Emerald Bay Community Wildfire Protection Plan

March 2026

Prepared for:

Emerald Bay Community
600 Emerald Bay
Laguna Beach, California
92651

CONTACT:
Michael Dunbar
Emerald Bay Service District

Toni Hughes –
Emerald Bay Community Association - Community Manager



Prepared by:

DUDEK

MAIN OFFICE
605 THIRD STREET
ENCINITAS, CA 92024

CONTACTS:
Noah Stamm
Senior Fire Protection Planner - Fire Protection + Urban Forestry

Austin Ott
Senior Fire Protection Planner - Fire Protection + Urban Forestry

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Acronyms and Abbreviations

ACRONYM/ABBREVIATION	DEFINITION
AI	Artificial Intelligence
AMSL	Above mean sea level
CAL FIRE	California Department of Forestry and Fire Protection
CFC	California Fire Code
City	Laguna Beach
Community	Emerald Bay Community
Community Plan Area	Emerald Bay Community Geographical Zone
County	County
CWPP	Community Wildfire Protection Plan
FHSZ	Fire Hazard Severity Zone
FRAP	Fire and Resource Assessment Program
GIS	Geographic Information Systems
HFHSZ	High Fire Hazard Severity Zone
LBCWD	Laguna Beach County Water District
LRA	Local Responsibility Area
MFHSZ	Moderate Fire Hazard Severity Zone
NFPA	National Fire Protection Association
OCFA	Orange County Fire Authority
OCSD	Orange County Sheriff's Department
OSFM	Office of the State Fire Marshal
SRA	State Responsibility Area
USDOE	United States Department of Energy
VHFHSZ	Very High Fire Hazard Severity Zone
WHA	Wildfire Hazard Area/Wildland-Urban Interface Fire Area
WUI	Wildland-Urban Interface/Intermix

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Executive Summary

Emerald Bay Community Association Community Wildfire Protection Plan (CWPP) – Action Plan

The Community Wildfire Protection Plan (CWPP) for Emerald Bay establishes a comprehensive, phased strategy to reduce wildfire risk, protect lives and property, and enhance long-term community resilience. Recognizing the community's location within a Very High Fire Hazard Severity Zone (VHFHSZ), the Action Plan prioritizes near-term and long-term initiatives focused on structural hardening, vegetation management, evacuation readiness, infrastructure improvements, and funding.

Purpose and Goals

The CWPP's primary goal is to identify and implement practical, prioritized actions that minimize wildfire impacts. The plan emphasizes collaboration between the community, public safety agencies, and adjacent landowners to reduce hazards through:

- Home hardening and ignition resistance
- Expanded defensible space and fuel modification
- Emergency notification enhancements
- Code and standards improvements
- Evacuation planning and access management
- Strategic funding and grant acquisition
- Long-term vegetation and tree risk management

Priority Actions (Near-Term)

1. Home Hardening (Priority 1)

Given the risk of ember intrusion and direct flame exposure, the highest priority is reducing structural ignitability. The plan encourages retrofitting vulnerable features such as roofs, vents, eaves, decks, windows, and garages.

Key actions include:

- Expanding inspection and compliance efforts
- Promoting cost-sharing and grant programs
- Integrating structure inspections with defensible space programs

- Educating residents on cost-effective retrofit measures
- Exploring triggers for mandatory upgrades during remodels

Improving individual homes reduces not only personal risk but also the likelihood of structure-to-structure fire spread.

2. Expanded Fuel Modification Zones (Priority 2)

Currently, fuel modification extends up to 170 feet along the northern and western perimeters. Fire modeling indicates that extreme fire behavior may occur within 400 feet of the community boundary.

The plan proposes:

- Gradually expanding fuel modification up to 400 feet where feasible
- Coordinating with California State Parks and County of Orange Parks
- Selective thinning and pruning between 170 and 400 feet
- Installing lower-flammability vegetation such as opuntia and coast live oak

The objective is to reduce fire intensity and create a broader buffer between wildland fuels and residential structures.

In addition, homeowners will be encouraged to strengthen defensible space practices, especially within the immediate 0–5 foot “Zone 0” area around structures.

3. Emergency Siren and AI Camera System (Priority 3)

To improve emergency communication during wildfire events or power outages, the plan proposes installing an outdoor emergency siren system with potential AI-enabled fire detection capabilities.

This includes:

- Finalizing the location of the siren and AI camera system (Sweany Reservoir area identified as optimal)
- Coordinating approvals with relevant agencies
- Integrating with broader emergency communication systems

4. Codes and Standards (Priority 4)

The plan recommends ongoing monitoring and potential adoption of enhanced fire-safe building codes and defensible space standards, including:

- Encouraging retrofits consistent with Chapter 7A standards

- Requiring remodels to meet current fuel modification requirements
- Increasing compliance with defensible space regulations
- Conducting annual surveys and enforcement of vacant lot maintenance

5. Access and Evacuation Improvements (Priority 5)

Due to narrow roads, limited access points, and reliance on Pacific Coast Highway for evacuation, improving evacuation safety is critical.

Key strategies include:

- Promoting registration with AlertOC
- Maintaining roadside vegetation clearance
- Managing parking and traffic during Red Flag conditions
- Providing and maintaining road access throughout the Community (I.e. maintain narrow roads with red curbing free of parked cars) can help facilitate fire suppression efforts during wildfire events and support pre-fire mitigation activities
- Identifying fallback staging areas
- Improving evacuation route signage

Emerald Bay is located within Laguna Beach Evacuation Zone 12.

Ongoing and Long-Term Initiatives

Funding Strategy

Securing funding is essential for implementation. The plan encourages pursuing grants from:

- CAL FIRE
- Federal Emergency Management Agency (HMGP, BRIC, and post-fire grants)
- State Fire Assistance and Coastal Conservancy programs

The community will research and apply for grants supporting vegetation management, structural hardening, and wildfire resilience planning.

Tree Management and Vegetation Strategy

The plan outlines proactive management of publicly maintained trees, particularly along evacuation corridors, including:

- Crown raising and thinning
- Removal of hazardous or structurally deficient trees
- Ongoing inspections
- Development of a fire-adaptive landscape manual

Homeowners will receive educational guidance on tree maintenance to reduce ladder fuels and crown fire potential.

Additional Wildfire Defense Measures (Long-Term)

The CWPP recommends evaluating supplemental infrastructure options such as:

- Perimeter water cannons
- Pool-based water pump systems
- Expanded hydrant and pipeline infrastructure

Feasibility, cost, water supply, and effectiveness under extreme conditions must be analyzed before implementation.

Conclusion

The Emerald Bay CWPP Action Plan provides a structured, risk-based roadmap for wildfire mitigation. Immediate priorities focus on strengthening homes, expanding defensible space, and improving emergency notification systems. Longer-term efforts address vegetation management, infrastructure resilience, evacuation safety, and sustainable funding.

Through coordinated action, resident participation, and strategic investment, the community hopes to significantly reduce wildfire risk and enhance long-term resilience in a high-hazard environment.

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1 Introduction

The Emerald Bay Community Association (Community) is proposing the implementation of this comprehensive, Community Wildfire Protection Plan (CWPP) to protect lives, property, and natural resources throughout the community threatened by wildland fire. This CWPP covers the Emerald Bay community, a gated community with approximately 537 homes in unincorporated Orange County. The Emerald Bay Community is bordered by the City of Laguna Beach to the northwest and southeast, Crystal Cove State Park to the northeast, Orange County naturally-vegetated open space areas directly to the east, and the Pacific Ocean to the west and south. The Emerald Bay Community is almost entirely mapped as being in a State Responsibility Area (SRA) Very High Wildfire Hazard Severity Zone as designated by the California Department of Forestry and Fire Protection (CAL FIRE) – Office of the State Fire Marshal (OSFM). More specifically, the eastern portion of the Emerald Bay Community located above California State Route 1 (CA-1) is designated as an SRA – VHFHSZ, with the western portion of the Emerald Bay Community located below CA-1 designated as a combination of Local Responsibility Areas (LRA) Moderate to Very High FHSZs (see Fire Hazard Severity Zone exhibit). The Community and the surrounding landscape exhibit a complex wildfire environment that presents a significant risk to public and firefighter safety and the built and natural environment. This region of Laguna Canyon and Emerald Canyon has been subject to numerous damaging wildland fires, influenced by local extreme wind and weather conditions (including Santa Ana wind events), which have steep and varied terrain with a mosaic of different vegetation types, and is characterized by wildland urban interface (WUI) development patterns that can exacerbate wildfire risk. The Emerald Bay CWPP was developed by Dudek, with input from the Orange County Fire Authority (OCFA) and the Community.

Wildfires have and will continue to be a natural part of our ecosystem; however, as humans continue to expand into the WUI areas, and the reality of climate change is fueled by drought and strong winds, wildfires will continue to grow and become more destructive and less predictable. 2024 was a record-breaking wildfire season in the western United States with the cost exceeding billions of dollars in damage and suppression. The area of the Community, situated along the open space areas within the Emerald Canyon Mountain Range, has a limited history of wildfires. However, since 1990, 19 wildfires have occurred within a 5-mile radius of the Community, including several large and/or damaging fires such as the 2022 Emerald Fire (approximately 155 acres), the 2018 Aliso Fire (approximately 176 acres), and the 1993 Laguna Fire (approximately 14,338 acres). This CWPP identifies local wildfire hazards and risks and recommends actions to mitigate these risks. It emphasizes community input and awareness, encouraging residents to take mitigative actions on their properties. With the growth and unpredictability of wildfires, many communities have taken advantage of developing a CWPP that focuses on identifying and addressing local hazards and risks from wildfire, as well as identifying potential projects intended to mitigate such risks. The Community is located approximately 1-mile north/northwest of the downtown Laguna Beach, adjacent to the Emerald Canyon Mountain Range, a naturally vegetated mountain range exhibiting a complex wildfire environment that presents a significant wildfire risk due to steep and varied terrain, a mosaic of different vegetation types, and WUI development pattern. The City/County and the OCFA recognize the catastrophic impact of wildfire in the community and are committed to reducing hazards and risk through fire protection, fuel hazard reduction, public education, preparedness, and community involvement. In order to mitigate catastrophic wildfires, communities need to have a plan in

place to prepare for, reduce the risk of, and adapt to wildfires. The implementation of CWPPs helps accomplish these goals and provide recommendations.

This CWPP also includes a detailed hazard and risk assessment using the Interagency Fuel Treatment Decision Support System (IFTDSS). This assessment identified areas of high wildfire hazard and potential crown fire activity in areas adjacent to the Community, emphasizing the need for targeted vegetation management and fuel reduction projects. Values at risk identified in the Community include life-safety, structures, critical infrastructure, community assets, natural resources, and recreation. This CWPP highlights the importance of protecting these values through comprehensive wildfire risk reduction strategies.

This CWPP includes an Action Plan that presents a series of recommendations intended to guide implementation of the CWPP. The recommendations focus on reducing structural ignitability (through defensible space and structural hardening), vegetation management, community outreach and education, funding, infrastructure and communications, evacuation, and post-fire recovery. The recommendations included in this CWPP are intended to achieve the stated goals of reducing wildfire hazards throughout the Emerald Bay Community to enhance community and firefighter safety, enhancing protection of values at risk from wildfire, improving public awareness of wildfire risk, and encouraging communication and coordination of wildfire risk reduction actions across land ownerships and jurisdictions. Additionally, this CWPP shall be treated as an ever-evolving plan and it will be important to monitor and evaluate the outcome of the plan. As the community continues to grow and change, so does the surrounding landscape within the adjacent Emerald Canyon Mountains, and the tasks and strategies to reduce the wildfire risk must also change. Thus, it will be important to establish a schedule to ensure that the tasks continue to meet the needs of the community.

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2 Background

Wildfires throughout California have occurred at a higher frequency, stronger intensity, and larger footprint since the 1980s. Of the 20 largest wildfires in California history, 15 have occurred since 2000, with 10 of the most destructive fires occurring since 2015 (CDFW 2024). These fires present a substantial hazard to life and property in communities within the Wildland-Urban Interface/Intermix (WUI)[1] and serve as a reminder to all residents living in Emerald Bay, that wildfire will occur, and diligent effort before a fire mitigates hazard, reduces risk, and increases resiliency for both the natural and built environments. This purposeful effort is commonly known as hardening, which implies lessening vulnerability. Although wildfires may occur at any time of year and in any climate, the risk of fire increases greatly with increased drought, low humidity and higher winds, and available fuels. California's predicted future climate of more severe droughts, higher summertime peak temperatures, and presumably lower humidity (Bedsworth et al. 2018) may equate to longer fire seasons, which could expose Emerald Bay to higher wildfire risk, particularly in the community's designated Wildland-Urban Interface Fire Area, otherwise known as the Wildfire Hazard Area (WHA). The WHA includes California Department of Forestry and Fire Protection (CAL FIRE) VHFHSZs within the SRA, the City's LRA, and other areas potentially threatened by wildfires based on historical fire activity and prevalent vegetation types.

The potential for damaging wildfire exists throughout Emerald Bay, as highlighted through regional fire history, existing vegetation types and fuels composition, terrain, local climate, and the presence of the WUI. Vegetation conducive to ignition and wildfire spread exists in proximity to communities, presenting risks to human life, safety, and property. The potential for extreme wildfire behavior is exacerbated by the occurrence of Santa Ana wind events, which facilitate extreme fire weather in Emerald Bay.

Emerald Bay's inclusion of urban areas adjacent to shrubland-dominated landscapes (north and east of Emerald Bay) results in potential wildfire pathways or corridors (see Figure 1, Project Location). Emerald Bay, as with the majority of Southern California, is subject to the semi-seasonal Santa Ana wind events, with high temperature; dry winds, which increase likelihood of ignitions; fire spread; and wildfire threat. This extreme fire environment can facilitate what would normally be small, controllable fires to expand into large, uncontrollable fires, which can quickly overburden fire response agencies and trigger large-scale evacuations. This community wildfire protection plan is specifically prepared to address the Emerald Bay areas most susceptible to wildfire impacts, which is the WHAs located to the north and east of Emerald Bay north of CA-1.

As a key component of the Healthy Forest Restoration Act of 2003, a CWPP serves as a mechanism for community input and identification of areas presenting high wildfire risk, as well as identification of potential projects intended to mitigate such risk. Further, the CWPP process is intended to provide the community with a forum for identifying values at risk from wildfire, which may include people, property, natural resources, cultural values, economic interests, and infrastructure. The identification of these values at risk by the community strongly influences the potential wildfire hazard mitigation projects identified in this CWPP.

[1] The WUI is the area where urban and suburban development meets the undeveloped areas containing natural vegetation.

This CWPP was developed by Dudek with input from the Emerald Bay Community with input from interested parties and the community. The purpose of this CWPP is to serve as a fire protection planning document that presents the Community's physical characteristics, wildfire hazard, assets at risk from wildfire, wildfire risk reduction approaches, vegetation/fuel management projects, and goals and action items intended to reduce wildfire risk to the Emerald Bay Community. The ultimate goal of this CWPP is to protect lives, property, and community assets threatened by wildland fire

As noted above, CAL FIRE - OSFM have classified the northern portion of the community, north of CA-1, as an SRA - VHFHSZ[2] also known as the WHA (refer to Figure 2, Very High Fire Hazard Severity Zone and Wildland-Urban Interface Fire Area). The Very High Fire Hazard Severity Zone designation is also in some areas in the southern portion of the community, south of CA-1, in addition to High Fire Hazard Severity Zone and Moderate Fire Hazard Severity Zone designations. The VHFHSZ designation in the northern portion of the community is based on the hazardous fire environment, including terrain, vegetation characteristics, and the potential for extreme weather conditions. The majority of Emerald Bay's WHA is a densely populated area with a clear boundary between urban areas and natural vegetation. WUI fires are high risk events in terms of resident life safety and property protection, including homes and other structures. Emerald Bay is aware of the wildfire threat in the WUI portions of the community and has hired Dudek to perform numerous assessments and evaluations of the area, including commissioning this community wildfire protection plan. Emerald Bay also routinely maintains hazardous fuels in the northern and eastern areas of the community adjacent to the open space. OCFA requires the management of vegetative fuels, including trees near homes and along roadways within the WHAs. Although these efforts reduce the area's fire vulnerability, concerns remain in the WHA, primarily due to the historical planting of tree species near residences and other structures that are presently considered highly flammable.

