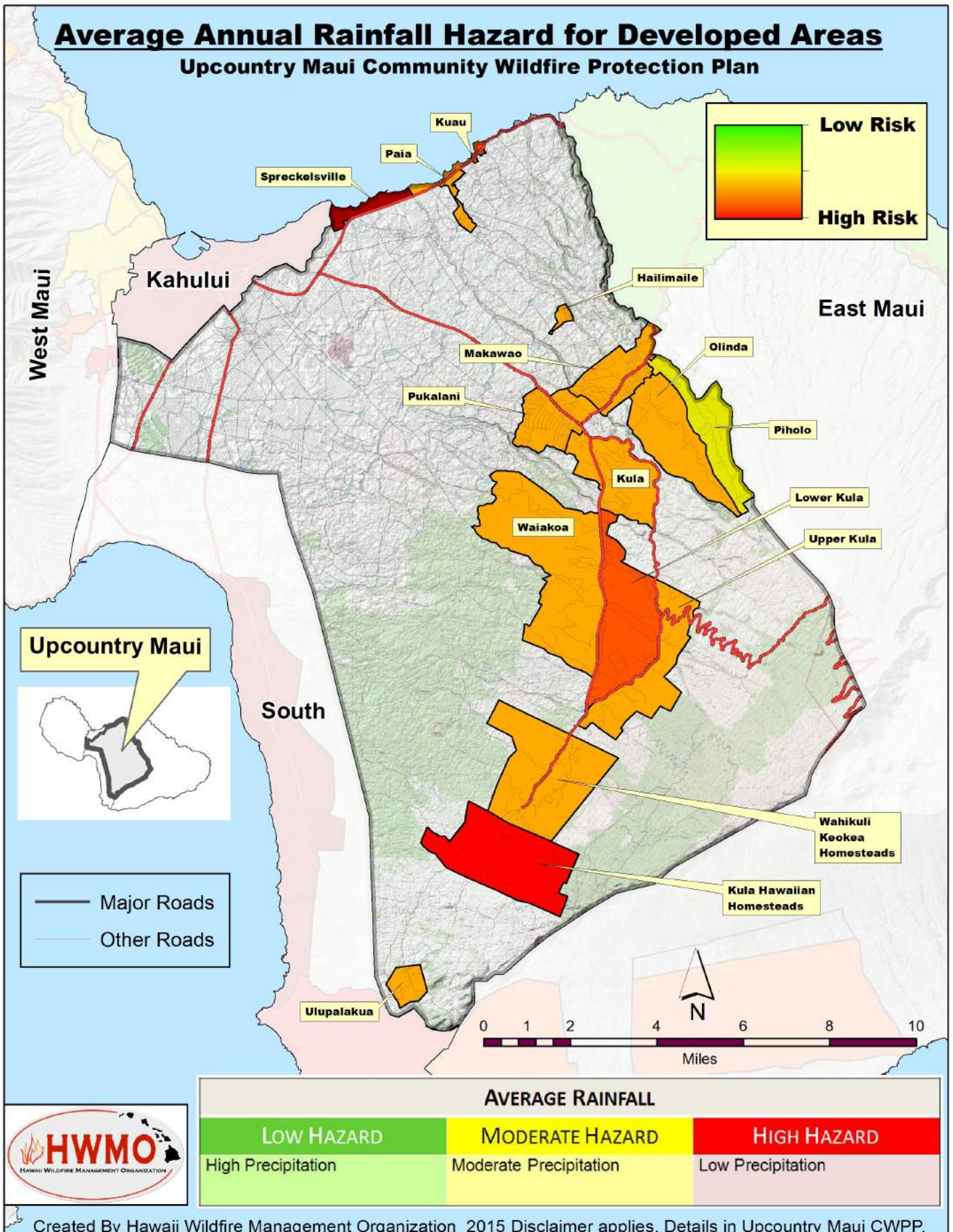
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
All underground or none.	One underground, one above ground.	Both above ground.

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FIRE ENVIRONMENT HAZARD FOR DEVELOPED AREAS

Average Annual Rainfall Hazard for Developed Areas

Upcountry Maui Community Wildfire Protection Plan



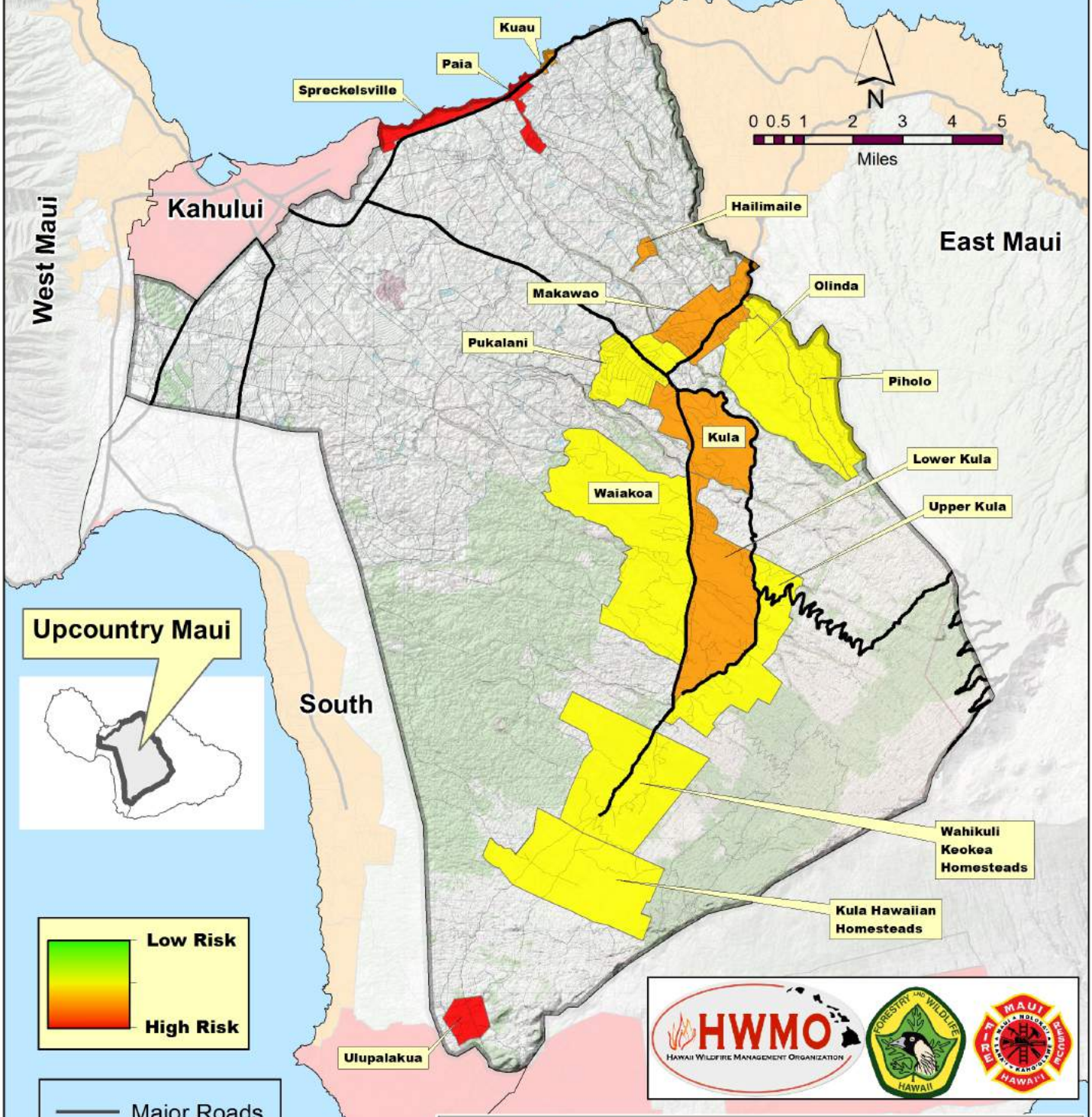
Upcountry Maui



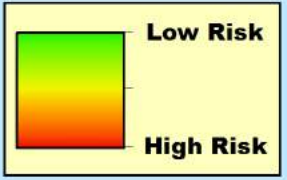
— Major Roads
— Other Roads



Prevailing Wind Speeds & Direction Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



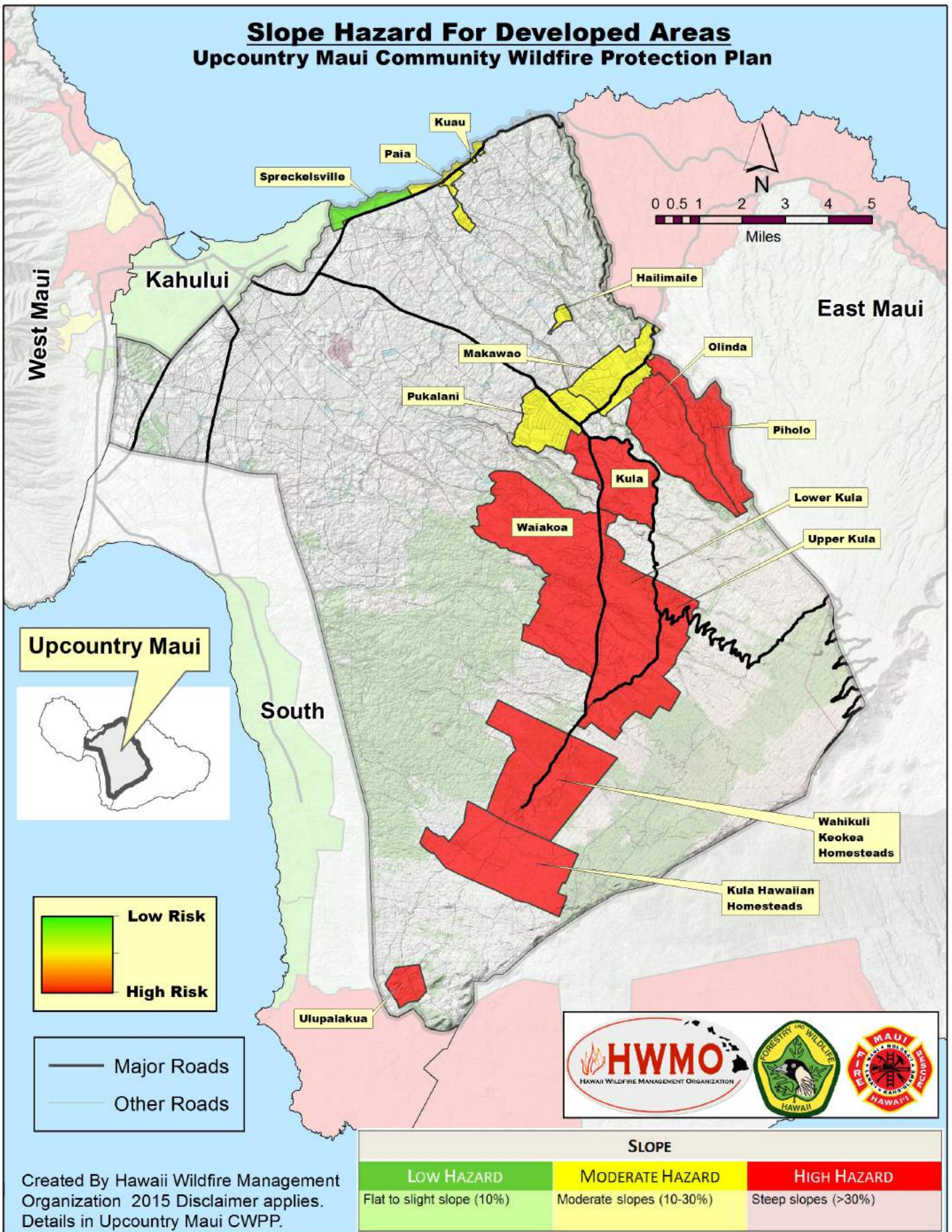
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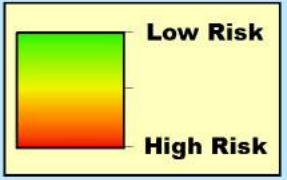
PREVAILING WIND SPEEDS AND DIRECTION		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Wind rarely (less than 10% of time) exceeds 15 mph. Protection from predominant winds.	Wind rarely (less than 10% of time) exceeds 15 mph.	Wind frequently (50% or more of time) exceeds 15 mph or frequent exposure to predominant winds or transitional/converging wind directions.

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Slope Hazard For Developed Areas Upcountry Maui Community Wildfire Protection Plan



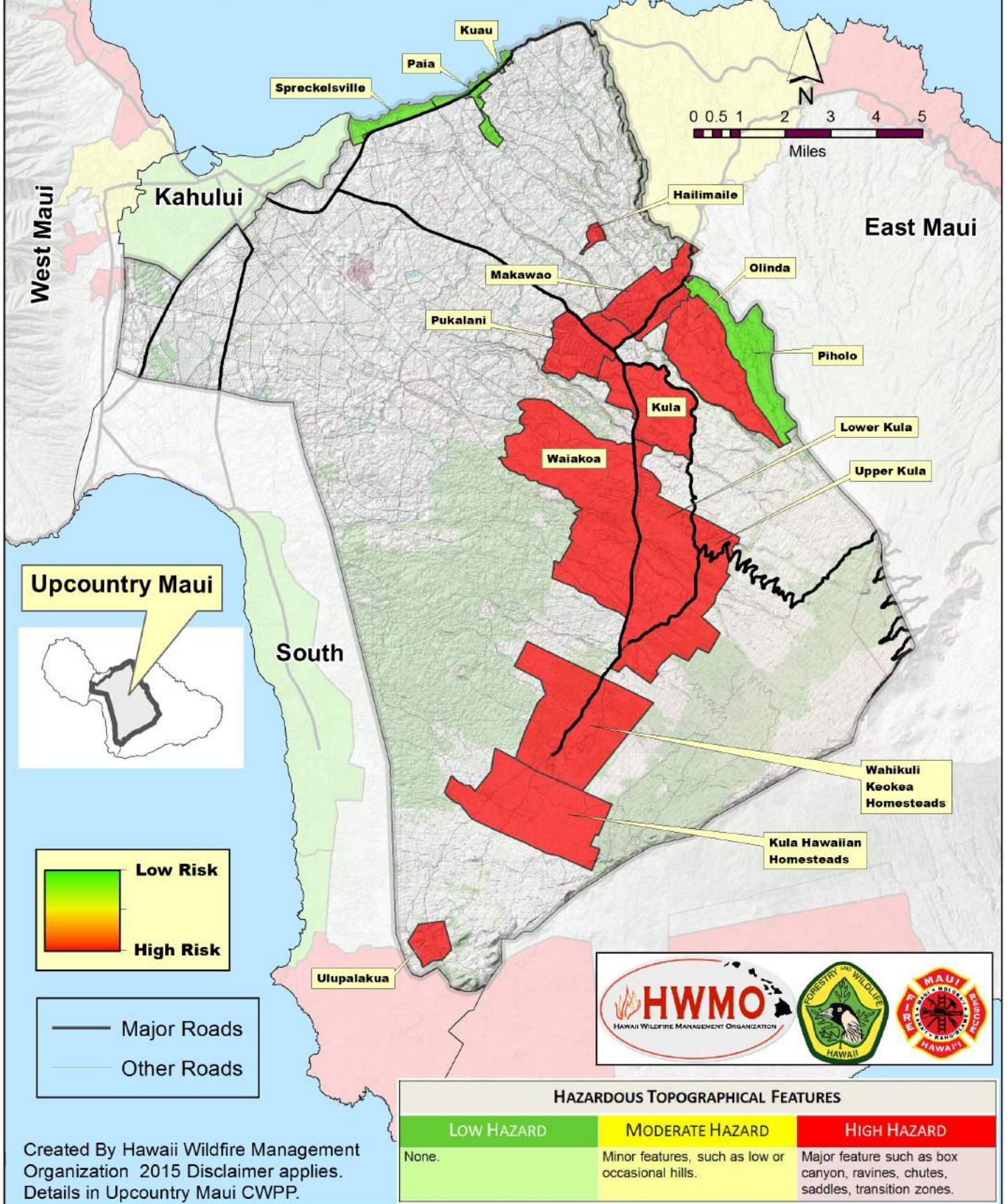
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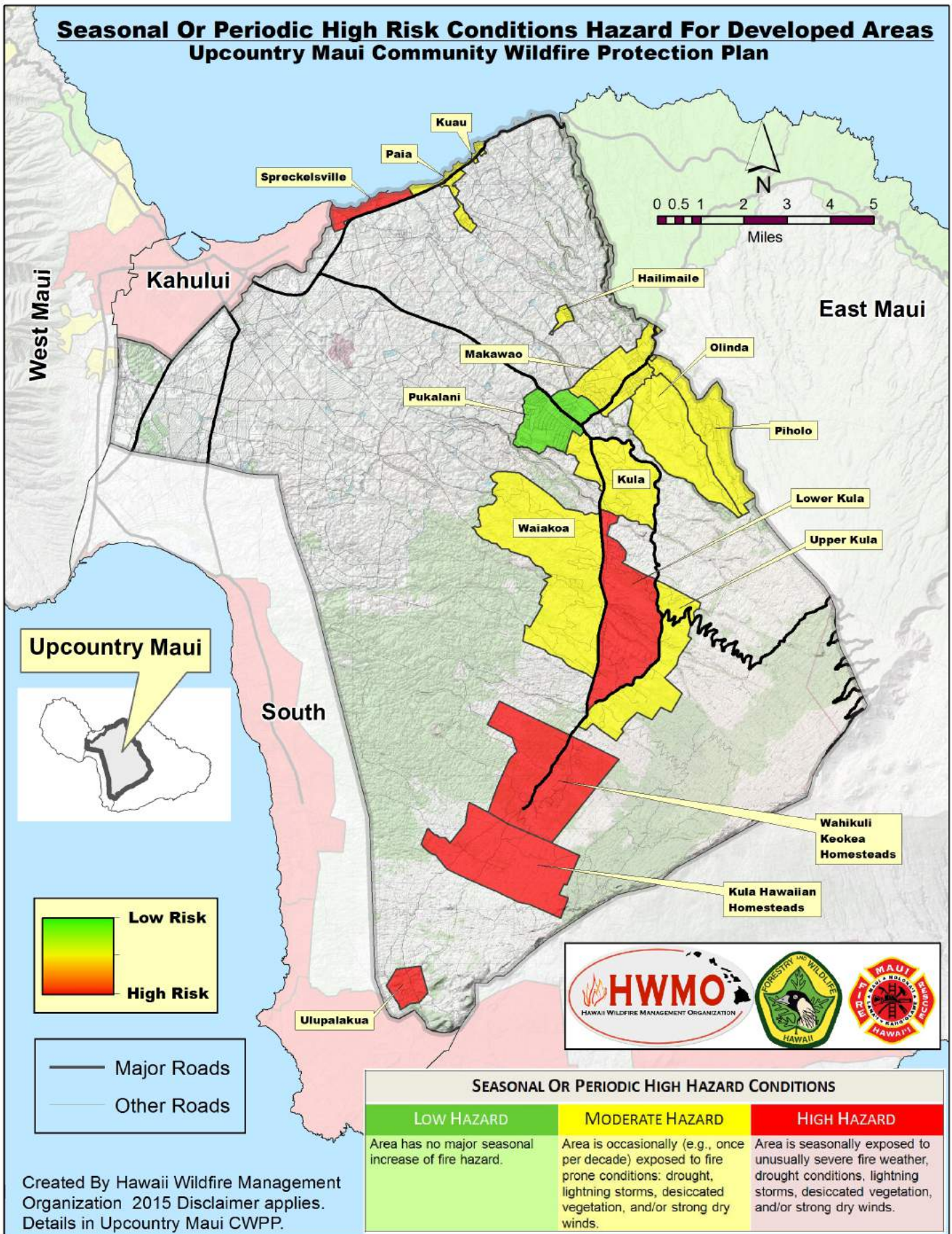
SLOPE		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Flat to slight slope (10%)	Moderate slopes (10-30%)	Steep slopes (>30%)

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Topographic Features That Adversely Affect Wildland Fire Behavior Hazard For Developed Areas Upcountry Maui Community Wildfire Protection Plan



Seasonal Or Periodic High Risk Conditions Hazard For Developed Areas Upcountry Maui Community Wildfire Protection Plan