This community wildfire protection plan includes urban forest implications, including both publicly managed and privately managed trees contributing to the spread of fire in the community's WHA.

2.1 Purpose and Need

The Community recognizes the potential for significant loss of life, property, and community assets from wildland fire and has taken proactive steps to reduce wildfire risk and increase community resilience to wildfire. The purpose of this CWPP is to create a community-based plan focused on identifying and addressing local hazards and risks from wildfire, as well as identifying opportunities where actions can be taken to mitigate such risks.

The CWPP process aids the Community in identifying wildfire risks to people, property, natural resources, community values, economic interests, and critical infrastructure, and recommends actions to reduce these risks. Community input, values, and perceptions help inform the CWPP recommendations. Additionally, the information presented in this CWPP is intended to increase community awareness about living within the wildland urban interface (WUI) and encourage residents to take mitigative actions on their properties.

[2] In 1992, Assembly Bill 337, known as the "Bates Bill," required all cities and counties in California to identify within their communities the Very High Fire Hazard Severity Zones.

2.2 Plan Goals and Objectives

The following goals were identified during development of this CWPP:

1. Reduce wildfire hazards throughout the Community through the expansion of perimeter defensible space limits from the OCFA required 170 feet to up to 400 feet in some locations where the threat of wildfire is greater, to enhance community and firefighter safety.

2. Enhance protection of values and resources at risk from wildfire.

3. Improve public awareness on the increasing risk of wildland fires

4. Encourage communication and coordination of wildfire risk reduction actions across land ownerships and jurisdictions.

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3 Community Plan Area Description

3.1 Location

This CWPP covers the Emerald Bay community (Community Plan Area), a gated community with approximately 537 homes in unincorporated Orange County, bordered by the City of Laguna Beach to the northwest and southeast, Crystal Cove State Park to the northeast, Orange County naturally-vegetated open space areas directly to the east, and the Pacific Ocean to the west and south. CA-1 runs through the center of the Emerald Bay Community, dividing the northern portion of the community and the southern portion (Figure 1). The Community Pan Area is also referred to as a specific geographical area this CWPP document provides specific detailed recommendations and action plan items that provide a framework for future community wildfire resilience and home hardening measures.

3.2 Fire Hazard Severity Zones

Fire Hazard Severity Zones (FHSZs) are geographical areas designated pursuant to California Public Resources Code Sections 4201 through 4204; they are classified as Very High, High, or Moderate in State Responsibility Areas, or as Local Responsibility Area Very High FHSZ designated pursuant to California Government Code Sections 51175 through 51189. California Public Resources Code Sections 4201–4204 and Government Code Sections 51175–51189 direct the California Department of Forestry and Fire Protection (CAL FIRE) to map areas of significant fire hazard based on fuels, terrain, weather, and other relevant factors. The resulting FHSZs define the application of various mitigation strategies to reduce the risk associated with wildland fires (OSFM 2024).

The model used to determine the extent of FHSZs is based on an analysis of potential fire behavior and fire probability predicated on the frequency of fire weather, ignition patterns, expected rate of spread, ember (brand) production, and past fire history (OSFM 2024). Structures built in FHSZs are subject to more stringent fire-hardening requirements than those that are not. The FHSZ classifications for State Responsibility Area (SRA) and Local Responsibility Area (LRA) lands in the Community Plan Area are provided in Figure 2.



SOURCE: USGS National Map 2025

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0 500 1,000 Feet

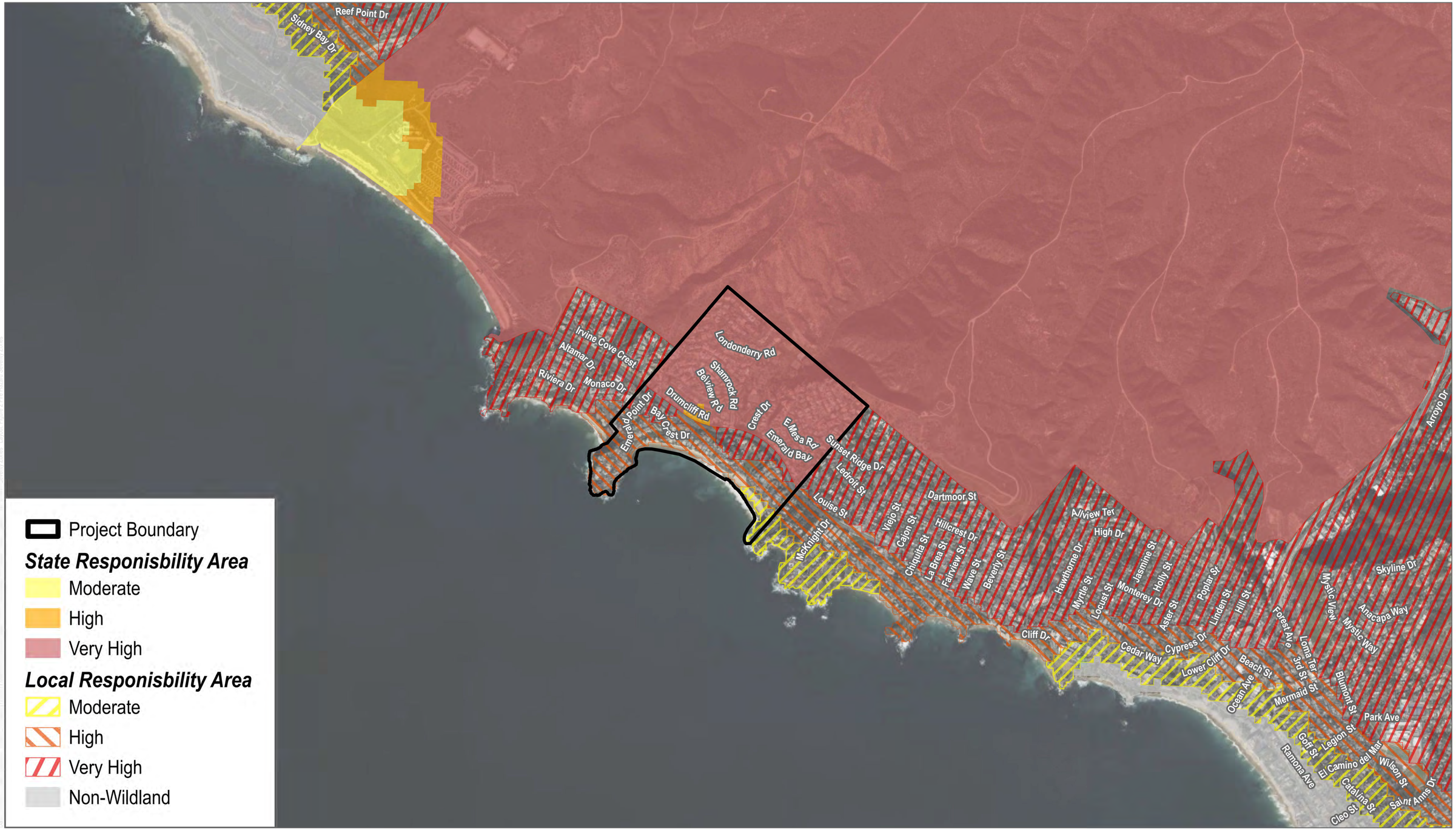
FIGURE 1

Project Location

Emerald Bay CWPP

Date: 7/2/2025 User: cgardner Path: Z:\Projects\18123001\MAPDOC\EmeraldBayCWPP\EmeraldBayCWPP.aprx Map: Figure 1 Project Location Layout: Figure 1 Project Location

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SOURCE: Bing Maps Imagery 2024; CalFire 2025

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FIGURE 2

Fire Hazard Severity Zones Map

Emerald Bay CWPP

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3.3 Fire Environment

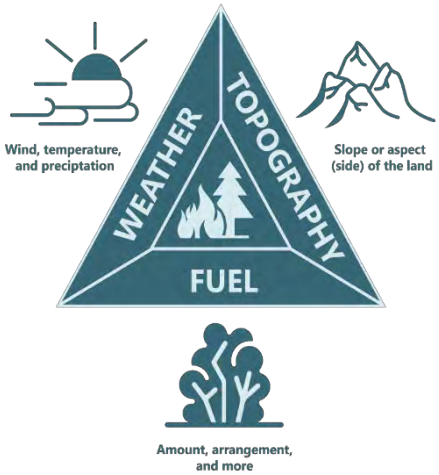


Exhibit 1. Fire Behavior Triangle

Fire environments are dynamic systems and include many types of environmental factors. Fires can occur in any environment where conditions are conducive to ignition and fire movement. Areas of naturally vegetated open space, like those located east/northeast/southeast of the Community, are typically comprised of conditions that may be favorable to wildfire spread. The three major components of fire environment are vegetation (fuels), climate, and topography. The state of each of these components and their interactions with each other determines the potential characteristics and behavior of a fire at any given moment. It is important to note that wildland fire may transition to urban fire if structures are receptive to ignition. Structure ignition depends on a variety of factors and can be prevented through a layered system of protective features including fuel modification directly adjacent to the structure(s), application of known ignition resistive materials and methods, and suitable infrastructure for firefighting purposes. Understanding the existing wildland vegetation and urban fuel conditions on and adjacent to the site along with the site's weather, topography and fire history are necessary to understand the potential for fire within and around the Community. Wildfire conditions in the Community are summarized below.

3.3.1 CLIMATE

The Emerald Bay Community is generally characterized by a subtropical Mediterranean climate, characterized by warm, dry summers followed by mild, somewhat rainy, wet winters (Orange County, 2024). Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuels will ignite more readily and burn more intensely. Thus, during periods of drought, the threat of wildfire increases.

Wet winters and dry summers with mild seasonal changes characterize the Southern California climate. This climate pattern is occasionally interrupted by extreme periods of hot weather, winter storms, or dry, offshore Santa Ana winds. The average high temperature in this area is approximately 73°F, with average highs in the summer and early fall months (July–October) reaching 78°F. Precipitation typically occurs October through April, with annual rainfall averaging approximately 11 inches (Weatherspark 2025). Winds can be significant at times in the area and drive wildfire spread. The prevailing wind pattern is from the southwest (onshore), but the presence of the Pacific Ocean causes a diurnal wind pattern known as the land/sea breeze system. During the day, winds are from the southwest (sea) and at night, winds are from the north-northeast (land). During the summer season, the diurnal winds may average slightly higher than the winds during the winter season due to greater pressure gradient forces. Surface winds can also be influenced locally by topography and slope variations. The highest wind velocities are associated with downslope, canyon, and Santa Ana winds. Surface winds can also be influenced locally by terrain variations. The varied terrain of the area also affects wind velocity and patterns. Annually, fire weather conditions often become critical in late July through October.

The climate has a large influence on fire risk because drying vegetation during the summer months becomes fuel available to advancing flames should an ignition occur. Typically, the highest fire danger is produced by the high-pressure systems that occur in the Great Basin, which result in the Santa Ana winds of Southern California. Sustained wind speeds recorded during recent major fires in Orange County reached up to 50 miles per hour and gusts up to 85 miles per hour. The Santa Ana wind conditions are a reversal of the prevailing southwesterly winds that usually occur on a region-wide basis during late summer and early fall. Santa Ana winds are warm and dry winds that flow from the higher desert elevations in the north through the mountain passes and canyons. As they converge through the canyons, their velocities increase. Consequently, peak velocities are highest at the mouths of canyons and dissipate as they spread across valley floors. Canyons that align with the direction of Santa Ana winds in the open space adjacent to the Project Area are likely to experience severe fire weather during Santa Ana wind events. Santa Ana winds generally coincide with the regional dry period and the period of highest fire danger.

Multiple historical fires that threatened Orange County recently were exacerbated by extreme fire weather conditions that included Santa Ana winds. For example, the 2007 Santiago Fire experienced wind speeds of 50 miles per hour and gusts up to 85 miles per hour. The Santiago Fire burned over 28,000 acres and destroyed 42 structures (OCFA 2007).

3.3.1.1 CLIMATE CHANGE

According to the National Oceanic and Atmospheric Administration (NOAA) for California's Fifth National Climate Assessment (Dettinger et al. 2018), experts concluded that fires in California and the rest of the Southwest have become larger and more severe. Effects of climate change include increased temperatures, higher likelihood of severe weather events including heat waves and dry lightning storms, and reduced precipitation and snowpack (Williams et al. 2019). These effects are expected to increase wildfire severity. Overall, the region is expected to become drier, reducing fuel and air moisture content over longer periods of time resulting in conditions more favorable to extreme wildfire behavior. Reduced precipitation is also expected to increase tree mortality in the region leading to an increased accumulation of hazardous fuels.

3.3.2 TERRAIN

Terrain within the adjacent areas slopes upwards towards the north. Elevation in the Community ranges from approximately 5 feet above mean sea level (AMSL) in the southern portion of the community, up to 515 feet AMSL in the northern corner of the community. The Laguna Coast Wilderness Park is located within the San Joaquin Hills in Southern California. Notable canyons within the Laguna Coast Wilderness Park, to the north and east of Emerald Bay, include Emerald Canyon, Laguna Canyon, Willow Canyon, and Laurel Canyon. Steeper slopes and drainages are more prominent within the northern and eastern portions of the WHA and closer to the toe of the Laguna Coast Wilderness Park. In general, the WHA and its proximity to the Laguna Coast Wilderness Park results in greater topographical variations compared to the remainder of Emerald Bay.

Terrain affects wildfire movement and spreads. Steep terrain typically results in faster upslope fire spread due to the preheating of uphill vegetation. Flat areas typically result in slower fire spread when absent of windy conditions. Topographic features, such as saddles, canyons, and chimneys (land formations that collect and funnel heated air upward along a slope), may form unique circulation conditions that concentrate winds and funnel or accelerate fire spread. For example, fire generally moves

slower downslope than upslope. Terrain may also buffer, shelter, or redirect winds away from some areas based on canyons or formations on the landscape. Saddles occurring at the top of drainages or ridgelines may facilitate the migration of wildfire from one canyon to the next. Various terrain features can also influence fire behavior, as summarized in Table 1, Effects of Topographic Features on Fire Behavior.

TABLE 1. EFFECTS OF TOPOGRAPHIC FEATURES ON FIRE BEHAVIOR

TOPOGRAPHIC FEATURE	EFFECT
Narrow Canyon	Surface winds follow canyon direction, which may differ from the prevailing wind; wind eddies/strong upslope air movement expected, which may cause erratic fire behavior; radiant heat transfer between slopes facilitates spotting/ignition on opposite canyon side.
Wide Canyon	Prevailing wind direction not significantly altered; aspect significant contributor to fire behavior. Wide canyons are not as susceptible to cross-canyon spotting except in high winds.
Box Canyon/ Chute	Air is drawn in from canyon bottom; strong upslope drafts. No gaps or prominent saddles to let heated air escape. Fires starting at the canyon bottom can move upslope very rapidly due to a chimney-like preheating of the higher-level fuels and upslope winds.
Ridge	Fires may change direction when reaching ridge/canyon edge; strong air flows likely at ridge point; possibility for different wind directions on different sides of the ridge. Ridges experience more wind. Fires gain speed and intensity moving toward a ridge. Fires burning at a ridge can exhibit erratic fire behavior. Strong air flows can cause a whirling motion by the fire. As the wind crosses a ridge, it usually has a leeward eddy where the wind rolls around and comes up the leeward side.
Saddle	Potential for rapid rates of fire spread; fires push through saddles faster during upslope runs. Winds can increase when blowing through saddles due to the funneling effect of the constricted pass. On the other side, winds will slow, but erratic winds potentially occur at the saddle due to eddies.

Sources: *Teie 1994.*

3.4 Vegetation and Fuels

Although most of the Community is categorized as suburban residential, a naturally-vegetated open space area exists in the northern and eastern perimeters of the Community. The Community and the adjacent open space areas include a variety of vegetation types that are common throughout Orange County.