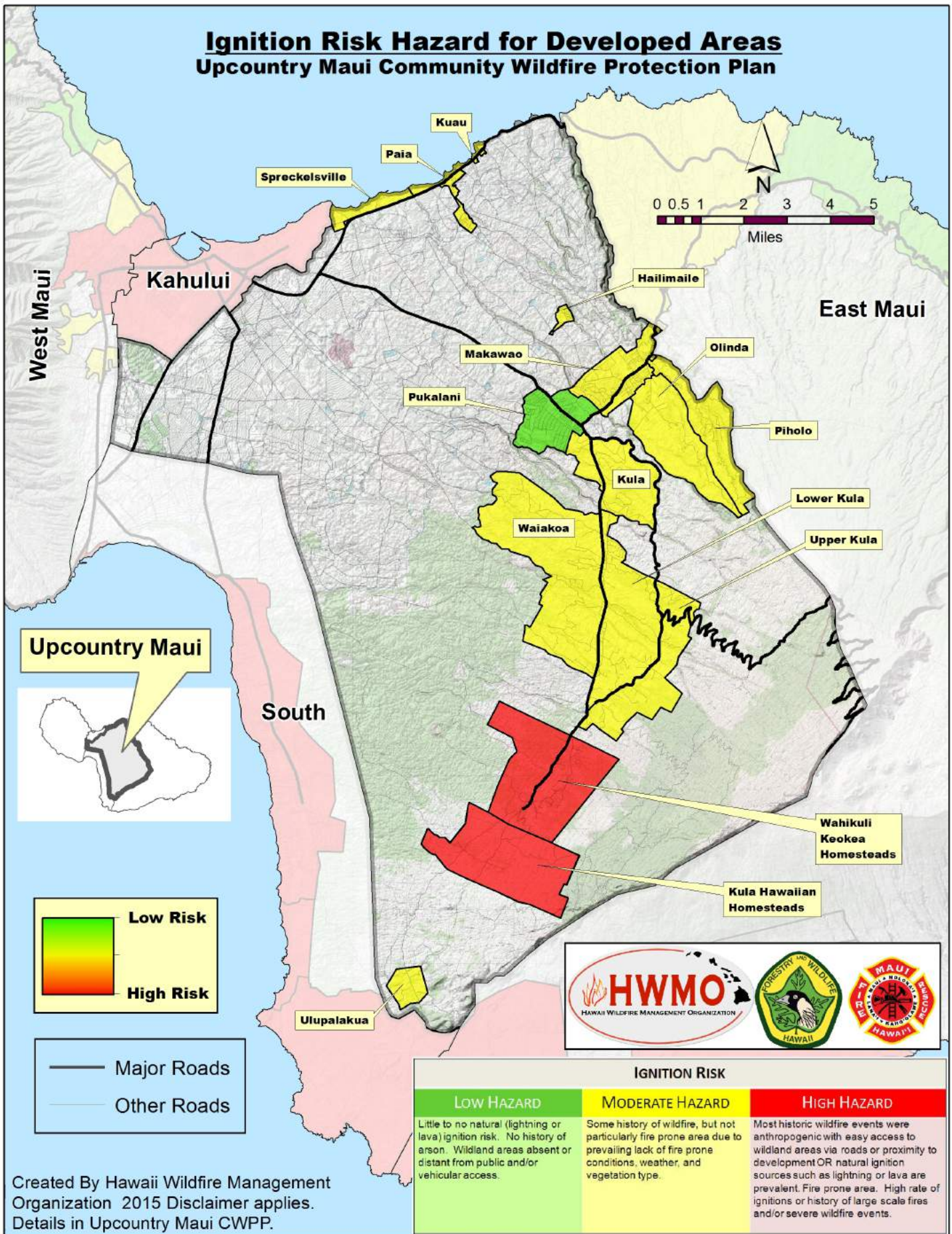


SEASONAL OR PERIODIC HIGH HAZARD CONDITIONS

LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Area has no major seasonal increase of fire hazard.	Area is occasionally (e.g., once per decade) exposed to fire prone conditions: drought, lightning storms, desiccated vegetation, and/or strong dry winds.	Area is seasonally exposed to unusually severe fire weather, drought conditions, lightning storms, desiccated vegetation, and/or strong dry winds.

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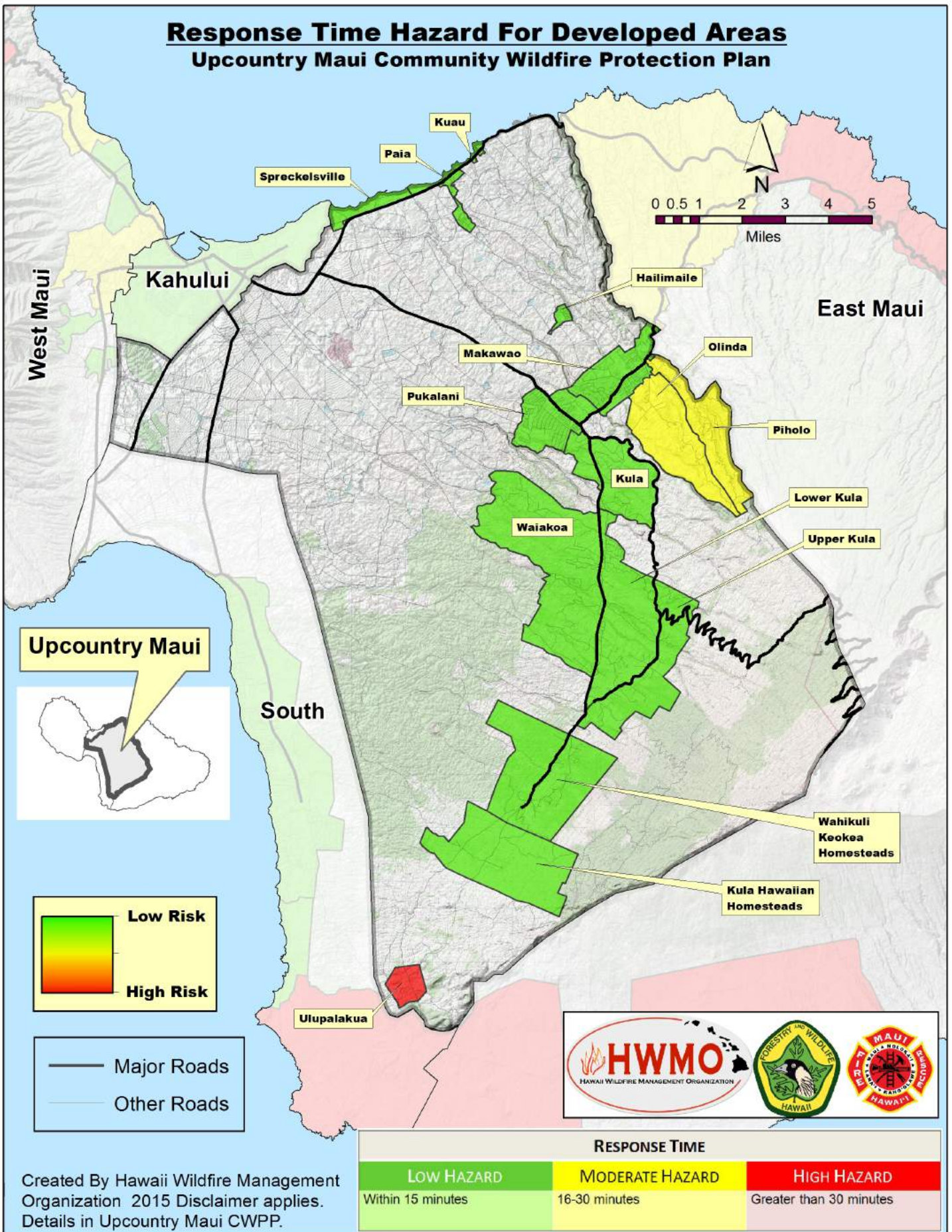
Ignition Risk Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



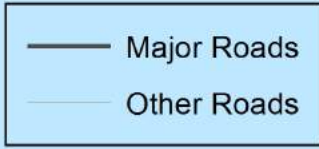
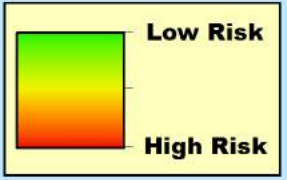
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FIRE PROTECTION HAZARD FOR DEVELOPED AREAS

Response Time Hazard For Developed Areas Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui



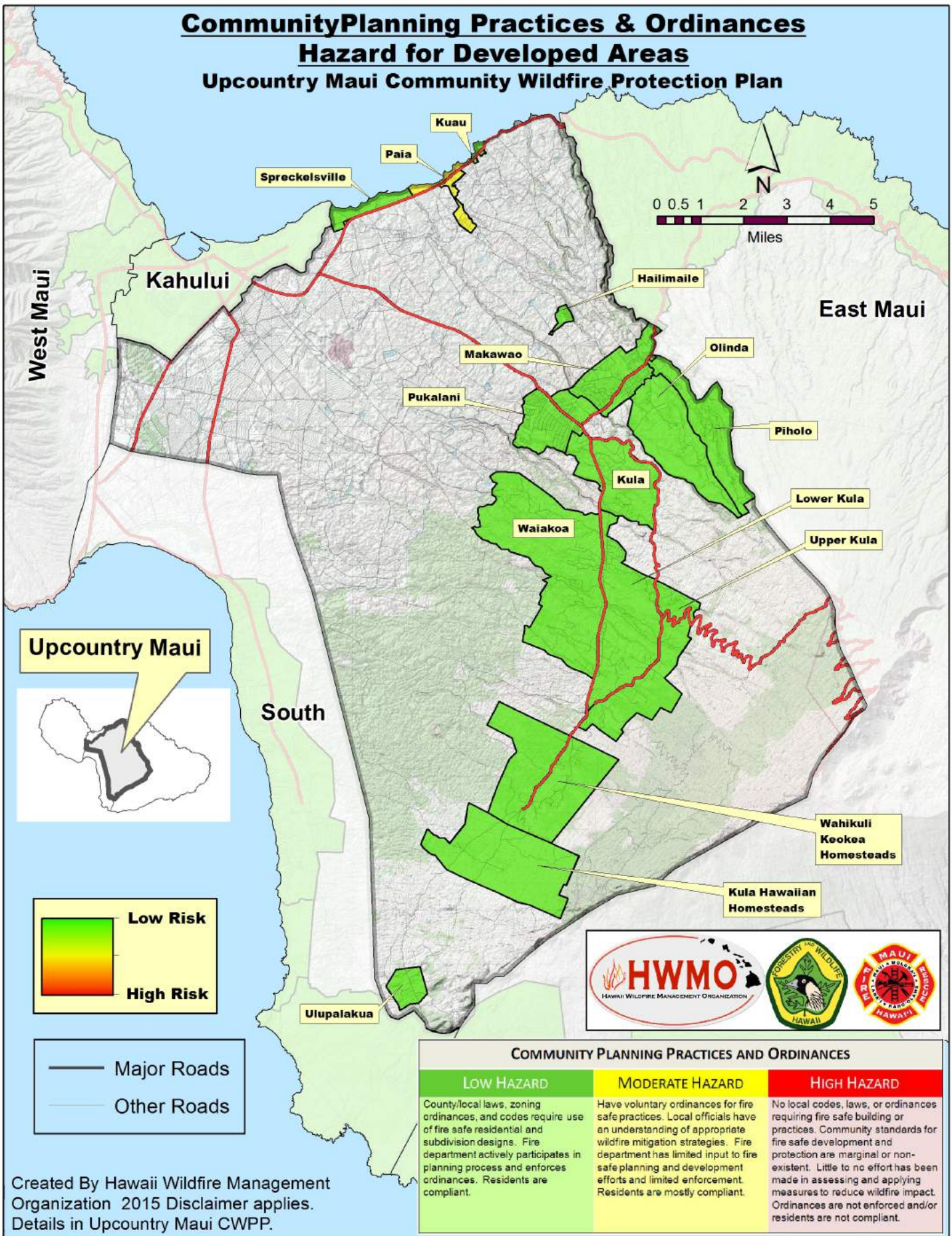
RESPONSE TIME		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Within 15 minutes	16-30 minutes	Greater than 30 minutes

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Community Planning Practices & Ordinances

Hazard for Developed Areas

Upcountry Maui Community Wildfire Protection Plan



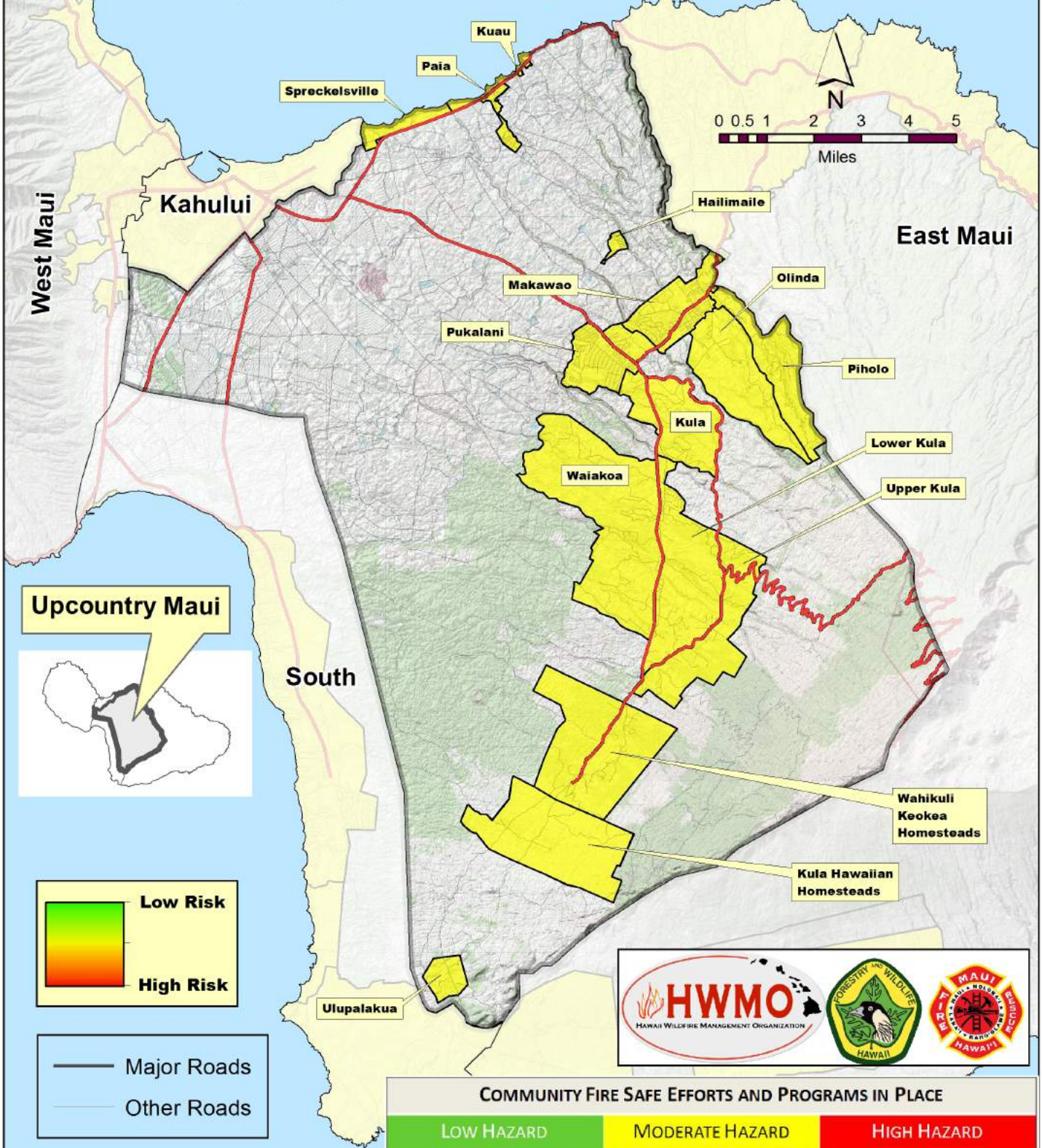
COMMUNITY PLANNING PRACTICES AND ORDINANCES		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
County/local laws, zoning ordinances, and codes require use of fire safe residential and subdivision designs. Fire department actively participates in planning process and enforces ordinances. Residents are compliant.	Have voluntary ordinances for fire safe practices. Local officials have an understanding of appropriate wildfire mitigation strategies. Fire department has limited input to fire safe planning and development efforts and limited enforcement. Residents are mostly compliant.	No local codes, laws, or ordinances requiring fire safe building or practices. Community standards for fire safe development and protection are marginal or non-existent. Little to no effort has been made in assessing and applying measures to reduce wildfire impact. Ordinances are not enforced and/or residents are not compliant.

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Community Fire Safe Efforts & Programs Already In Place

Hazard for Developed Areas

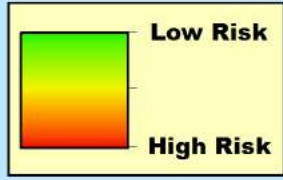
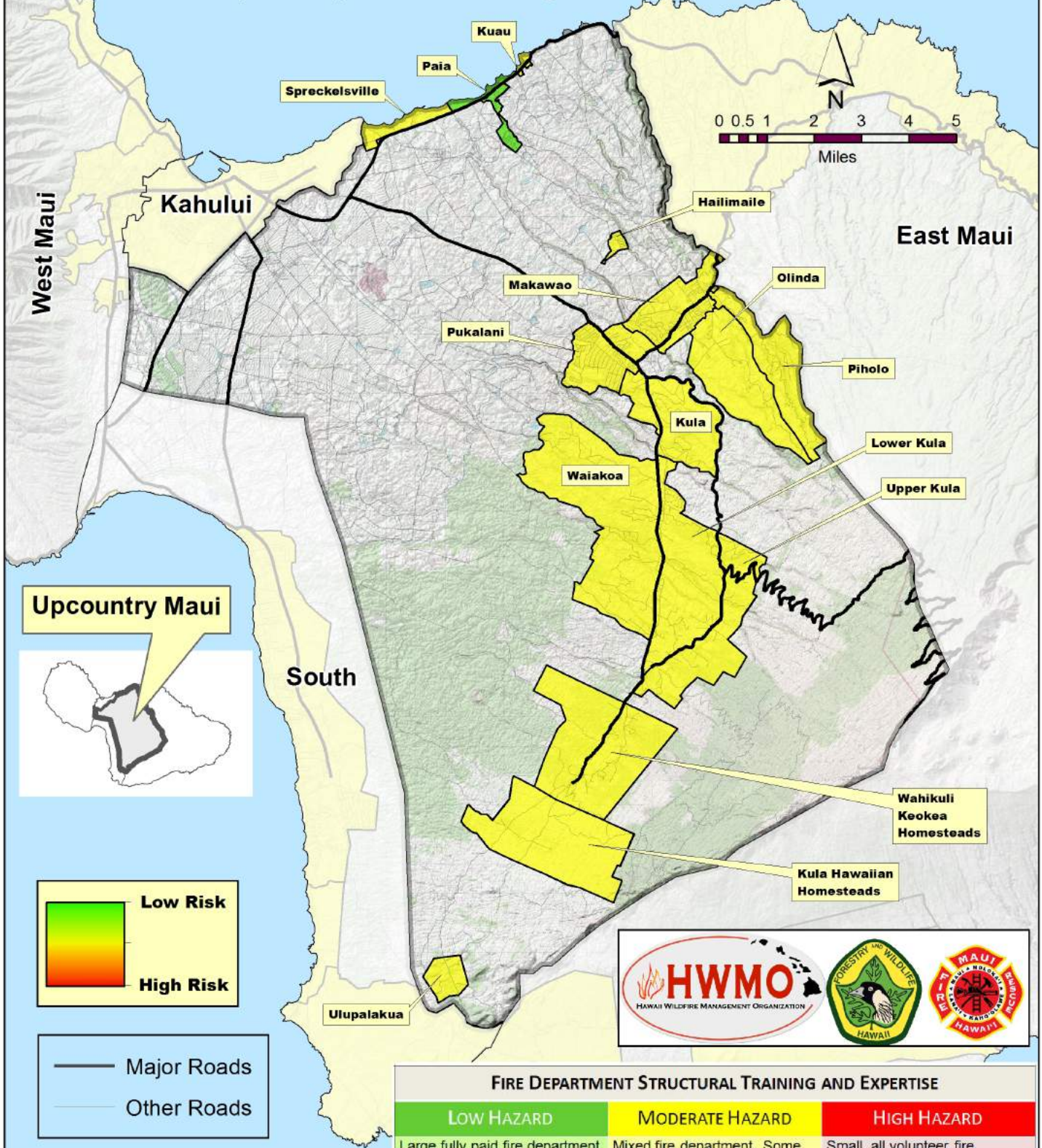
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COMMUNITY FIRE SAFE EFFORTS AND PROGRAMS IN PLACE		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Organized and active groups provide educational materials and programs throughout the community.	Limited provision of or interest in educational efforts. Fire Department or local group does some limited prevention and public education.	No interest or participation in educational programs. No prevention education by local fire department.