Vegetation type greatly influences wildfire hazard. Although all vegetation burns, some plants exhibit characteristics that make them more flammable than others. Age of fuels can also affect their vegetative fire hazard. In general, the proportion of woody biomass, both live and dead, increases within chapparal and scrub fuels with age resulting in increased wildfire hazard over time (Rothermel and Philpot 1973). Fires in these older fuels tend to burn hotter and spread faster compared to fires burning in younger fuels. Shrub-dominated vegetation communities, including both mixed chapparal and scrub vegetation, are the most prominent vegetation type within undeveloped portions of the Community Plan Area. Chaparral has a high surface-area-to-volume ratio, requiring less heat to remove fuel moisture and raise the fuel to

ignition temperature. Chaparral is subject to early seasonal drying in the late spring and early summer but does not fully cure in the way that grasses do. The fire regime of chaparral communities is mostly stand-replacing crown fires. Fire frequency interval is moderate and ranges depending on the dominate species. Fire return intervals can range from 33 to 125 years (USDA 2022). Mature chaparral stands are more flammable compared to younger chaparral stands. Older chapparal stands are more flammable due to their ability to accumulate more dead material. Although less likely to ignite compared to other vegetation types, such as grasses, wildfire in chaparral communities can move rapidly and consume fuel at rapid rates. Chaparral communities also exacerbate fire severity through the combustion of volatile organic compounds present within the plants that contributes to flammability and increases combustion rates. Although coastal shrub has similar characteristics to chaparral, coastal scrub tends to have a lower content of volatile organic compounds.

Vegetation conditions within the first five feet of a structure have been proven to be a significant factor when predicting structural losses during wildfire (IBHS 2023). Numerous studies highlight the positive impacts from creating adequate spacing between structures and vegetation. Strategic management of urban vegetation can serve as a protective buffer, limiting the extent of wildfire spread. By ensuring well-maintained green spaces, properly spaced and pruned trees, and the intentional use of fire-resistant plants, defensible space can be created. This defensible space acts as a barrier, safeguarding structures from nearby flammable vegetation. The choice of plants also significantly influences the wildfire hazard associated with urban vegetation. Different plant species and their maintenance levels determine their fire resistance. While no plant is entirely fireproof, certain characteristics greatly diminish the risk of wildfire hazard:

- Leaves have a high moisture content, and the plant is resistant to drought conditions;
- Little dead material is present, and the plant does not accumulate dry and dead material within the plant;
- Sap and resin content is low;
- The plant does not produce a significant amount of leaf or needle litter;
- The plant does not contain volatile organic compounds; and
- Open and airy growth structure that does not trap heat.

The OCFA, as well as the City of Laguna Beach, provides a list of recommended and non-recommended residential tree species, in addition to management practices, to reduce wildfire risk in developed areas as part of this CWPP (Appendix A1, OCFA Guideline C-05 - Undesirable and Invasive Plant Species, and Appendix A2, OCFA Guideline C-05 – Fuel Modification Zone Plant List).

3.5 Wildfire Types and Potential Fire Behavior

Several wildfire types exist, as summarized below.

- **Ground Fire:** A fire burning on the ground or through understory vegetation and not reaching into the canopy (NWCG 2022).

- **Surface Fire:** A surface burning fire with low flame lengths (usually less than 1 meter) that does not result in significant movement into understory or overstory vegetation (NWCG 2022).

- **Crown Fire:** A fire that has burned upward from the ground and into the tree canopy. There are three types of crown fires:
  - ***Passive Crown Fire*:** A crown fire in which individual or small groups of trees torch out, but solid flaming in the canopy cannot be maintained except for short periods. Passive crown fires encompass a wide range of crown fire behavior, from the occasional torching of an isolated tree to a nearly active crown fire. Also called torching (Scott and Reinhardt 2001).
  - ***Active Crown Fire*:** A crown fire in which the entire fuel complex becomes involved, but the crowning phase remains dependent on heat released from the surface fuels for continued spread. Also called running and continuous crown fire (Scott and Reinhardt 2001).
  - ***Independent Crown Fire:*** A crown fire that spreads without the aid of a supporting surface fire (Scott and Reinhardt 2001).

3.6 Fire Hazard Severity Zones

Fire Hazard Severity Zones are geographical areas designated pursuant to California Public Resources Code Sections 4201 through 4204; they are classified as Very High, High, or Moderate in State Responsibility Areas and with recent updates to the State Fire Hazard Severity Zone Maps, Very High, High, or Moderate in Local Responsibility Areas. California Public Resources Code Sections 4201 through 4204 and Government Code Sections 51175 through 51189 direct CAL FIRE to map areas of significant fire hazard based on fuels, terrain, weather, and other relevant factors. The resulting Fire Hazard Severity Zones define the application of various mitigation strategies to reduce the risk associated with wildfires (OSFM 2024a). The model used to determine the extent of Fire Hazard Severity Zones is based on an analysis of potential fire behavior and fire probability predicated on the frequency of fire weather, ignition patterns, expected rate of spread, ember (brand) production, and past fire history (OSFM 2024a). Structures built in Fire Hazard Severity Zones are subject to more stringent fire-hardening requirements than those that are not. Fire-hardening is the process, materials, and methods used to make structures and landscaping more resilient and less vulnerable to the effects of wildfires, especially ember intrusion or ignition.

OCFA staff consulted with CAL FIRE and the United States Forest Service to determine where clear lines of demarcation could be drawn for designated WHAs. The Fire Hazard Severity Zone classifications in the State Responsibility Areas of the Community Plan Area are provided in Table 2, and the Fire Hazard Severity Zone classifications in the Local Responsibility Areas of the Community Plan Area are provided in Table 3.

TABLE 2. FIRE HAZARD SEVERITY ZONE CLASSIFICATIONS IN STATE RESPONSIBILITY AREA OF THE COMMUNITY PLAN AREA

CLASSIFICATION	ACRES IN PLAN AREA	PERCENTAGES OF PLAN AREA
Very High	97.17	67%
High	01.53	1%
Moderate	00.00	0%

Source: *OSFM 2024b.*

TABLE 3. FIRE HAZARD SEVERITY ZONE CLASSIFICATIONS IN LOCAL RESPONSIBILITY AREA OF THE COMMUNITY PLAN AREA

CLASSIFICATION	ACRES IN PLAN AREA	PERCENTAGES OF PLAN AREA
Very High	08.49	6%
High	34.38	23.5%
Moderate	03.10	2%
Non-fire zone	00.51	<1%

Source: *OSFM 2024a.*

3.7 Fire History of Emerald Bay

Fire history assists in understanding potential wildfire behavior based on previous wildfire occurrences. Identifying known areas of historical wildfire helps with determining areas and communities that may be impacted again by wildfire. Since the beginning of the historical fire record, only two wildfires have occurred within the Community Plan Area. The only fire to have burned within the Community Plan Area was the 1993 Laguna Fire, which burned approximately 14,338 acres.

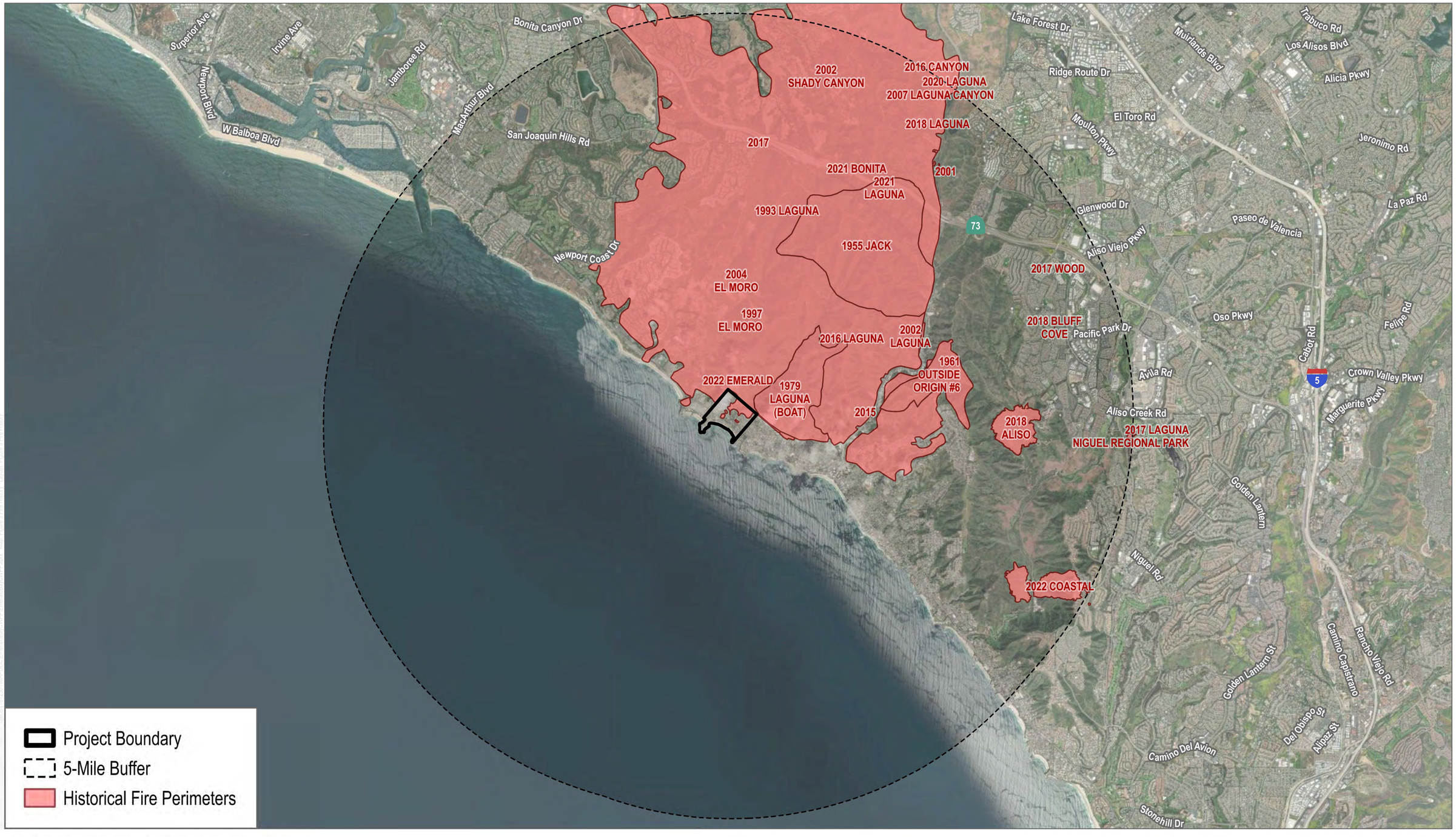
Steep and variable terrain, combined with fire-adapted vegetation and ample natural and anthropogenic ignition sources, influence the frequency of wildfires in the neighboring Laguna Coast Wilderness Park. Since 1955, 24 wildfires have occurred within five miles of the Community Plan Area, with an average fire return interval of three years. Recent wildfires over 100 acres in size within five miles of the Community Plan Area include the 2022 Coastal Fire (which burned 202 acres to the southeast), the 2022 Emerald Fire (which burned 155 acres to the north), and the 2018 Aliso Fire (which burned 176 acres to the east). A graphical representation of fire history is presented in Figure 3. Table 4 summarizes the historical wildfires within five miles of the Community Plan Area.

TABLE 4. HISTORICAL WILDFIRES WITHIN FIVE MILES OF THE COMMUNITY PLAN AREA

DECADE	NUMBER OF FIRES	ACRES BURNED WITHIN COMMUNITY PLAN AREA
1950s	1	0
1960s	1	0
1970s	1	0
1980s	0	0
1990s	2	28
2000s	5	0
2010s	9	0
2020s	5	0
Total	**24**	**28**

Source: *CAL FIRE 2024.*

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SOURCE: Bing Imagery 2024; Open Street Maps 2019; CalFire 2025

DUDEK

0 3,000 6,000 Feet

FIGURE 3

Fire History Map

Emerald Bay CWPP

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3.8 Wildland-Urban Interface and Intermix

The locations where Emerald Bay abuts vegetative fuels is known as the Wildland-Urban Interface. This condition exists commonly in the northern and eastern portions of the Community Area where the community abuts natural fuels at the base of the Laguna Coast Wilderness Park. Wildland-Urban Interfaces present advantages and disadvantages with respect to reducing wildfire risk, as described below. The WUI across the County was mapped under the following categories:

- **Wildland Urban Interface:** Higher density development in close proximity to vegetation that can burn in a wildfire.
- **Wildland Urban Intermix:** Lower-density development interspersed in an area dominated by wildland vegetation subject to wildfire.
- **Wildfire Influence Zone:** Wildfire susceptible vegetation up to 1.5 miles from WUI or Wildland Urban Intermix.
- **Major Roadways Zone:** Wildfire susceptible vegetation within 150 feet of major roadways that may be used during emergency ingress or egress. The Major Roadways Zone is removed where Wildland Urban Intermix and Interface areas overlap this zone.

3.8.1 WILDLAND-URBAN INTERFACE

The wildland-urban interface includes development areas that are near or adjacent to wildland areas. Unlike the wildland-urban intermix, interface areas often have a defined boundary between wildlands and development areas. Interface areas may contain wildfire susceptible vegetation; however, wildland fuels are not interspersed within areas of development. The main wildland fire risks associated with interface areas include propagation of fire via house-to-house fire spread, landscaping-to-house fire spread, or ember intrusion. Other common characteristics of the wildland-urban interface include:

Interface Advantages

- Community water supply systems in place;
- Multiple homes accessed by a single road;
- Emergency equipment protects multiple assets at once; and
- Houses are usually only exposed to flammable fuels on one side.

Interface Disadvantages

- High housing density;
- Congested roads during emergencies; and
- Limited options if the community water systems fail.

3.8.2 WILDLAND URBAN INTERMIX

Intermix areas are those where housing and vegetation intermingle. In an intermix area, wildland vegetation is continuous, and more than half of the land area is vegetated with combustible fuels. This

creates pathways for wildfire to spread into and throughout development areas. The wildland fire risk associated with intermix areas includes direct wildfire exposure via vegetation-to-house fire spread or ember intrusion. For Emerald Bay, the wildland-urban intermix encompasses the majority of the residential areas throughout the community where the rear and side yards of many of the residential lots abut naturally-vegetated open space areas. Other common characteristics of the wildland urban intermix include:

- Low housing density and reduced potential for structure-structure spread
- Diversity in water supply systems
- Increased risk of firefighters
- Emergency equipment can only protect single assets.
- Delayed emergency equipment response times due to the following:
    - Rural roads (single lane, windy, heavy fuel loading)
    - Long driveways
- Congested roads during emergencies
- Structures surrounded by vegetation

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4 Planning and Regulatory Environment

4.1 Codes and Standards

Resilient communities can be planned and designed to perform well in the event of catastrophic wildfires. The planting, pruning, and maintenance of trees must be coupled with effective policies and ordinances that adhere to best fire-safe landscaping practices. Fire-resistant landscapes require that fire-safe practices in the CWPP extend beyond public space and onto private property, where a large portion of the urban forest tree canopy exists.

Applicable codes and regulations include the California Fire Code (CFC), including Chapter 49; California Building Code (CBC), including Chapter 7A for new construction in wildfire-prone areas; the California Residential Code (CRC); the California Public Resources Code (PRC); the California Government Code; and local ordinances, including OCFA Guideline C-05, which sets requirements for development in the WHA.

Note: Chapter 7A of the CBC is intended to increase the likelihood of a structure to survive a wildfire within Fire Hazard Severity Zones by requiring the use of specific construction material and methods. It correlates with the maintenance of the defensible space, which includes hazardous trees and building materials used on the outside of the structure. Some highlights of the Chapter 7A building standards regarding exterior materials and construction methods include the following:

- The required fire rating of roof covering (Class A) and assembly is defined;
- Gaps between the roof covering and roof deck, such as clay barrel tile roofs, must be plugged at the ends (i.e., bird stops);
- Energy-efficient dual-pane windows must include at least one pane of tempered glass;
- Vents used in eaves and soffits or roof must resist the intrusion of embers and flames; and
- Exterior Siding must be classified as noncombustible or ignition-resistant.

This chapter describes existing fire codes and standards relevant to hazardous vegetation located in the community's WHA. It examines these documents for their ability to require and enforce proper and adequate wildfire hardening of the landscape.