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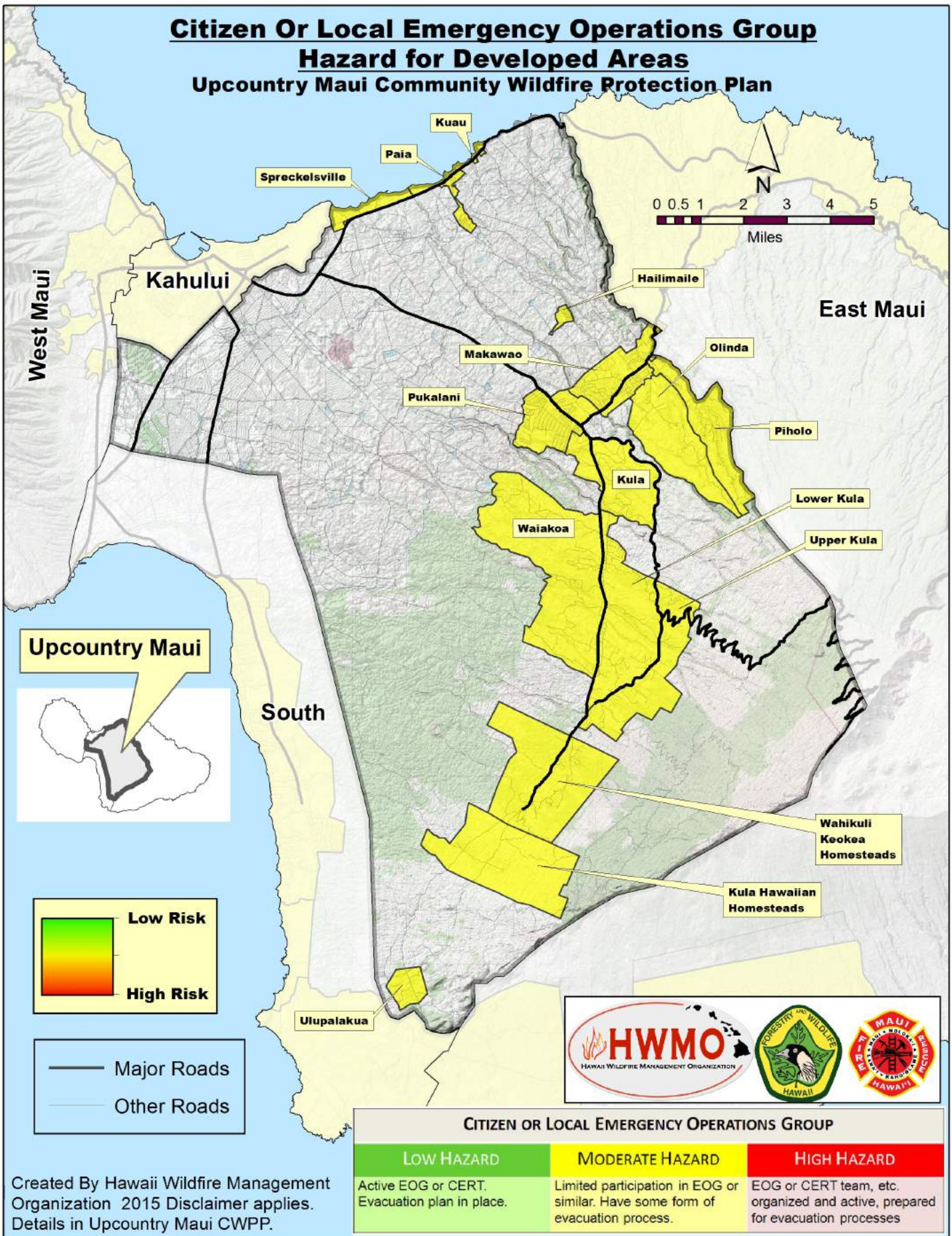
Fire Department Structural Training & Expertise Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



FIRE DEPARTMENT STRUCTURAL TRAINING AND EXPERTISE		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Large fully paid fire department with personnel that meet NFPA or NWCG training requirements and have adequate equipment.	Mixed fire department. Some paid and some volunteer personnel. Limited experience, training, and equipment to fight fire.	Small, all volunteer fire department. Limited training, experience, and budget with regular turnover of personnel. Do not meet NFPA or NWCG standards.

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Citizen Or Local Emergency Operations Group Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan

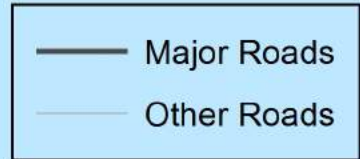
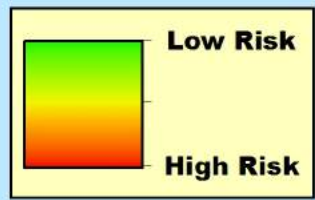
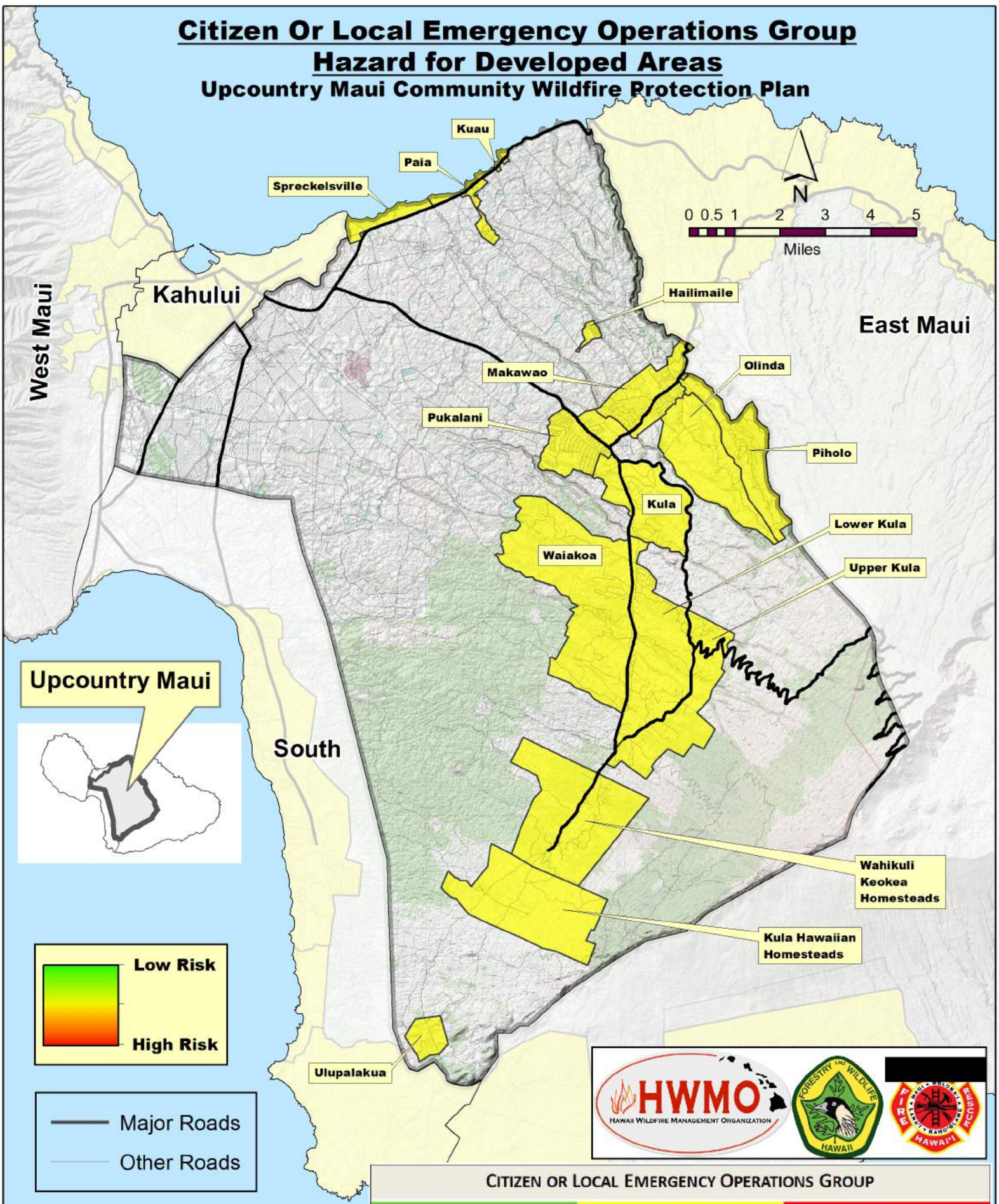


CITIZEN OR LOCAL EMERGENCY OPERATIONS GROUP

LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Active EOG or CERT. Evacuation plan in place.	Limited participation in EOG or similar. Have some form of evacuation process.	EOG or CERT team, etc. organized and active, prepared for evacuation processes

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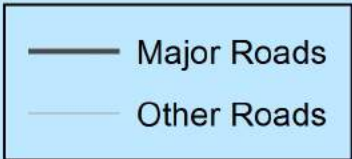
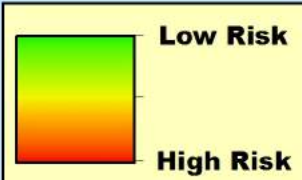
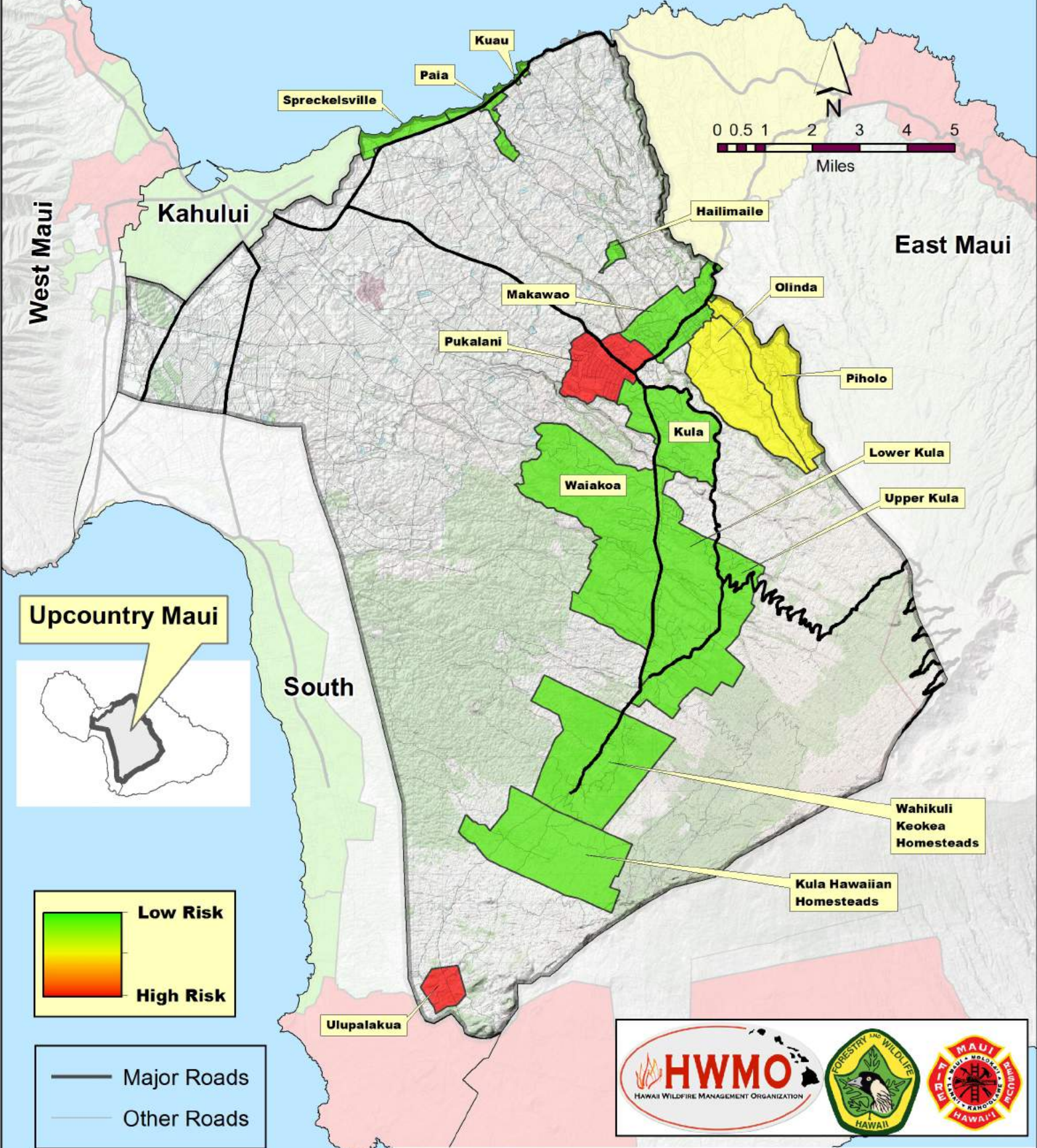
Citizen Or Local Emergency Operations Group Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



CITIZEN OR LOCAL EMERGENCY OPERATIONS GROUP		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Active EOG or CERT. Evacuation plan in place.	Limited participation in EOG or similar. Have some form of evacuation process.	No effective activity or strategy in place.

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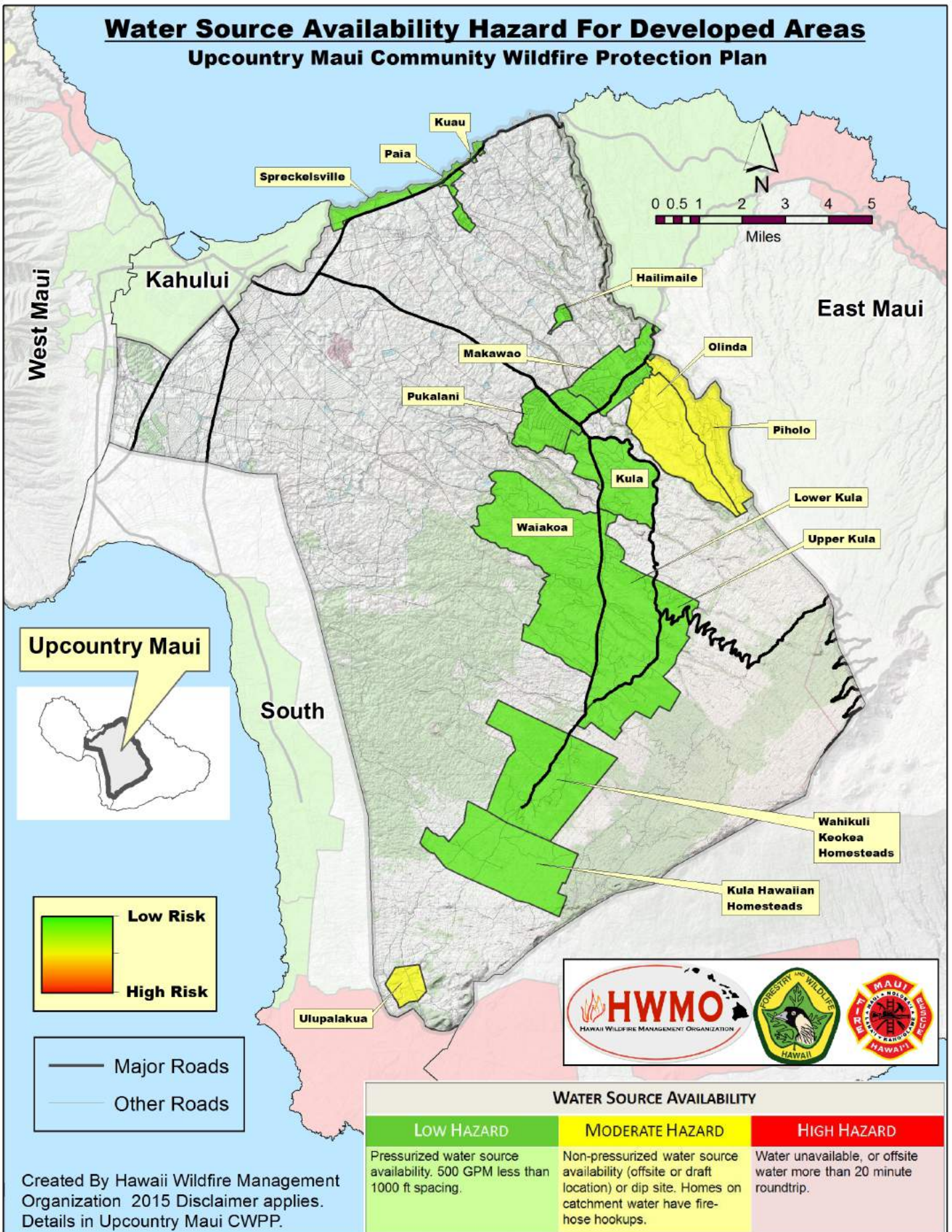
Proximity To Fire Station Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



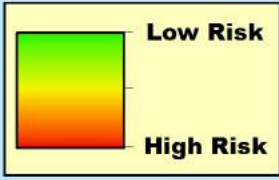
PROXIMITY TO FIRE STATION		
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Less than 5 miles	6-10 miles	More than 10 miles

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Water Source Availability Hazard For Developed Areas Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui



— Major Roads
— Other Roads

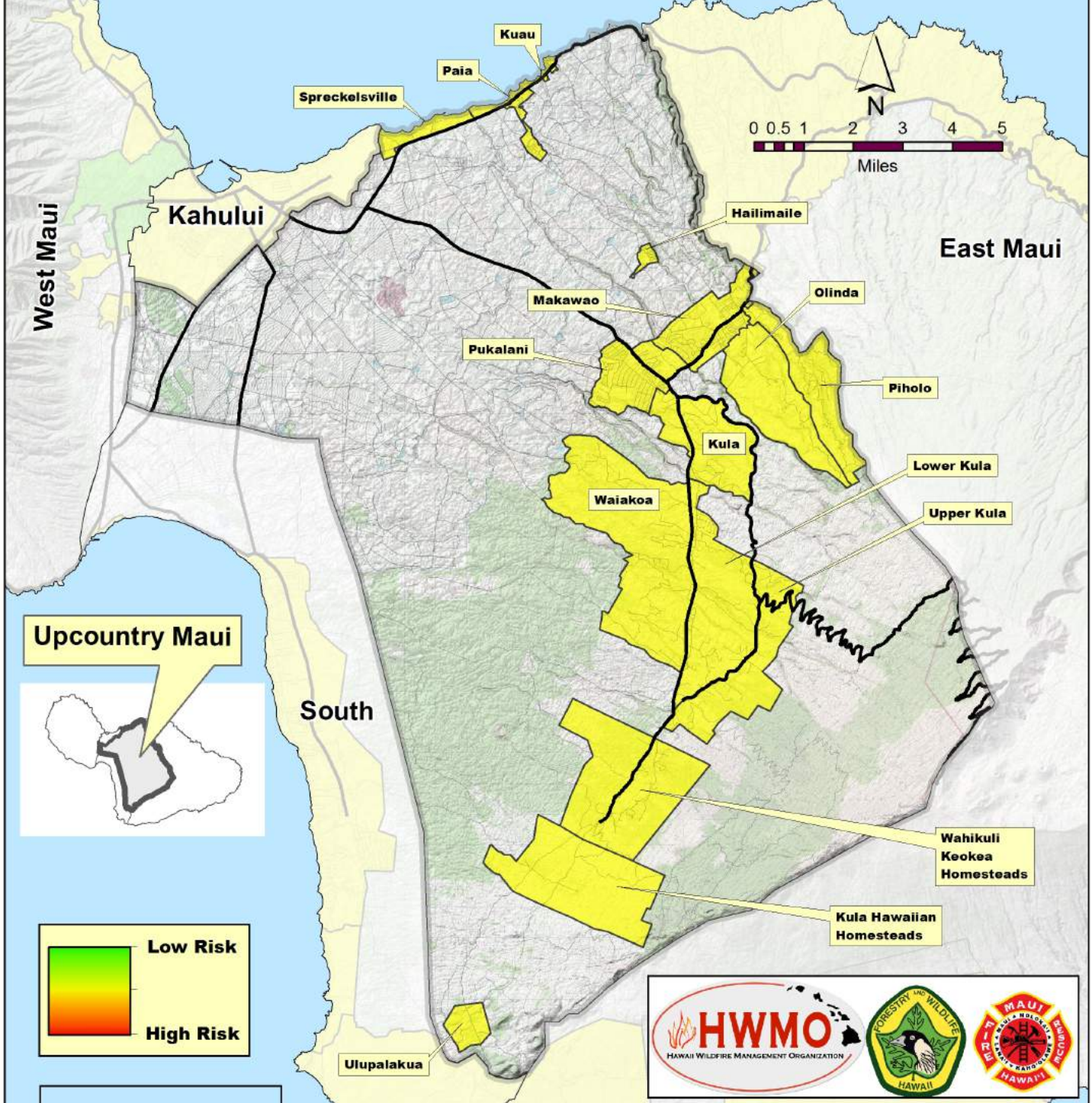


WATER SOURCE AVAILABILITY

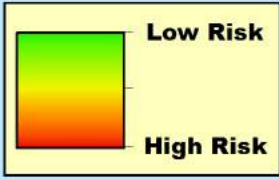
LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Pressurized water source availability. 500 GPM less than 1000 ft spacing.	Non-pressurized water source availability (offsite or draft location) or dip site. Homes on catchment water have fire-hose hookups.	Water unavailable, or offsite water more than 20 minute roundtrip.