4.2 County of Orange General Plan

The Couty of Orange's General Plan is a policy document designed to guide future conservation, enhancement, and development in the County. The General Plan establishes goals, objectives, policies, and implementation measures to guide development and address current and future issues. The following elements of the County's General Plan include goals, objectives, policies, and implementation measures that address the impacts of wildland fires.

- Land Use Element: Contains goals, objectives, policies, and implementation programs related to land use, growth management, community design, and neighborhoods within high fire hazard areas.

- Public Services and Facilities Element: Contains goals, objectives, policies, and implementation programs related to the planning, management, and implementation of public facilities, including the Orange County Fire Authority.
- Safety Element: Contains goals, policies, and implementation programs to reduce the potential risk of death, injuries, property damage, and economic and social dislocation resulting from large-scale hazards, including fires.

4.3 Fire Code

The Orange County Code of Ordinances was updated in January 2023. Title 3, Division 3 – Fire Protection and Explosives, Article 1, Section 3-3-1, adopts the 2022 California Fire Code, based on the International Fire Code, 2021 Edition, with errata, published by International Code Council (ICC), and the whole thereof, including Appendix B, Appendix BB, Appendix C, Appendix CC, and Appendix H are hereby adopted by the County of Orange for the purpose of prescribing regulations governing conditions hazardous to the life and property from fire and explosion, save and except such portions as are hereinafter added, deleted, modified or amended. One copy of all the above is now on file in the office of the Clerk for public inspection and is adopted with the same force and effect as set out herein in full. The California Fire Code sets minimum standards for defensible space and vegetation management, fire department access, roadway standards, and water supply. California Fire Code Chapter 49 outlines requirements for WHAs, specifically, minimum standards to increase the ability of a building to resist the intrusion of flame or burning embers being projected during a wildfire event.

4.3.1 VEGETATION ALONG ROADWAYS

Vegetation and other combustible growth is prohibited within 10 feet of each side of portions of highways and private streets which are improved, designed, or ordinarily used for vehicular traffic. However, Section 3-3-5 of the Orange County Fire Code allows for the following exception:

> **Exception:** Single specimens of trees, ornamental shrubbery or cultivated ground cover such as green grass, ivy, succulents or similar plants used as ground covers, provided that they do not form a means of readily transmitting fire.

4.4 Emergency Response and Access

OCFA Guideline B-01 “Fire Master Plans for Commercial and Residential Development” applies to fire apparatus access roads which provide access to residential communities. The effectiveness of emergency response and firefighting operations is directly related to the proper installation and maintenance of fire access roadways, proper location of fire hydrants, adequate water supply, and access to buildings and facilities.

Emerald Bay is an existing residential community, however, many of the roads throughout the community are narrow and/or dead-end roads, and do not provide well maintained emergency vehicle access. The minimum width of a fire lane is 20 feet. No parking is permitted along fire lanes that are narrower than 28 feet in width. Parking on one side is permitted on a fire lane that is at least 28 feet in width; parking on two sides is permitted on a roadway 36 feet or more in width. Furthermore, all cul-de-sacs should be

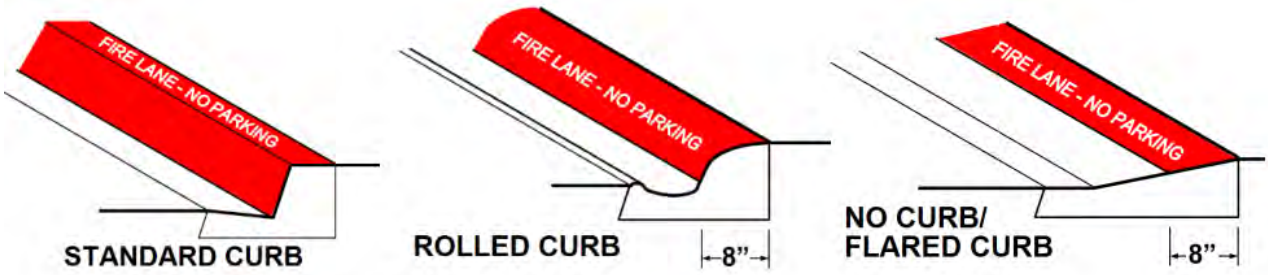
red-curbed and no parking allowed within any cul-de-sac. Please refer to Figure 4, Proposed Red-curb location Map for the recommended red curb locations throughout the Community.

4.4.1 FIRE LANE IDENTIFICATION

Fire lane identification is required to maintain the required width of fire lanes for emergency vehicle use. Unlawful use of fire lanes will be enforced by the local law enforcement agency in accordance with the California Vehicle Code (CVC) on public roadways. Enforcement of fire lane no-parking restrictions on private roadways is the responsibility of the property owner, HOA, or their designated agent (Attachment 2).

4.4.1.1 **SIGN AND CURB MARKING OPTIONS –** AREAS DESIGNATED AS A FIRE LANE REQUIRE AN ACCEPTABLE METHOD OF MARKING THAT SHALL BE APPROVED PRIOR TO INSTALLATION. SELECT EITHER OPTION A) OR OPTION B) BELOW.

A) Specific areas designated by the OCFA as fire lanes must be marked with red curbs meeting the specifications below (Exhibit 2). In addition, where the number of entrances into the area marked with fire lanes is limited, all such vehicle entrances to the designated area shall be posted with approved fire lane entrance signs.



- *Curbs shall be painted OSHA safety red.*
- *"FIRE LANE – NO PARKING" shall be painted on top of curb in 3" white lettering at a spacing of 30' on center or portion thereof.*

Exhibit 2. Fire Lane Identification, Red Curbs

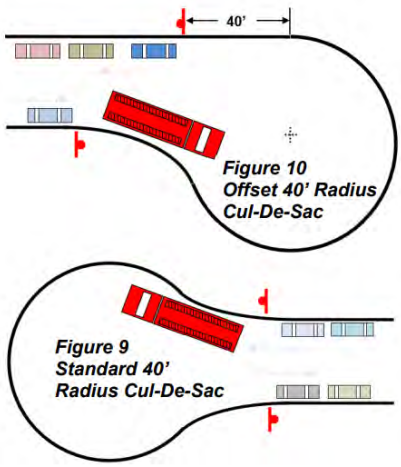
B) "Fire Lane – No Parking" signs (Exhibit 3) meeting the appropriate specifications shall be posted immediately adjacent to each designated fire lane and at intervals not to exceed 50 feet, unless otherwise approved by the fire code official.



Exhibit 3. Fire Lane Identification, No Parking Sign

4.4.2 FIRE LANE – NO PARKING IN CUL-DE-SAC

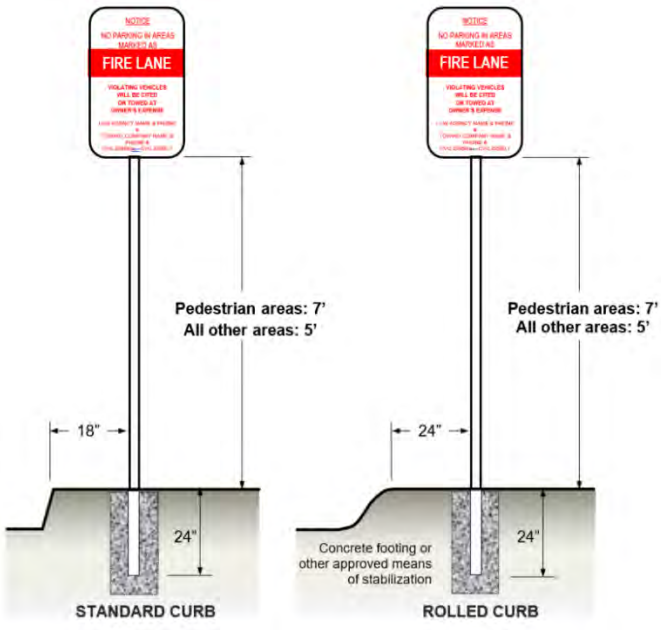
"Fire Lane – No Parking in Cul-De-Sac" signs may be approved for use on the right side of a roadway. Signs shall be securely mounted facing the direction of travel and clearly visible to oncoming traffic entering the designated area. For a standard cul-de-sac, the "begin" and "end" signs shall be located at the point where the street begins to widen into the bulb (Exhibit 4). A cul-de-sac with an offset radius shall have signs located at the point where the street begins to widen into the bulbs and at a point 40' from where the cul-de-sac and street are tangent (Exhibit 5). Additionally, a minimum 2" red lettering on white reflective background must be provided for the "BEGIN" sign at entry into cul-de-sac and "END" sign when leaving cul-de-sac.



Exhibits 4 and 5. Cul-de-sac designs

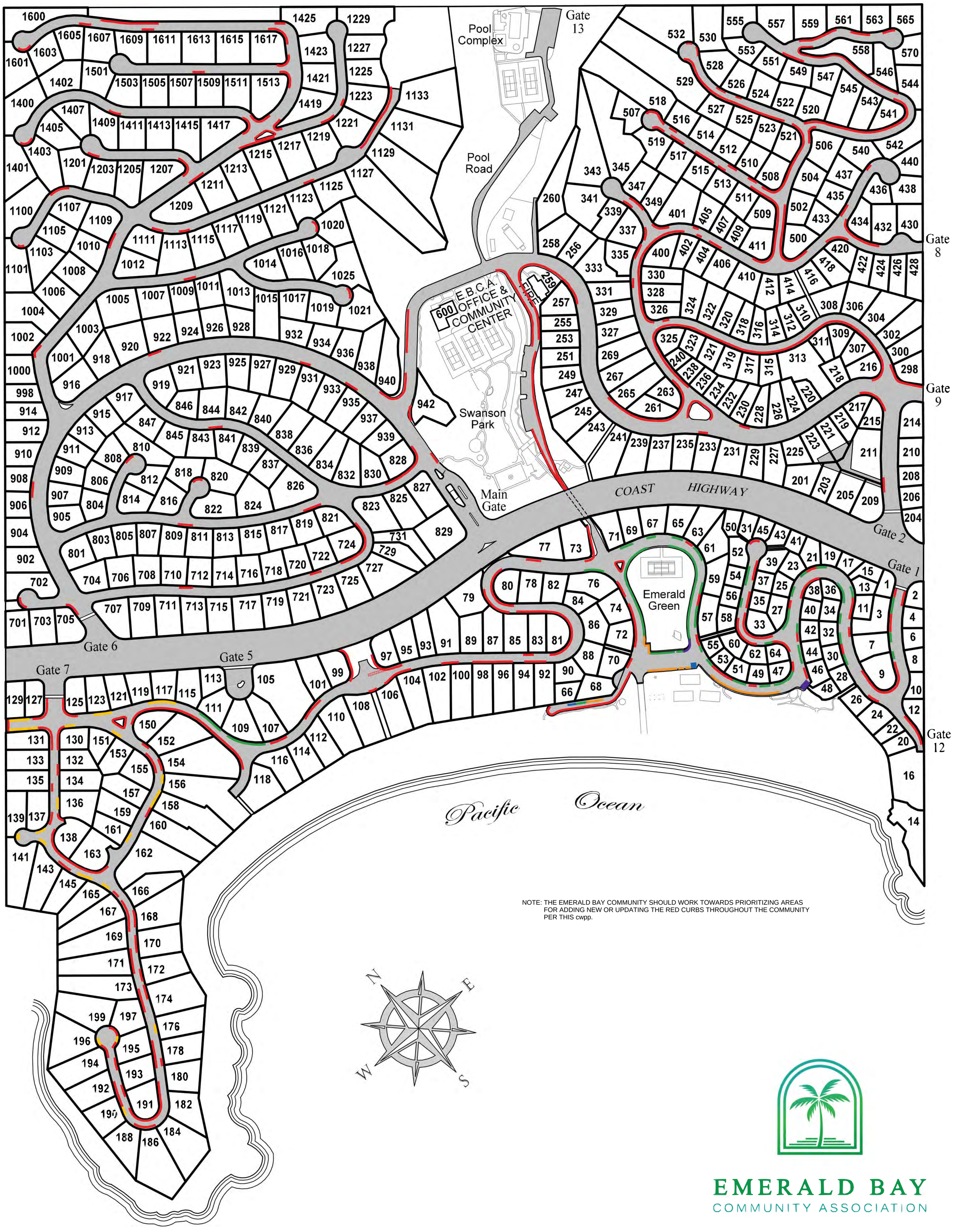
4.4.3 MOUNTING SPECIFICATIONS FOR FIRE LANE ENTRANCE AND NO PARKING SIGNS

Signs shall be mounted facing the direction of vehicular travel. They may be mounted on existing posts or buildings where the centerline of the sign is no more than 24" from the edge of the roadway. The signpost depth of bury shall be a minimum of 24" and rebar, a concrete footing, or another method to prevent removal is recommended (Exhibit 6). Footings for signs located in the public right-of-way shall be per the local jurisdiction's requirements.



Exhibits 6. Mounting Specifications

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NOTE: THE EMERALD BAY COMMUNITY SHOULD WORK TOWARDS PRIORITIZING AREAS FOR ADDING NEW OR UPDATING THE RED CURBS THROUGHOUT THE COMMUNITY PER THIS cwpp.

EMERALD BAY
COMMUNITY ASSOCIATION

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4.5 Fuel Modification and Defensible Space

OCFA Guideline C-05 "Vegetation Management Guideline - Technical Design for New Construction Fuel Modification Plans and Maintenance Program" amends the California Fire Code Chapter 49 to include specific criteria for Fuel Modification Plans in Orange County. OCFA Guideline C-05 provides information on the design and placement of vegetation around structures to minimize the effects of wildfire. Vegetation management and landscaping provisions of this guideline are applicable for all new single-family homes, multi-family residential, accessory dwelling unit (ADU), utility, and commercial structures built in, or adjacent to, a wildfire-risk area or such areas designated by the fire code official in coordination with the 2022 California Fire Code (CFC), Chapter 49. The Emerald Bay Community is an established community that currently maintains up to 170 feet of defensible space around the perimeter of the community. Specifically, the Emerald Bay Community Service District provides fuel modification on an annual basis up to 170 feet outside the Emerald Bay property lines within naturally-vegetated open space areas on both California State Parks' property (along the western portion of the community) and County of Orange Parks and Recreations' property (along the northern portion of the community). In general, maintenance includes reducing the vegetation fuel load volumes by removing all annual weeds, removal of perennials growing species, and removal and/or pruning of shrubs outside of the Emerald Bay boundary areas up to 170 feet.

As described below in Section 5 – Wildfire Hazard and Risk Assessment, the potential for damaging wildfire exists within the Emerald Bay Community due to the terrain, existing vegetation types and fuel load amounts, and local climate north and west of the Emerald Bay Community. The Model Results presented in Section 5.2 show that a wildfire originating 1- to- 2 miles north of the Emerald Bay Community driven by 35 mph winds, was modeled to spread in a southwest direction rapidly towards the Community, potentially reaching the Community within approximately 45-minutes. The wildfire spread towards the Community is amplified through high load shrubs and topography that funnels and accelerates northeastern winds. Within the Community's perimeter fuel modification zones, flame lengths range from approximately 12 to 25 feet depending on fuel types, slope, and local wind speeds. As a result, there is a considerable risk of direct flame exposure to the structures along the perimeter edges of the Emerald Bay Community with areas of concentrated extreme fire behavior within approximately 400 feet of the Community Boundary. Because of this, one of the Action Plan Goals of this CWPP is to increase the perimeter Fuel Modification Zone widths from 170 feet up to 400 feet with certain limitations. See Section 8 for Action Plan Goals. Expanding the fuel modification zone widths around the northern and western perimeters of the Emerald Bay Community offers numerous benefits, including a wider buffer between human development and the naturally-vegetated open space areas, reducing the intensity and speed of a wildfire as it approaches the perimeter of the Community, and creating an overall safer environment for those living in the Community and firefighters.

4.5.1 TREE SPECIES SELECTION

OCFA Guideline C-05 provides information for proper selection of appropriate vegetation within the WHA:

i. Fuel Modification Zone Plant List, which can be planted in all fuel modification zones.

ii. Undesirable and Invasive Plant Species List, which cannot be planted in any fuel modification zone or must be removed if the species already exist within the Community Plan Area.

iii. Requirements for Planting Installation in Fuel Modification Zones, which describes the planting and maintenance of vegetation within fuel modification zones.

4.5.2 DEFENSIBLE SPACE AND FUEL MODIFICATION ZONES

In order to offer wildfire protection, Defensible Space should reach a minimum of 100 feet from the house, garage, and other buildings on the property, or to the property line. Defensible space is an area between your house and an oncoming wildfire, where the vegetation has been controlled, trimmed, or removed to reduce wildfire threat from embers, flames, and interior heat. Furthermore, fuel modification zones are designed to provide vegetation buffers that gradually reduce fire intensity and flame lengths from advancing fire by strategically placing thinning zones, restricted vegetation zones, and irrigated zones adjacent to each other on the perimeter of structures in the WHA. Fuel modification zones were originally developed by CAL FIRE to protect natural resources from urban area fires and over the years have become essential to setting urban areas back from wildland areas, with a dual role of protecting structures and people while buffering natural areas from urban ignitions and reducing the potential for urban fires to spread into wildland areas. Typical Fuel Modification in Orange County consists of a minimum 100 feet of defensible space and up to 170 feet in width if possible, measured out horizontally from the structure in all directions on the site. The Orange County Fire Authority has created a Vegetation Management Maintenance Guideline for property owners that is intended to assist property owners with defensible space requirements in wildland fire-risk areas.[3]

As noted above, the Emerald Bay Community Association and Service District currently provide fuel modification up to 170 feet of interior and perimeter defensible space (See Figure 5, Emerald Bay Community Fuel Modification Plan for the Emerald Bay Community). OCFA also has a Defensible Space Guideline for HOA's Interior Slope Areas that is a sub-set of the Vegetation Management Maintenance Guideline and applies in the absence of a Fuel Modification Zone Plan.[4]

OCFA Guideline C-05 outlines requirements for fuel modification zones, which are described below.

Immediate/Ember Resistant Zone 0 (First 5 feet measured from the structure out, in all directions)

The protection within the first five (5) feet of your home is the most important. Keeping the area closest to buildings, structures, and decks clear will prevent embers from igniting materials that can spread the fire to your home.

[3] OCFA – Vegetation Management Maintenance Guideline for Property Owners: https://storageocfaprod001.blob.core.windows.net/blobocfaprod01/2025/08/OCFA-RSG-Vegetation-Management-Guidelines.pdf

[4] OCFA – Defensible Space Guidelines for Homeowner Association Interior Slope Areas: https://storageocfaprod001.blob.core.windows.net/blobocfaprod01/2025/07/OCFA-DSpace-Guide-for-HOAs.pdf

Why is the immediate/ember resistant Zone 0 important? The majority of homes lost to wildfire are ignited by flying embers. Embers can travel miles ahead of the active front of wildfires.

The immediate/ember resistant Zone 0 shall include the following:

- **No combustible bark or mulch; Use hardscapes like** gravel, pavers, or concrete within the first feet of your home.
- **Remove all dead and dying plants,** weeds, and debris (leaves, needles, etc.) from your roof, gutter, decks, porch, stairways, and under any areas of your home.
- Plants in this area to be irrigated, naturally low growing (below 2 feet in height), and non-woody.
- **Remove all branches within 10 feet of any chimney** or stovepipe outlet.
- **Limit combustible items** (like outdoor furniture and planters) on top of decks.
- **No combustible construction is allowed, fencing, gates, patio covers, etc.; Replace combustible fencing, gates, and arbors** attached to the home with noncombustible alternatives.
- **Consider relocating garbage and recycling containers outside this zone.**

Zone A (20-foot minimum width, measured from the structure out)

Keep it lean, clean, and green. Within this zone, it's important to regularly clear dead or dry vegetation and create space between trees. During times of drought when watering is limited, pay special attention to clearing dead or dying material.

Why is Zone A important? By removing dead plants and creating space between trees and shrubs creates a buffer for your property and reduces potential fuel for fire.

Zone A shall include the following:

- Flat level ground requirement
- Building foundation setback (no design alternatives allowed)
- Setback from the slope nearest the foundation
- No combustible construction is allowed within Zone A.
- Automatic irrigation systems to maintain healthy vegetation with high moisture content and to be regularly irrigated.
- Plants in this zone shall be highly fire resistant and selected from the Fuel Modification Zone Plant List in Appendix A2.
- If all Zones A-D are to be maintained by the structure owner, then Zone A shall begin at the wall of the structure.

Zone B (50 -150 feet in width)

- Slope design requires a minimum 50-foot irrigated zone.
- A dry Zone B may be used if plants and design are appropriate.

- Required at the nearest slope adjoining Zone A.
- Irrigated and planted per the Requirements for Planting Installation in Fuel Modification Zones in Appendix A2.
- May replace Zones C/D when grading plans require larger replanted areas
- All plant species designed for Zone B shall be selected from the Fuel Modification Zone Plant List in Appendix A2. Existing fuel modification maintenance programs are limited to the plants listed on the approved plans unless a revision is requested. Planting and maintenance shall be in accordance with planting restrictions from the Requirements for Planting Installation in Fuel Modification Zones, Undesirable and Invasive Plant Species, and Fuel Modification Zone Plant List in Appendix A1.
- No combustible construction is allowed within Zone B.

Zone C/D (0-100 feet in width)

- One natural vegetation thinning (Zone C) or two thinning zones (Zone C/D)
  - Zone C shall be 50% thinning of vegetation
  - Zone D shall be 30% thinning of vegetation
- If installing plants:
  - Existing plants that will remain shall be in accordance with the Requirements for Planting Installation in Fuel Modification Zones and the Undesirable and Invasive Plant Species in Appendix A1. and A2
- Plant species introduced into Zone C and D shall be selected from Fuel Modification Zone Plant List in Appendix A. Maintenance shall be in accordance with the Requirements for Planting Installation in Fuel Modification Zones and the Undesirable and Invasive Plant Species in Appendix A1 and A2.
- No combustible construction is allowed within Zone C and D.

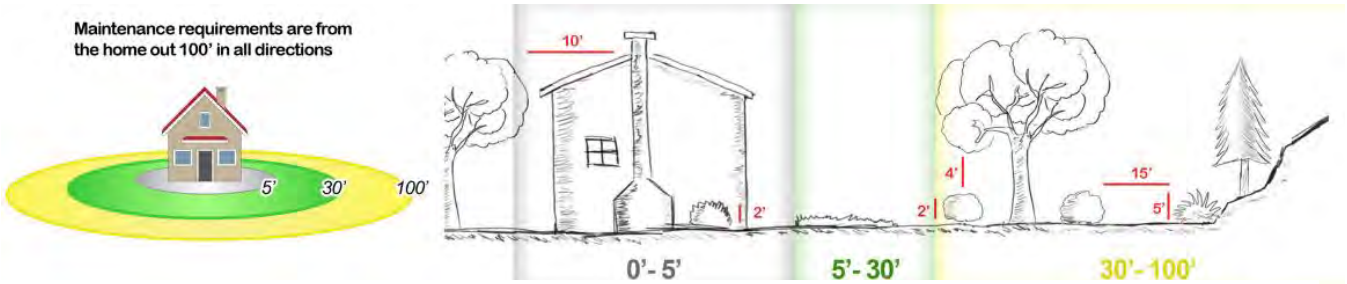
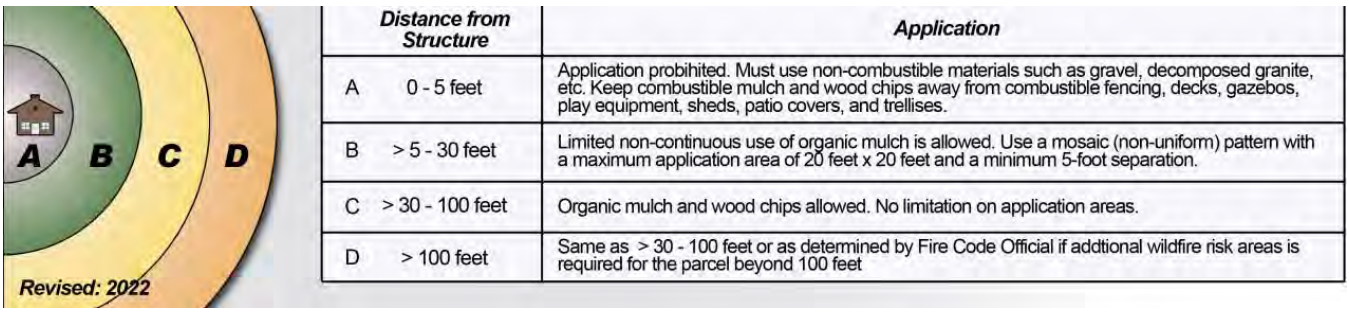


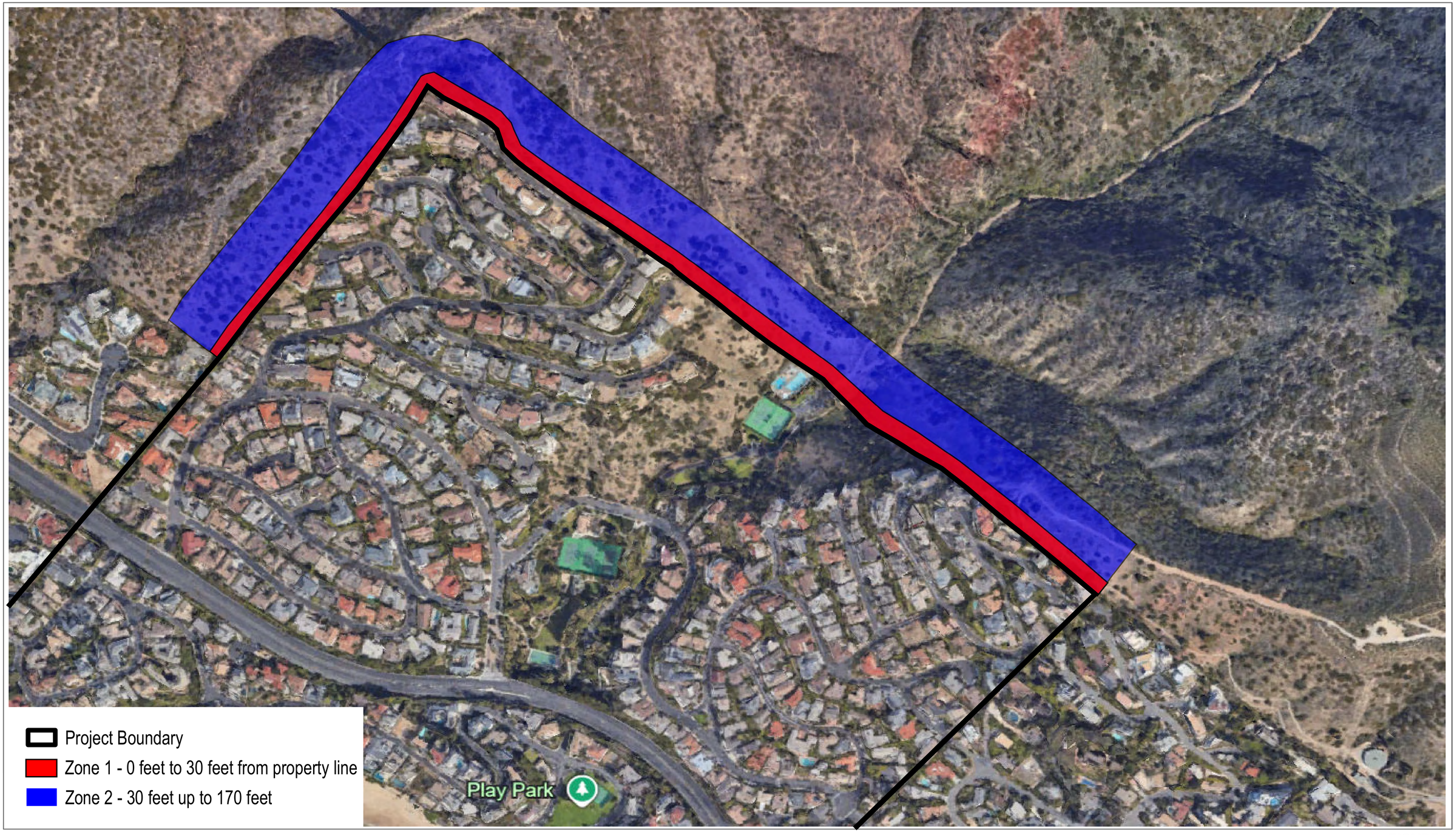
Exhibit 7. OCFA Defensible Space Spacing Guide



	Distance from Structure	Application
A	0 - 5 feet	Application probihited. Must use non-combustible materials such as gravel, decomposed granite, etc. Keep combustible mulch and wood chips away from combustible fencing, decks, gazebos, play equipment, sheds, patio covers, and trellises.
B	> 5 - 30 feet	Limited non-continuous use of organic mulch is allowed. Use a mosaic (non-uniform) pattern with a maximum application area of 20 feet x 20 feet and a minimum 5-foot separation.
C	> 30 - 100 feet	Organic mulch and wood chips allowed. No limitation on application areas.
D	> 100 feet	Same as > 30 - 100 feet or as determined by Fire Code Official if addtional wildfire risk areas is required for the parcel beyond 100 feet

Exhibit 8. OCFA Defensible Space Spacing Guide and Mulch Application

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SOURCE: Bing Maps Imagery 2024; CalFire 2025

DUDEK

0 100 200 Feet

FIGURE 5

Fuel Modification Zones Map

Emerald Bay CWPP

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4.6 Defensible Space

Properties within Emerald Bay must be compliant with PRC 4291 and/or local vegetation management ordinances. This includes the Vegetation Management Maintenance Guidelines for Property Owners (Appendix B) and Cal Fire's Defensible Space Guidelines. These guides inform property owners with Defensible Space requirements for vegetation within a minimum of 100 feet and up to 170 feet of a structure. The purpose of these guidelines is to protect properties by reducing the wildfire threat to homes within Orange County. Private property owners are required to abate vegetation fire hazards on their property. These guidelines apply to existing structures that were not developed with a fuel modification plan or condition within a wildland fire-risk area.

4.6.1 HOW TO SPACE TREES AND SHRUBS

Vertical Spacing:

Maintain space between the lowest tree branches and the ground or shrubs.

- Remove all tree branches at least six feet from the ground.
- Allow extra vertical space between shrubs and trees. Lack of vertical space can allow a fire to move from the ground to the brush to the treetops like a ladder. This leads to more intense fire closer to your home.
- Keep at least three times the height of any shrubs between the shrubs and the lowest branches of trees.
- Example: A 5-foot shrub is growing near a tree. 15 feet of clearance is needed between the top of the shrub and the lowest tree branch.

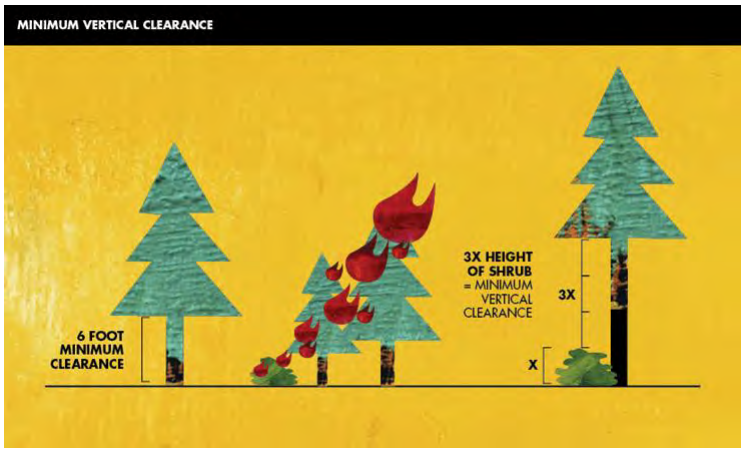


Exhibit 9. Vertical Spacing example.

Horizontal Spacing:

How much space should you leave between trees or shrubs?

Horizontal space depends on the slope of the land and the height of the shrubs or trees. Leave more space between vegetation on bigger slopes. Refer to Exhibit 8 to determine spacing distance.