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Wildland Firefighting Capacity Of Initial Response Agency Hazard For Developed Areas Upcountry Maui Community Wildfire Protection Plan



Upcountry Maui



— Major Roads

— Other Roads

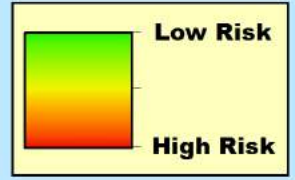
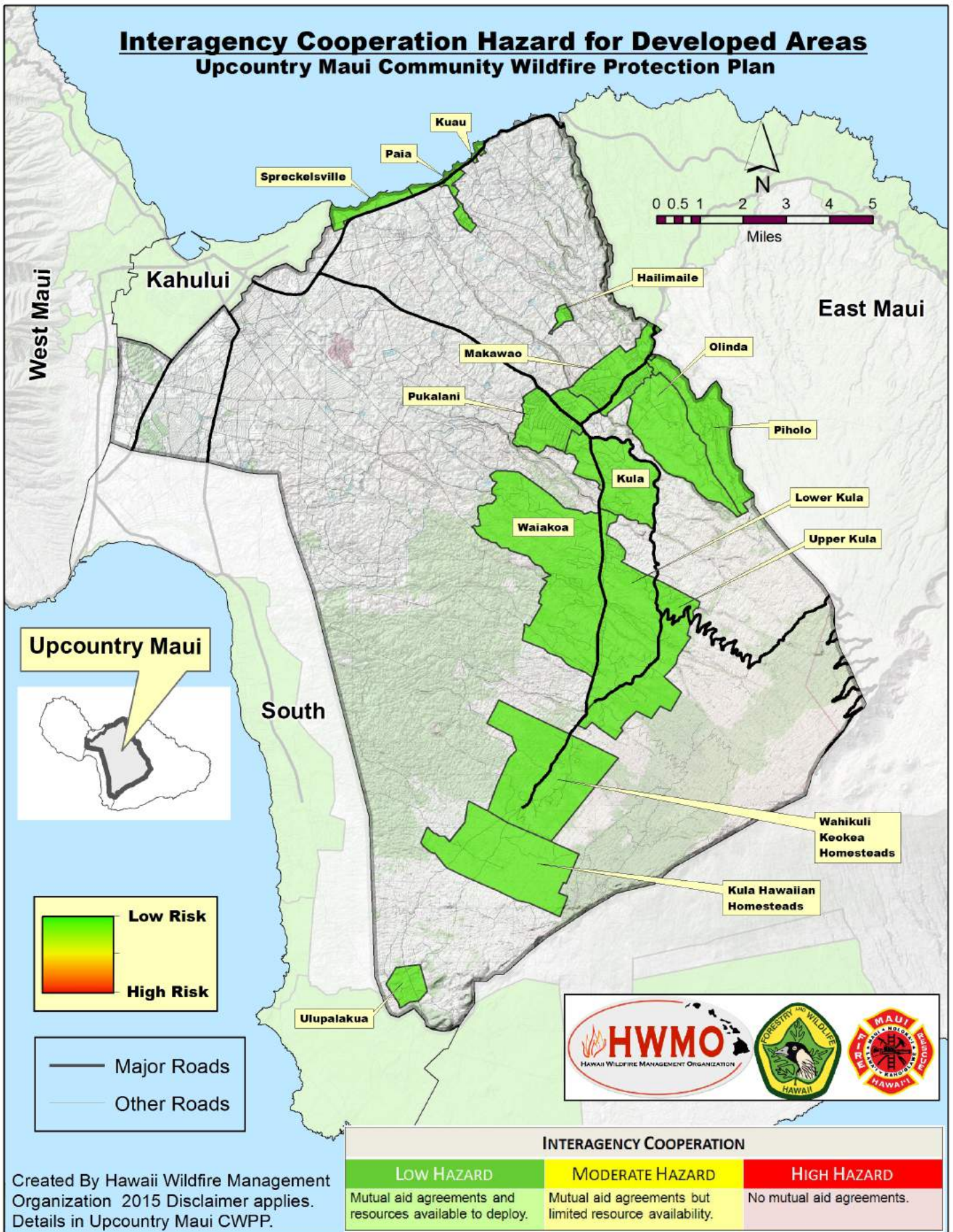


WILDLAND FIREFIGHTING CAPACITY OF INITIAL RESPONSE AGENCY

LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Sufficient personnel, equipment, and wildland firefighting capability and experience. Good supply of structural and wildland fire apparatus and misc specialty equipment	Limited personnel, and or equipment but with some wildland firefighting expertise and training. Smaller supply of fire apparatus in fairly good repair with some specialty equipment.	Fire department non-existent or untrained/unequipped to fight wildland fire. Minimum amount of fire apparatus, which is old and in need of repair. None or little specialty equipment.

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Interagency Cooperation Hazard for Developed Areas Upcountry Maui Community Wildfire Protection Plan



INTERAGENCY COOPERATION

LOW HAZARD	MODERATE HAZARD	HIGH HAZARD
Mutual aid agreements and resources available to deploy.	Mutual aid agreements but limited resource availability.	No mutual aid agreements.

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Appendix D
Upcountry Maui Community Wildfire Protection Plan
Maui Fire Department 2016 Apparatus and Vehicles Inventory

Make	Utilization	MFD #	Location	Mileage as of 4/6/16	Year	Target Replacement Date
EMERGENCY APPARATUS 1-5 YEARS OLD						
PIERCE LADDER 105' L3	LADDER	229	LAHAINA	10,946	2015	FY 2029
PIERCE PUMPER E14	PUMPER	228	WAILEA	10,030	2015	FY 2029
PIERCE PUMPER E5	PUMPER	215	MAKAWAO	11,553	2015	FY 2029
PIERCE/PETERBILT TANKER T14	3500 G	213	WAILEA	7,946	2014	FY 2025
W.MARK/PETERBILT TANKER T10	3500 G	212	KAHULUI	12,674	2013	FY 2022
PIERCE PUMPER E4	PUMPER	209	KAUNAKAKAI	13,957	2011	FY 2022
SVI/TATRA TANKER T3 (2500G)	6x6 TANKER	224	LAHAINA	16,855	2010	FY 2021
E-ONE/INTL TANKER T7 (2500G)	4x4 TANKER	225	HANA	5,771	2010	FY 2021
SVI/TATRA TANKER T8 (2500G)	6x6 TANKER	218	LANAI	8,726	2010	FY 2021
SVI/DODGE MINI PUMPER M11	4x4 MINI PUMPER	222	NAPILI	17,012	2010	FY 2021
SVI/DODGE MINI PUMPER M13	4x4 MINI PUMPER	223	KULA	27,974	2010	FY 2021
E-ONE/DODGE MINI PUMPER M2	4x4 MINI PUMPER	217	PAIA	31,162	2010	FY 2021
E-ONE PUMPER E2	PUMPER	216	PAIA	63,818	2010	FY 2021
E-ONE PUMPER E13	PUMPER	199	KULA	44,876	2010	FY 2021
CHEVY/TAHOE/SUV	4x4 SUV	220	BATTALION 2	61,844	2010	FY 2020
EMERGENCY APPARATUS 6-10 YEARS OLD						
SVI/SPARTAN PUMPER E3	PUMPER	200	LAHAINA	69,797	2009	FY 2020
SVI/SPARTAN RESCUE R10	RESCUE	198	KAHULUI	30,749	2009	FY 2020
SVI/FREIGHTLINER AIR/LIGHT	AIR/LIGHT	193	HEALTH/SAFETY	7,368	2009	FY 2020
PIERCE PUMPER E7	PUMPER	205	HANA	20,853	2007	FY 2018
PIERCE PUMPER E1	PUMPER	204	WAILUKU	74,840	2007	FY 2018
PIERCE/GMC MINI PUMPER M1	4x4 MINI PUMPER	203	WAILUKU	20,591	2007	FY 2018
SVI/SPARTAN HAZMAT HM10	HAZMAT	192	KAHULUI	25,044	2007	FY 2018
PIERCE WILDLAND PUMPER E11	4x4 PUMPER	180	NAPILI	46,027	2006	FY 2017
PIERCE WILDLAND PUMPER E9	4x4 PUMPER	181	HO'OLEHUA	19,854	2006	FY 2016
PIERCE WILDLAND PUMPER E8	4x4 PUMPER	202	LANAI	18,881	2006	FY 2017
PIERCE PUMPER E10	PUMPER	177	KAHULUI	81,270	2005	FY 2017
PIERCE PUMPER E6	PUMPER	178	KIHEI	84,415	2005	FY 2017
CHEVY/TAHOE/SUV	4x4 SUV	195	BATTALION 1	69,697	2008	FY 2020
EMERGENCY APPARATUS 11-15 YEARS OLD						
PIERCE/KENWORTH WILDLAND E12	4x4 PUMPER	174	PUKO'O	48,122	2004	FY 2016
PIERCE/FORD MINI PUMPER M7	4x4 MINI PUMPER	176	HANA	9,308	2004	FY 2015
PIERCE/LADDER 95' L14	TOWER	163	WAILEA	45,600	2002	FY 2013
PIERCE/OSHKOSH TANKER T4 (2800G)	RT4 6x6	183	KAUNAKAKAI	35,410	2002	FY 2016
RELIEF EMERGENCY APPARATUS 6-10 YEARS OLD						
CHEVY/TAHOE/SUV RB2	4x4 RBATT 2	197	KAHULUI	119,820	2009	Used as Bkup only