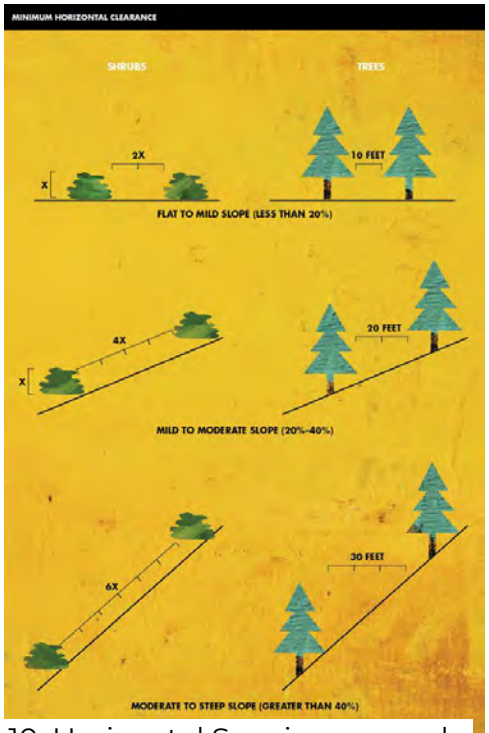


Exhibit 10. Horizontal Spacing example.

It should be noted that the way defensible space is provided around a property can come in many different shapes and forms. As part of this CWPP, we reviewed and analyzed the possibility of implementing a 'fire resistant landscape barrier' around the perimeter of the Emerald Bay Community, mimicking the prescription of something similar to that of what the property owner at 1600 Emerald Bay has incorporated around their property. The property owner at 1600 Emerald Bay has created and maintained a fire-resistant landscape barrier between the open space areas and the residential structure, which consists of cacti, succulent plant species, and spaced eucalyptus tree species on the hillside that surrounds the property. The property owner notes that because of the fire-resistant landscape barrier, their property survived the 1993 Laguna Beach Fire and the 2022 Emerald Fire. Although this defensible space prescription may have contributed to saving the structure at 1600 Emerald Bay, to incorporate this as a community-wide defensible space program wouldn't necessarily work the same as it does for this property due to the topography of the open space area, the site aspect of the open space areas (i.e. the compass direction a slope faces), and overall site constraints and restrictions.

4.7 IBHS – Wildfire Prepared Neighborhood and Wildfire Prepared Home Technical Standards[5]

The Insurance Institute for Business and Home Safety (IBHS) has developed the IBHS Wildfire Prepared Neighborhood Standard to address the critical needs for neighborhoods within the WUI, where buildings may be separated by only feet or tens of feet, the survivability of a structure is highly influenced by its neighbors (See Appendix C – IBHS Wildfire Prepared Neighborhood Guide). The standards within the IBHS Wildfire Prepared Neighborhood Guide focus on the following core principles:

1. Reducing the probability of initial ignitions along the perimeter of the neighborhood from an approaching wildfire, where direct flame and radiant heat can first impinge on homes.

2. Protect the neighborhood from embers.

3. If ignitions occur, reduce the rate of fire spread.

4. Enable the entire neighborhood to act as a passive system to defend against wildfire in all directions and to not serve as a volatile fuel source.

In developing the IBHS Wildfire Prepared Neighborhood Standard, IBHS used a performance-based design approach, recognizing that all neighborhoods are different. Factors such as surrounding fuels, layout, size, shape, and the arrangement of structures and spaces between them can influence fire spread and fire behavior. The IBHS Wildfire Prepared Neighborhood Standard integrates the current state of knowledge on how wildfire interacts with the built environment. It combines insights from post-event analyses, dynamical modeling, and experimental testing. The adaptive and objective process provided here determines the most beneficial mitigation strategies for each specific neighborhood, aligning with the core principles of the standard. The standard is also designed to incorporate new scientific

[5] IBHS Wildfire Prepared: https://wildfireprepared.org/

knowledge and data sources while maintaining an objective approach and accounting quickly and efficiently for the uniqueness of each neighborhood[6].

In addition to the Wildfire Prepared Neighborhood Standard, IBHS has also designed the IBHS Wildfire Prepared Home Technical Standard which provides individual homeowners with science-based actions to help protect their homes and properties from wildfires. The IBHS Wildfire Prepared Home Technical Standard follows a two-tiered approach to reducing parcel-level wildfire risk. Two designations are available within the IBHS Wildfire Prepared Home Technical Standard. To earn a designation, a home shall meet all the requirements for the chosen designation level, as evaluated by an authorized third-party, and verified by IBHS. The Plus level builds upon the Base level requirements. The two designations are as follows:

1. Wildfire Prepared Home Base – Applicants for this level must meet criteria such as creating the 0–5 Foot Noncombustible Zone, upgrading building features, and maintaining the defensible space surrounding the parcel to 30 feet. This is typically achieved when retrofitting existing homes.

2. Wildfire Prepared Home Plus – This level includes additional protective measures beyond the Base level for key building features of the home, and it is easiest to achieve with newly constructed homes or those undergoing exterior renovations.

The IBHS Wildfire Prepared Home Technical Standard has been included within this CWPP as Appendix D – IBHS Wildfire Prepared Home Technical Standard[7].

4.8 Safer from Wildfires – Wildfire Prepared Homes Program

The insurance industry has a role in recommending home hardening and landscape management and even requiring home hardening if it is a prerequisite to offering insurance. The California Department of Insurance has responded to the insurance industry's desire for greater protection from wildfires by prescribing a comprehensive and succinct list of requirements known as Safer from Wildfires (SFW). The SFW checklist includes complying with the Cal Fire Defensible Space Guidelines (CDF DS).

Safer from Wildfires is a ground-up approach to wildfire resilience with three layers of protection — for the structure, the immediate surroundings, and the community. Following 10 achievable steps can help you save money on your insurance while making your home safer as well.[8]

1. **Class-A fire rated roof** – Most roofs qualify including asphalt shingles, concrete, brick, or masonry tiles, and metal shingles or sheets. Wood shake shingles are not Class A fire-resistant rated. The Office of the State Fire Marshal maintains a list of tested and approved materials located here: https://osfm.fire.ca.gov/what-we-do/fire-engineering-and-investigations/building-materials-listing.

[6] IBHS Wildfire Prepared: https://wildfireprepared.org/wildfire-prepared-home-overview/
[7] IBHS Wildfire Prepared Home Technical Standard: https://wildfireprepared.org/wp-content/uploads/WFPH-Technical-Standard.pdf
[8] Safer from Wildfire: https://www.insurance.ca.gov/01-consumers/200-wrr/Safer-from-Wildfires.cfm

2. **5-foot ember resistant zone 0, including fencing** – Removing greenery and replacing wood chips with stone or decomposed granite 5 feet around your home prevents fire from getting a foot in the door. Replacing wood fencing connecting to your home with metal is critical because it can act like a candle wick leading fire straight to your home.

3. **Ember- and fire-resistant vents** – Installing 1/16 to 1/8 inch noncombustible, corrosion-resistant metal mesh screens over exterior vents can keep wind-blown embers out of your house.

4. **Non-combustible 6 inches at the bottom of exterior walls** – Having a minimum of 6 vertical inches measured from the ground up and from any attached horizontal surface like a deck can stop embers from accumulating and igniting your walls. Noncombustible materials include brick, stone, fiber-cement siding or concrete.

5. **Enclosed eaves** – Installing soffits under your eaves can prevent heat and embers from getting trapped and igniting. When enclosing eaves, non-combustible or ignition resistant materials are recommended.

6. **Upgraded windows** – Multi-paned windows are more resistant to breaking during a wildfire, which helps keep flames from entering. Multi-paned glass or added shutters all qualify.

7. **Cleared vegetation, weeds and debris from under decks** – Noncombustible materials like concrete, gravel, or bare soil are permitted.

8. **Removal of combustible sheds and other outbuildings to at least a distance of 30 feet** – These include sheds, gazebos, accessory dwelling units (ADUs), open covered structures with a solid roof, dog houses and playhouses.

9. **Defensible space compliance** – following state and local laws requiring defensible space including trimming trees and removal of brush and debris from yard. See CAL FIRE's defensible space page https://www.fire.ca.gov/dspace and your local city or county for details.

10. **Being safer together** – Safer from Wildfires recognizes two community-wide programs, Firewise USA and Fire Risk Reduction Communities as small as 8 dwelling units or as big as 2,500 can create an action plan and start being safer together. Firewise USA is a nationally recognized program with proven results, sponsored by the National Fire Prevention Association.

4.9 Firewise by NFPA

Being a Firewise community is a certification that communities can achieve through a process of registration and upkeep to ensure a fire-resistant community. The Firewise USA program, administered by NFPA, is a certification program for communities to gain recognition for the fire-wise design and maintenance of their community. Firewise USA began in 2019 with seven sites that were challenged to improve the fire resilience of their communities through a focused approach to active wildfire risk reduction. This is done through a collaborative framework created to empower neighbors to get organized and take action to reduce wildfire risk at a local level. The program has grown to include over 1.5 million residents living in Firewise USA communities (Firewise USA, 2024). The insurance industry,

due to Department of Insurance Regulation #REG-2020-00015, is required to recognize the Firewise certification and consider it when it comes to determining if a community is insurable; cuts to insurance premiums have been made based on this certification. Given the established framework of Firewise USA, its direct mention in regulatory language, and its existing adoption by multiple insurance companies, it can be reasonably anticipated that more companies will require the same certification from customers that attempt to pursue discounted policies.

There are several requirements to become a Firewise USA community and multiple living documents must be prepared. Firewise USA communities must have a minimum of 8 dwelling units and a maximum of 2,500, meaning the proposed Project, in its entirety, would be able to participate in the program (Firewise USA, 2024). It should be noted that the Emerald Bay Community Association became a Firewise Community in 2023 (see Appendix E – EBCA Firewise Community Certification) and is currently in the process of the annual renewal. These are the steps the Emerald Bay Community Association was required to follow in order to be recognized as a Firewise USA community[9]:

1. **Form a board or committee:** Create a board or committee of volunteers to represent the community, made up of residents and partners such as a representative of the local fire department would first need to be formed. A resident leader will need to be identified who will be the program point of contact. The board or committee is responsible for defining the boundaries of the site and determines the number of individual single-family dwelling units within the community or site. As mentioned above, in order to be recognized as a Firewise site, the community must have a minimum of 8 dwelling units and a maximum of 2,500. (Firewise USA, 2024).

2. **Create a Firewise USA portal account:** Create a Firewise USA account and submit an application to your state Firewise USA liaison. (Firewise USA, 2024).

3. **Obtain a wildfire risk assessment:** The board or committee will collaborate with their local wildfire expert or a 3rd-party consultant such as Dudek to complete a community wildfire risk assessment (CWRA). The assessment should be a community-wide view that identifies areas of successful wildfire risk reduction and where improvements could be made. Emphasis should be on the general conditions of homes and related home ignition zones. The CWRA is a living document and would need to be updated at least every five years. (Firewise USA, 2024).

4. **Develop an action plan:** The board or committee will use the CWRA to create a three-year action plan, broken down by year, that identifies and prioritizes actions to reduce ignition to homes. These can include community-wide investments along with suggested homeowner actions and education activities that participants will strive to complete annually, or over a period of multiple years. The action plan document is required to be updated at least every three years. As circumstances change (e.g. completing activities, experiencing a fire or natural disaster, new construction in community, etc.), the action plan may need to be updated more frequently. (Firewise USA, 2024).

[9] How to become a Firewise USA site. https://www.nfpa.org/education-and-research/wildfire/firewise-usa/become-a-firewise-usa-site

5. **Host an educational event:** Host at least one event per year to educate the community about wildfire risk reduction. (Firewise USA, 2024).

6. **Meet the minimum investment:** Every year, neighbors will need to complete educational and risk reduction actions identified in the plan which go towards your site's annual reporting efforts. At a minimum, each site is required to annually invest the equivalent of one (1) volunteer hour per dwelling unit in wildfire risk reduction actions. If your site identifies 100 homes within its boundary, then 100 hours of work or the monetary equivalent, based on the independent sector value of volunteer time, need to be completed for that year. (Firewise USA, 2024).

7. **Submit an annual renewal:** Maintain your Firewise USA status. (Firewise USA, 2024).

In addition to the Firewise certification, the community can hire a qualified individual such as Dudek to assess the community regularly to document compliance with not only the fire code but the insurance industry minimums. Wildfire Risk Assessments have proven valuable in helping communities maintain fire insurance or even apply for reduced premiums, given that the insurance industry evaluates fire resistant features above and beyond what the fire code requires. It should be noted that the Emerald Bay Community already performs yearly fuel reduction around the perimeter of the community as well as within the interior portion of the community.

A community is Firewise when one works to take appropriate wildfire resilience-building measures to reduce the risk of structural damage from fire are 'Firewise.' These strategies include landscaping with fire-resistant plants, using fireproof building materials, and building out ignition zones around your home. The Firewise USA® Program recognizes these communities that have organized and implemented Firewise® risk mitigation structures in their neighborhood. Firewise has been recommended by Dudek frequently since the program's recent emergence within California.

4.10 Water Efficient Landscape Ordinance

Since 2015, all landscapes are required to comply with California's Executive Order B-29-15. These requirements are commonly called the Water Efficient Landscape Ordinance. For any project that involves landscaped areas or altered landscaped areas, the project applicant must submit a landscape documentation package for review and approval by the Orange County Fire Authority Community Development Department before a building permit is issued. As part of the submittal package, the landscape design is required to address fire safety and prevention if the project is in the WHA.

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5 Wildfire Hazard and Risk Assessment

The potential for damaging wildfire exists within the Emerald Bay Community, as highlighted through regional fire history; existing vegetation types and fuels composition; terrain; and local climate. Vegetation conducive to ignition and wildfire spread exists adjacent to and throughout the community, presenting risks to human life, safety, and property. The potential for extreme wildfire behavior is exacerbated by the occurrence of Santa Ana wind events, which facilitate extreme fire weather in the region. In October 2025, the City of Laguna Beach conducted a Fuels and Fire Analysis in a Technical Memo which summarizes the City's evaluation of the current Fuel Modification Zone (FMZ) Program and recommends improvements and prioritizations to strengthen the City's wildfire resiliency. This Fuels and Fire Analysis has identified the area surrounding the Emerald Bay Community as an area with the most severe fire risk and is in alignment with the wildfire hazard and risk assessment completed as part of this CWPP. The full City of Laguna Beach Fuels and Fire Analysis Technical Memo can be found as Appendix F.

To evaluate the extent of potential wildfire impacts in the assessment area, a Wildfire Hazard Assessment was conducted through customized wildfire modelling. Modelling was conducted to assess fire spread and behavior near the Emerald Bay Community.

This summary of the Wildfire Hazard Assessment provides both an overview of the modeling process and a detailed discussion of the resulting findings. It begins by describing the model inputs, such as vegetation types, topography, weather conditions, and fire behavior parameters, which establish the basis for the analysis. It then presents the model results, which map and evaluate three key wildfire hazard components:

- **Wildfire Progression Modeling from a Santa Ana–Driven Wildfire** – Simulates the potential movement of a wildfire under extreme Santa Ana wind conditions, identifying major spread pathways, rates of spread, and areas most susceptible to rapid fire advancement.
- **Flame Length Modeling** – Estimates flame lengths under modeled conditions, which helps determine the potential intensity of a fire, its suppression difficulty, and the likely impact to structures and vegetation.
- **Extreme Fire Behavior Modeling** – Assesses the concentration of areas modeled to produce extreme fire behavior in close proximity to the Emerald Bay Community.

Together, these results are intended to provide community members with a clear understanding of the level and nature of wildfire risk within the assessment area. In addition, the findings serve as a technical foundation for identifying, prioritizing, and guiding the implementation of effective wildfire risk mitigation measures.

5.1 Model Inputs

The wildfire hazard assessment involved a desktop analysis utilizing the Flammap fire behavior modeling software and subsequent GIS analysis. Flammap is a wildfire behavior modeling software developed by the U.S. Forest Service that simulates potential fire characteristics across a landscape without tracking

fire growth over time. It uses spatial data to generate outputs such as flame length, rate of spread, and fireline intensity under constant weather and fuel moisture conditions.

Required inputs include:

- **Topography:** Raster layers for elevation, slope, and aspect.
- **Surface Fuels:** LANDFIRE or custom fuel models describing fuel load, arrangement, and type.
- **Canopy Fuels:** Canopy cover, canopy height, canopy base height, and canopy bulk density.
- **Weather:** Wind speed and direction, temperature, and relative humidity.
- **Fuel Moisture:** Live and dead fuel moisture contents for different size classes.

Flammap's outputs are often used to assess fire hazard, support mitigation planning, and evaluate potential fire behavior under specified conditions.

5.1.1 LANDSCAPE BASE FILE

To initiate the modeling effort, a Landscape Base file was created and analyzed. The Landscape Base file consisted of eight distinct data layers representing terrain (elevation, slope, and aspect) and vegetation/fuels (fuel model designation). The Landscape Base file was created at a scale of 30 meters and was obtained from the LANDFIRE 2024 dataset.

The Fuel Model layer within the landscape file was edited to reflect existing conditions within the Emerald Bay community, including development areas and perimeter fuel modification zones. Table 5 below summarizes the fuels conditions assigned for existing perimeter Fuel Modification Zones.

TABLE 5. LANDSCAPE BASE FILE INPUTS

FUEL MODEL	DESCRIPTION
Fuel Model GS1 (121)	Low Load, Mowed Dry Climate Grass and Scattered Shrubs
Fuel Model Gr2 (102)	Low load, Mowed Dry Climate Grass
Fuel Model SH2 (142)	Moderate Load, Scattered Shrubs

Source: Scott and Burgan, 2005

5.1.2 WIND AND FUEL MOISTURE INPUTS

Wind speed, wind direction, and fuel moisture values were determined through local Remote Automated Weather Stations and confirmed through historic wildfire and Santa Ana wind events. The 97th percentile values, reflecting extremely low fuel moisture and very high wind speeds, were used for the peak weather (Santa Ana) scenario. Wind data for 97th percentile weather was obtained from the Aliso Laguna Remote Automated Weather Station using the FireFamily Plus software.

For 97th percentile weather conditions, gridded winds were used to model fire behavior, which utilize the WindNinja program embedded in Flammap. Gridded winds alter wind flows across the landscape based on topographic effect (e.g., drag effect vegetation has on wind flow). Gridded winds more accurately

model the effects of complex terrain (e.g., funneling through narrow canyons) during directional wind events. Wind and fuel moisture inputs utilized in this analysis are provided below in Table 6.

TABLE 6. WILDFIRE BEHAVIOR MODELING INPUTS

MODEL INPUT	97TH PERCENTILE (SANTA ANA WIND)
Wind Speed*	35 mph
Wind Direction	45 degrees
Wind Type	Gridded
1-Hour Fuel Moisture	2%
10-Hour Fuel Moisture	3%
100-Hour Fuel Moisture	5%
Herbaceous Fuel Moisture	30%
Live Woody Fuel Moisture	60%
Crown Fire Calculation Method	Scott/Reinhardt

* Represents a more severe, Santa Ana wind gust speed rather than a typical average wind speed in the area.

5.1.3 FIRE PROGRESSION MODELING INPUTS

Flammap's Minimum Travel Time tool was used in order to evaluate the fire spread towards the Emerald Bay community from a wildfire spreading towards the site from the northeast during a Santa Ana wind event. The Minimum Travel Time (MTT) tool in the FlamMap software package is a two-dimensional fire growth model which calculates fire growth based on calculated fire spread rates from an ignition source (point, line, or polygon). The MTT tool uses fire spread rates to find minimum travel paths between data cells in the GIS landscape, with an output data file representing the number of minutes for a wildfire to reach a particular location from the ignition source. As FlamMap provides a static representation of fire behavior, modeling using the MTT tool holds wind and weather inputs constant over the modeling period.

The fire progression model relied on the landscape file and weather inputs described above, in addition to an ignition file which identifies the simulated fire's origin. To simulate fire spread towards the Emerald Bay community during Santa Ana conditions, an upwind ignition location was mapped. The ignition location, in line format to represent many possible ignition origins, was mapped roughly 1 mile northeast of the Emerald Bay community. Fire spread was modeled over a 1-hour (60 minute) time period.

The output files generated for the fire progression runs included one grid and one line file representing fire progression over time and major spread paths, considering modeling inputs and ignition location. The files include data presenting time (in minutes) for the modeled fire to reach a specific location.

5.2 Model Results

Model results are presented graphically in Figures 6 through 8 for the respective analyses. A summary of the results for the fire progression, flame length, and extreme fire behavior assessments is provided below.

5.2.1 FIRE PROGRESSION MODELING

As presented in Figure 6, a wildfire driven by 35 mph winds is modeled to spread in a southwest direction rapidly towards the Emerald Bay Community. Wildfire spread is amplified through high load shrub and topography that funnels and accelerated northeast winds.

From the selected ignition location, wildfire is modeled to reach the community's northern edge in roughly 45 minutes. Emerald Canyon, which travels into the interior of the community, is modeled to be a major pathway for fire spread. When a canyon or drainage is aligned with the prevailing wind direction, it can act like a natural wind tunnel, channeling and accelerating airflow through space. The canyon walls restrict the lateral spread of wind, forcing it into a narrower path and increasing its velocity. This acceleration can be further influenced by the drainage slope, as winds moving downslope may gain additional speed. In wildfire conditions, this funneling effect can significantly increase flame lengths, spotting distances, and the rate of spread, making canyons particularly hazardous corridors for rapid fire movement.

This fire progression analysis simulates the spread of wildfire through natural vegetation but does not account for fire transmission directly from structure to structure. Once the modeled fire reaches developed areas, the model assumes those areas have no combustible natural fuels and considers them as non-burnable, meaning the model does not simulate ignition caused by radiant heat, direct flame contact, or embers igniting adjacent buildings. In reality, structure-to-structure spread can be a significant driver of fire growth in dense communities such as Emerald Bay, but this mechanism is captured in standard wildfire progression outputs. As a result, this assessment does not map the potential damage associated with an urban conflagration. However, given limited separation between structures, considerable urban vegetation, and many structures built prior to modern fire-resistant building codes, the potential for an urban conflagration within the Emerald Bay community is considered very high.

5.2.2 FLAME LENGTH MODELING

The results of the flame length modeling are presented graphically in Figure 7. Flame length—the length of the flame of a spreading surface fire within the flaming front—is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews et. al. 2008). Although it is a somewhat subjective and nonscientific measure of fire behavior, it is imperative to fireline personnel when evaluating Fireline intensity and is worth considering as a vital wildfire variable (Rothermel 1993).

TABLE 7. FIRE BEHAVIOR INTERPRETATION

Flame Length	Fireline Intensity	Interpretation
Under 4 feet	Under 100 BTU/ft/s	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 feet to 8 feet	100–500 BTU/ft/s	Fires are too intense for a direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 feet to 11 feet	500–1,000 BTU/ft/s	Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11 feet	Over 1,000 BTU/ft/s	Crowning, spotting, and major fire runs are probable. Control efforts at the head of fire are ineffective.

Source: Roussopoulos and Johnson 1975.
Note: BTU/ft/s = British thermal units per foot per second.

Within the community's perimeter fuel modification zones, flame lengths range from 12-25 feet depending on fuel type, slope, and local wind speeds. As a result, there is a considerable risk of direct flame exposure to structures in the Emerald Bay Community.

5.2.3 EXTREME FIRE BEHAVIOR MODELING

Using the flame length modeling results described above, areas of concentrated extreme fire behavior were identified within 400 feet of the community boundary. For this analysis, extreme fire behavior was defined as flame lengths exceeding 18 feet. These zones represent the highest hazard, posing significant risks to structures from intense heat and ember generation.

Figure 8 identifies areas with a high concentration of extreme fire behavior. Within the community's existing fuel modification zone, notable areas of concern include the interior slopes adjacent to Canyon Park. Steep terrain and higher fuel loading present within this area is conducive to increased wildfire severity adjacent to structures.

As identified above, the Emerald Bay Community currently provides fuel modification up to 170 feet around the perimeter of the community. Specifically, the Emerald Bay Community Service District provides fuel modification on an annual basis up to 170 feet outside the Emerald Bay property lines within naturally-vegetated open space areas on both California State Parks' property (along the western portion of the community) and County of Orange Parks and Recreations' property (along the northern portion of the community).

As described above, the potential for damaging wildfire exists within the Emerald Bay Community due to the terrain, existing vegetation types and fuel load amounts, and local climate north and west of the Emerald Bay Community. The Model Results presented in Section 4.2 show that a wildfire originating 1-to- 2 miles north of the Emerald Bay Community driven by 35 mph winds, was modeled to spread in a southwest direction rapidly towards the Community, potentially reaching the Community within approximately 45-minutes. The wildfire spread towards the Community is amplified through high load shrubs and topography that funnels and accelerates northeastern winds. Within the Community's perimeter fuel modification zones, flame lengths range from approximately 12 to 25 feet depending on fuel types, slope, and local wind speeds. As a result, there is a considerable risk of direct flame exposure

to the structures along the perimeter edges of the Emerald Bay Community with areas of concentrated extreme fire behavior within approximately 400 feet of the Community Boundary. Because of this, one of the Action Plan Goals of this CWPP is to increase the perimeter Fuel Modification Zone widths from 170 feet up to 400 feet with certain limitations. See Section 8 for Action Plan Goals. Expanding the fuel modification zone widths around the northern and western perimeters of the Emerald Bay Community offers numerous benefits, including a wider buffer between human development and the naturally-vegetated open space areas, reducing the intensity and speed of a wildfire as it approaches the perimeter of the Community, and creating an overall safer environment for those living in the Community and firefighters.

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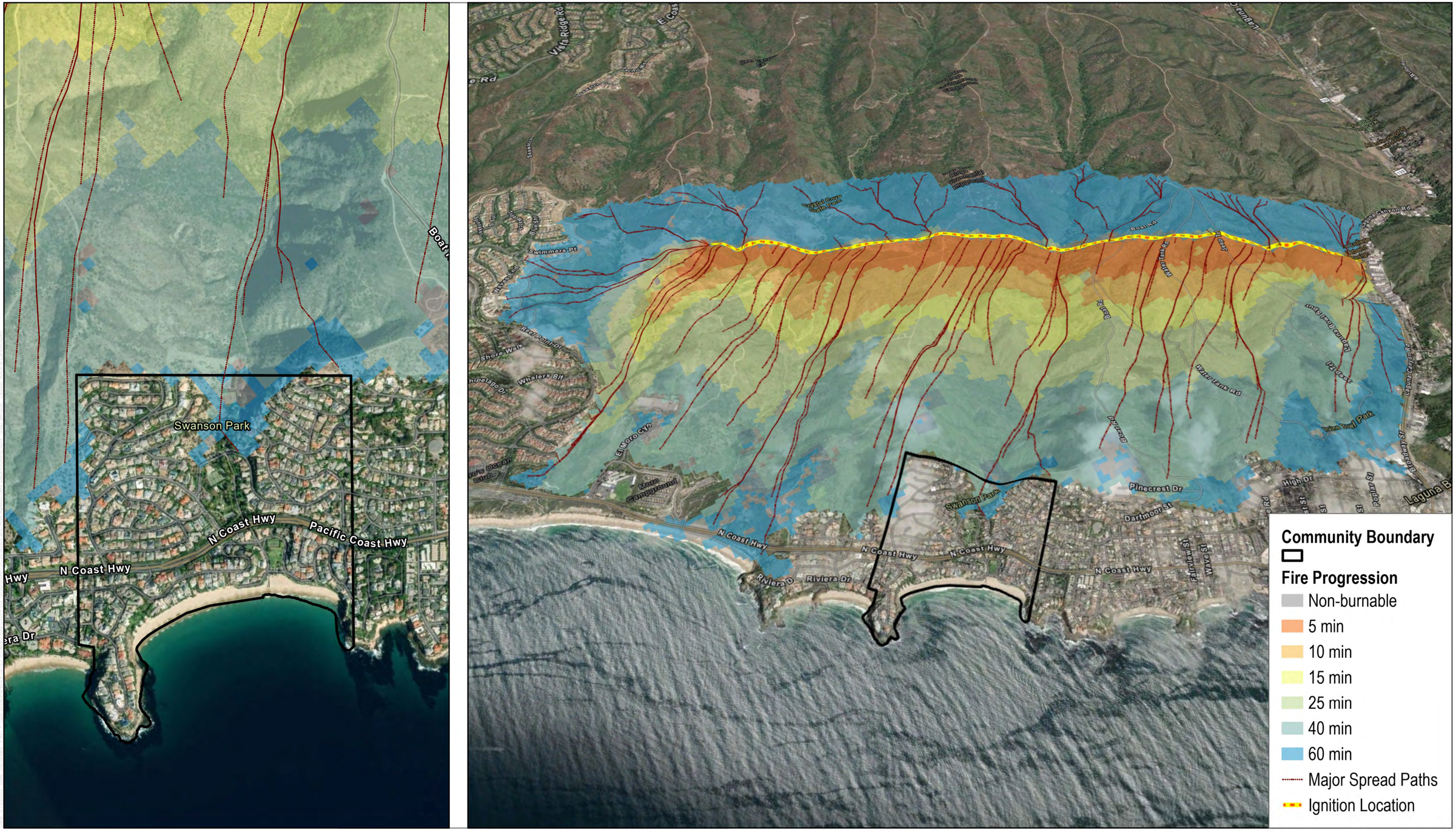


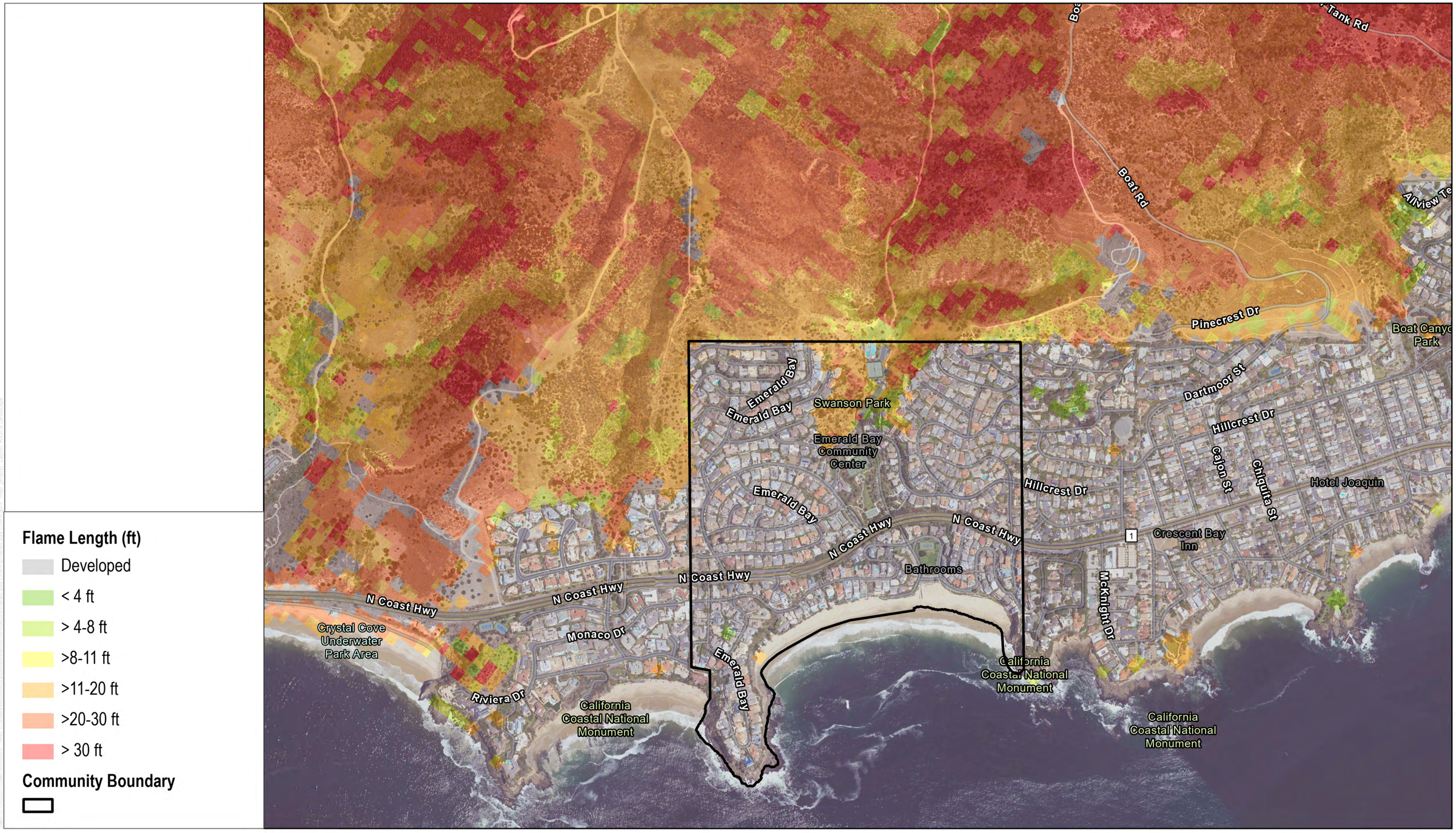
FIGURE 6

Fire Progression - Santa Ana Weather (35 mph winds)