RELIEF EMERGENCY APPARATUS 11-15 YEARS OLD						
PIERCE LADDER 105' RL3	RL3	173	WAIKO	59,145	2003	Relief Apparatus
PIERCE PUMPER RE5	RE5	161	KAHULUI	101,936	2002	Relief Apparatus
PIERCE PUMPER RE14	RE14	162	WAILEA	79,100	2002	Relief Apparatus
OMCO/PETERBILT TANKER RT10 (3500G)	RT10	168	KAHULUI	64,766	2002	Relief Apparatus
RELIEF EMERGENCY APPARATUS 16+ YEARS OLD						
PIERCE PUMPER	RE13	145	KAHULUI	105,723	1994	Relief Apparatus
PIERCE PUMPER	RE8	146	LANAI	48,307	1994	Relief Apparatus
PIERCE PUMPER	RE7	143	LAHAINA	57,760	1993	Relief Apparatus
PIERCE PUMPER	RE4	159	KAUNAKAKAI	50,543	2000	Relief Apparatus
UTILITY VEHICLES 1-7 YEARS OLD						
FORD F350 Crew Cab R10UT	4x4	232	KAHULUI RESCUE	442	2015	FY 2026
FORD F350 Crew Cab UT3	4x4	230	LAHAINA	476	2015	FY 2026
FORD F150 Extra Cab UT8	4x4	239	LANAI	1,104	2015	FY 2026
FORD F150 Extra Cab UT12	4x4	241	PUKO'O	297	2015	FY 2026
FORD F150 Extra Cab UT7	4x4	242	HANA	234,781	2015	FY 2026
WILDLAND WL8	WILDLAND 8	214	LANAI	2,005	2014	FY 2025
FORD F-350 UT14	UTILITY 14	210	WAILEA	9,492	2012	FY 2023
FORD F-350 WL1	WILDLAND 1	227	KAHULUI	6,835	2011	FY 2022
CHEVY 2500 UT9	UTILITY 9	221	HO'OLEHUA	39,993	2011	FY 2022
UTILITY VEHICLES 8-14 YEARS OLD						
CHEVY 3500 HM10UT	HAZMAT UTILITY	187	KAHULUI	45,153	2006	FY 2017
FORD F-350 UT4	UTILITY 4	186	KAUNAKAKAI	64,178	2005	FY 2016
STAFF VEHICLES 1-7 YEARS OLD						
FORD F350 Crew Cab	4x4 P/U	231	TRAINING	1,623	2015	FY 2026
FORD F150 Extra Cab	4x4 P/U	240	PREVENTION	2,005	2015	FY 2026
FORD F150 Extra Cab	4x2 P/U	238	FSO	1,638	2015	FY 2026
CHEVY / SILVERADO / 4x4 w/LIFTGATE	4x4	226	MECHANICS	18,281	2010	FY 2021
FORD F150 P/U	P/U	219	HEALTH/SAFETY	53,380	2010	FY 2021
CHEVY / SILVERADO / 4x4 w/LIFTGATE	4x4	196	Educ PREVENTION	17,842	2009	FY 2020
FORD EXPLORER	4x4 SUV	208	PREVENTION	103,637	2008	FY 2016
FORD EXPLORER	4x4 SUV	207	PREVENTION	52,220	2008	FY 2019
NISSAN TITAN P/U	P/U	206	SUPPLY	84,581	2008	FY 2018
GMC ENVOY	4x4 SUV	191	TRAINING	97,537	2007	FY 2017
NISSAN FRONTIER P/U	4x4	188	PREVENTION	47,108	2007	FY 2018
NISSAN FRONTIER P/U	4x4	211	PREVENTION	113,724	2007	FY 2016
NISSAN FRONTIER P/U	4x4	190	PREVENTION	76,752	2007	FY 2018
STAFF VEHICLES 8-14 YEARS OLD						
CHEVY P/U 3500	UTILITY	179	PREVENTION	44,931	2006	FY 2017
FORD EXPLORER	SUV	184	PREVENTION	107,853	2005	FY 2016
FORD EXPLORER	SUV	185	PREVENTION	54,924	2005	FY 2016
CHEVROLET / CAVALIER	SEDAN	175	ADMIN.	57,598	2004	FY 2015
TOYOTA / PRE-RUNNER	4W DR P/U	167	SHOP	88,196	2002	Relief Apparatus
STAFF VEHICLES 15+ YEARS OLD						
FORD / CROWN VICTORIA	SEDAN	153	BC7	117,467	1999	Relief/Disposal
MFD WATERCRAFT - BOATS						
		HA #	VIN #			
26 FT. RADON - RESCUE BOAT	RB10	0350XC	RAD 26511H515		2015	Repower FY 2026
26 FT. RADON - RESCUE BOAT	RB4	0310XC	RAD 26506J010		2010	Repower FY 2021
26 FT. RADON - RESCUE BOAT	RB3	0276XC	RAD 26504B808		2008	Repower FY 2019

22 FT. AQUASPORT - RESCUE BOAT	RB4A	0136 XC	ASP A0701C87		1987	Relief Apparatus
MFD WATERCRAFT - FIRE SKIS						
		HA #	VIN #			
YAMAHA FXHO 1.8	FS14	0306XC	YAMA 1907H910		2010	FY 2016
YAMAHA FXHO 1.8	FS9	0307XC	YAMA 1939H910		2010	FY 2016
YAMAHA FXHO 1.8	FS10	0280XC	YAMA 4461H708		2008	FY 2014
YAMAHA FXHO 1.8 - TRAINING	FS10	0281XC	YAMA 4480H708		2008	FY 2014
YAMAHA XA 1200	FS4	0273XC	YAMA 2049I304		2004	FY 2010

Vehicles that are assigned to stations that have fewer alarms will be evaluated by the Apparatus Committee at 10 years of age to determine if the replacement year can be extended out further. Final determination will be made by the Lead Mechanic who is the subject matter expert using the following criteria:

1. Overall condition and safety
2. Corrosion of critical components like the chassis, frame, plumbing, etc.
3. Future major repairs and costs
4. Annual PUC Inspection
5. Annual Pump test
6. Changes to NFPA 1901 Standard for Automotive Fire Apparatus

Appendix E
Upcountry Maui Community Wildfire Protection Plan
Leeward Haleakalā Watershed Restoration Partnership Proposed Priority Projects

The following list was provided by the Leeward Haleakalā Watershed Partnership as 1-5 year project ideas related to wildfire hazard mitigation and protection activities. While the partnership includes lands and partners both inside and outside of the Upcountry CWPP area, all projects and lands have been included in this list, as they complement and support fire protection activities across the broader region.

1. Haleakala Ranch

- Firewise certification for the Ranch
- Pi'ilani Highway roadside grazed firebreak
- Lennox grove firebreak maintenance

2. Thompson Ranch

- CWPP
- Invasive tree control - potential to use grazing for wattle (*Acacia mearnsii*) control
- Native species planting/reforestation

3. 'Ulupalakua Ranch

- CWPP
- Firewise certification
- Invasive tree control
- Grazed firebreaks
- Native species planting/reforestation

4. Department of Hawaiian Home Lands - Kahikinui (see attached map for schematic)

- Firewise certification
- CWPP update
- Distribution of seed balls to counter recent fire and encourage native species regeneration
- Greenbreak creation
- Firebreak maintenance
- Roadwork for emergency exits
- Fence around community
- Paddocks for grazing between community and forest restoration area
- Internal units within the forest restoration area where grazing can occur for fuel mitigation as restoration proceeds
- Water catchment and reservoir construction and repair
- Native species planting/reforestation

5. Nakula Natural Area Reserve-Kahikinui Forest Reserve

- CWPP
- Invasive tree control
- Grazed firebreaks
- Greenbreaks

6. Nu'u Mauka Ranch

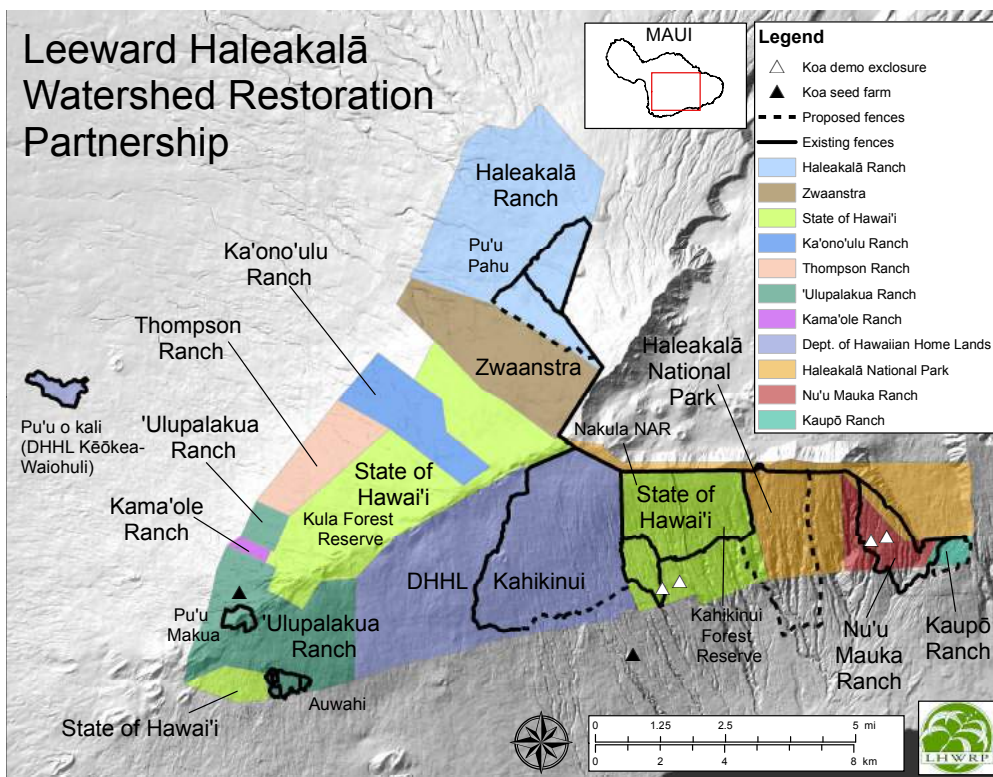
- CWPP
- Firewise certification
- Invasive tree control
- Grazed firebreaks
- Water catchment
- Native species planting/reforestation

7. Kaupo Ranch

- CWPP
- Firewise certification
- Invasive tree control
- Grazed firebreaks
- Reservoir upgrades
- Native species planting/reforestation

8. Partnership wide:

- Roadside signage regarding natural and cultural resources and fire risk
- Roadside grazed firebreaks and greenbreaks
- Increasing reservoirs for fire fighting
- Creation of seed farms to make collection of common native species more efficient
- Increase storage capacity to be prepared for fire response



Map of Leeward Haleakalā Watershed Restoration Partnership partners and landholdings