Emerald Bay Community CWPP

DUDEK

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SOURCE:

DUDEK

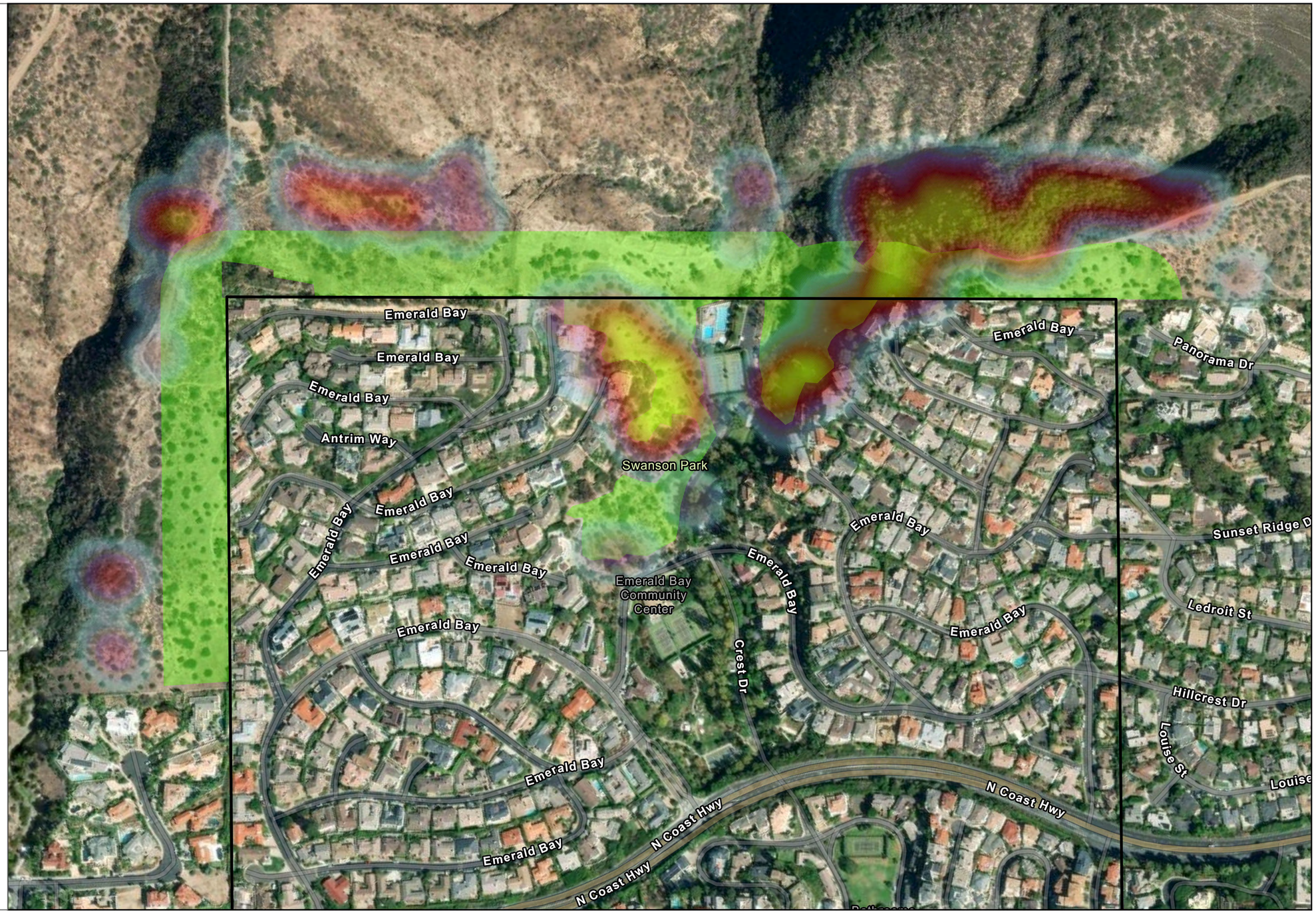
0 350 700 Feet

FIGURE 7

Flame Length (ft): Santa Ana Weather Conditions

Emerald Bay Priority CWPP

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Fuel Modification Zone

High Severity Fire Behavior

High Concentration

Highest Concentration

Community Boundary

SOURCE:

DUDEK

N

0 140 280 Feet

FIGURE 8

Concentration of High Severity Wildfire

Emerald Bay Priority CWPP

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6 Values at Risk

6.1 At-Risk Community

The Healthy Forest Restoration Act of 2003 (HFRA) identifies at-risk communities as an area:

(A) that is comprised of—

(i) an interface community as defined in the notice entitled "Wildland Urban Interface Communities Within the Vicinity of Federal Lands That Are at High Risk From Wildfire" issued by the Secretary of Agriculture and the Secretary of the Interior in accordance with title IV of the Department of the Interior and Related Agencies Appropriations Act, 2001 (114 Stat. 1009) (66 Fed. Reg. 753, January 4, 2001); or

(ii) a group of homes and other structures with basic infrastructure and services (such as utilities and collectively maintained transportation routes) within or adjacent to Federal land;

(B) in which conditions are conducive to a large-scale wildland fire disturbance event; and

(C) for which a significant threat to human life or property exists as a result of a wildland fire disturbance event.

In addition to this definition, the Office of the State Fire Marshal (OSFM) maintains a list of communities at risk. The National Fire Plan directs funding to be provided for projects designed to reduce the fire risks to these communities. These high-risk communities identified within the WUI were published in the Federal Register in 2001 and include those communities neighboring federal lands. Laguna Beach and Orange County areas are identified as a community at risk by the California Office of the State Fire Marshal but were not listed in the Federal Register as an at-risk community.

6.2 Values and Assets at Risk

Values threatened by wildfire in the Community area include life, property, critical infrastructure, community assets, natural resources, and recreation. The primary focus of this CWPP is to protect these values at risk. The lives and property threatened by wildfire are of paramount importance. However, infrastructure, community assets, natural resources, and recreation threatened by wildfire are also significant. Wildfires in the Community Plan Area, and even the threat of wildfires during extreme fire weather periods, also have the capability to generate secondary impacts to the community, including the loss of access (closed/damaged roads), communication capabilities (damaged/inoperable phone lines or cell towers), power supply (damaged distribution lines, public safety power shutoffs), water availability (damaged infrastructure, no power to well pumps), recreation/tourism opportunities (limited access to area closures), and economic activity (inability of employees/workers to access job sites, reductions in tourism). This section summarizes the values threatened by wildfire in the Community.

6.2.1 LIFE SAFETY

The potential for loss of life due to wildfire is difficult to calculate. Locally, in the Laguna Beach area, specifically in the Emerald Bay Community, the 1993 Laguna Fire did not result in any fatalities yet left 8

injured and the 2022 Emerald Fire also did not result in any injuries or fatalities. However, the potential for greater loss of life is possible during extreme wildfire events. While roughly 70 miles northwest of the Community, the fire environment and community characteristics of Palisades are highly similar to those of Emerald Bay. The potential for loss of life due to wildfires is substantial in the Community Plan Area.

The size and severity of wildfires is predicted to continue increasing in California due to a changing climate and fuel conditions (Fried et al. 2004; Lenihan 2008; Westerling et al. 2011; Westerling 2018). This current trend in California's wildfire regime poses threats to human life and safety. In response, preserving human life and safety from wildfires has become a priority for state agencies and local governments.

6.2.2 STRUCTURES

There are an estimated 545 structures in the Emerald Bay Community, as calculated from available structure mapping data (Microsoft 2022). These 545 structures include houses, recreational buildings, and other structure types whose footprints were readily visible from aerial imagery. The majority of residential structures within the Community resemble moderate- to- high density development patterns. Many neighborhoods can be described as wildland-urban intermix, with substantial tree canopy cover and vegetation present surrounding and between structures. While the entirety of the Community is designated by CAL FIRE as a High or Very High Fire Hazard Severity Zone, on a relative basis, structures at the highest risk of direct wildfire exposure are generally located closer to large open space and undeveloped areas. **However, all structures within the Community are considered at high risk from wildfire due to vegetation conditions, the potential for extreme weather, and the risk of airborne embers.**

Within the Community, there are also residential structures that are vacation homes where they are left unoccupied for extended periods of time. In addition, the Community includes many non-residential structures of importance. These include a community center, recreation facilities, landscape structures, and a fire station, amongst others.

As most residential structures within the Community are not part of a planned community, there is a lot of variability in structure type, age, and setting. Structure age in the Community Plan Area is predominantly older, many of which were constructed prior to 2007 (after which current California Building Code ignition-resistant construction requirements went into effect). However, many of the homes throughout the Community have been remodeled or are currently being remodeled and being brought up to the current codes. As such, there are properties throughout the Community that feature the following construction features that increase their susceptibility to damages from wildfire.

- Combustible exterior construction materials (e.g., wood siding, exposed wooden eaves, single-pane windows)
- Ignition susceptible roofing materials and conditions (e.g., Openings within tile roofs that allow birds and other animals to nest, pine needles accumulated on roofs and in gutters)
- Exterior vents with large screen openings that increase risk of ember intrusion
- Wooden decks attached to structures

- Wood fences connected directly to structures
- Widespread lack of Zone 0 – (0-5' Non-combustible Zone)

As discussed, the topography, vegetation, climatic, and geological conditions in the Mountain adjacent to the Community combine to create a unique situation capable of supporting large-scale, high-intensity, and sometimes damaging wildfires. Vegetation management and defensible space are key components to an overall fire protection strategy; however, structural hardening also plays an important role in minimizing the potential for structure ignitions. Hardening refers to steps a property owner may take to enhance the survivability of an existing structure that may not be up to current building or residential code standards for wildland areas. Homes survive wildfires through a combination of vegetation management and maintenance, management of combustible materials on the property, and installation and maintenance of fire- and ember-resistant construction materials. Hardening of the homes and other structures to enhance survivability during a wildfire would include retrofitting the most vulnerable home features, including:

- Roofs
- Vents
- Eaves and soffits
- Windows
- Walls
- Decks
- Rain gutters
- Patio covers
- Chimneys
- Garages
- Fences
- Driveway and access roads
- Address signage
- Water supply

There are three ways your home can be exposed to wildfire: direct flames from a wildfire or burning neighboring home; radiant heat from nearby burning plants or structures; and flying embers. Communities located in wildfire-prone areas need to take extra measures to live safely. There are many ways to prepare communities and properties for wildfire, including creating and maintaining adequate defensible space and hardening homes through altering or replacing the construction components. The

most effective way for homes to withstand wildfire is a "coupled approach" that considers the exterior construction materials and how they are put together, as well as the surrounding vegetation and other near-home combustible materials. Selection, location, and maintenance of vegetation and other combustible materials on a property can reduce the chance of a wildfire burning the home (Office of the State Fire Marshal, 2021). While high fire construction standards are mandatory for new buildings in the VHFHSZ Areas, hardening of existing structures is voluntary. Adopting mandatory home hardening provisions of building and fire codes is problematic because existing, nonconforming structures were typically approved and built to the codes in effect at the time of construction. The problem persists, however, that a burning structure in a wildfire contributes to the fire and presents a danger to other structures downwind by way of flying brands (embers). Retrofits to existing structures can reduce fire risk, and some cost-sharing and grant programs are available to offset costs.

Resources for hardening structures can be found on the following websites:

- https://www.readyforwildfire.org/prepare-for-wildfire/get-ready/hardening-your-home/
- Wildfire Home Retrofit Guide (readyforwildfire.org)
- https://ocfa.org/rsg/home-hardening/
- https://www.nfpa.org/education-and-research/wildfire/preparing-homes-for-wildfire
- https://ibhs.org/ibhs-news-releases/ibhs-releases-updated-wildfire-prepared-home-standard/

6.2.2.1 ACCESSORY DWELLING UNITS

Accessory Dwelling Units (ADUs) are self-contained residential units, typically used as a rental, and either incorporated within, detached from, or attached to the primary residential unit(s) on the same property. A Junior Accessory Dwelling Unit (JADU) is a unit up to 500 square feet in size contained within an existing or proposed home with a separate exterior entry and an efficiency kitchen. The state views ADUs/JADUs as one important strategy to increase housing statewide and in 2017 significantly amended state law to remove local government barriers for their construction.

In 2019, the state continued to be concerned about local government barriers to ADUs and signed a new package of legislation that again significantly amended state law for ADUs/JADUs effective January 1, 2020. New state law significantly expanded the types and numbers of ADUs allowed per parcel. The County has concerns regarding the impact of California's ADU Law that can affect fire safety. Specifically, the County has concerns related to setbacks and prohibition on fire sprinklers. Separate from the wildfire issues, State law continues to not require automatic fire sprinklers in ADU's when the main residence was not required to have fire sprinklers.

6.2.3 READY! SET! GO!

The Orange County Fire Authority (OCFA) and the Community have adopted the OCFA "Ready! Set! Go!" Wildfire Action Plan, which was designed to provide the community with information on creating defensible space around their home, retrofitting their home with fire-resistive materials, and preparing them to safely evacuate well ahead of a wildfire. The "Ready! Set! Go!" Action Plan provides a three step

process that teaches homeowners to create their own Action Plan of preparedness, have situational awareness and leave early in the event of a fire. **READY –** Being ready for a wildfire starts with the property owner maintaining an adequate defensible space and hardening the home against flying embers by using fire resistive building materials. Get **SET –** Before a wildfire strikes, it's important to be set to get out. Creating an Wildfire Action Plan to include important phone numbers, what items to take and prepare to evacuate. Be sure to stay aware of the latest news from the local fire department and media outlet for updated information on the fire. And **GO –** If a wildfire strikes, be ready to go early for your safety. Take all evacuation steps necessary to give your family and home the best chance of surviving a wildfire. A list of all the OCFA "Ready! Set! Go!" Action Plan documents can be found on the OCFA website: https://ocfa.org/rsg/home-hardening/ and some of the documents are included as Appendix G of this CWPP.

6.2.4 CRITICAL INFRASTRUCTURE AND FACILITIES

As defined within the County's Local Hazard Mitigation Plan, a critical facility is defined as, "Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event." (County of Orange 2021).

6.2.4.1 UNDERGROUNDING POWER LINES

Power lines and the entire electrical grid are considered critical infrastructures and are vital to our society. Southern California Edison (SCE) is the primary electric provider for most of Laguna Beach, including for the Emerald Bay Community. All power lines throughout the interior portions of the Emerald Bay Community are currently installed underground. One of the key advantages of underground transmission and distribution lines is the significant reduction in vulnerability to disruption from wildfires by preventing the initial ignition and propagation caused by overhead powerlines. According to the U.S Department of energy (USDOE) there was a recorded 99% ignition risk reduction for wildfire ridden areas during Pacific Gas and Electric conversion from overhead lines to underground lines (USDOE 2024).

Overhead power lines do exist outside of the community and are adjacent to wildland fuels. Overhead have the potential for igniting wildfire in several ways, all of which have the potential to be mitigated for with proper mitigation design measures. The most common ways power lines can spark a wildfire include but are not limited to:

1.) Downed power lines – power lines can be knocked down by falling trees or strong winds, and remain energized until the electric company shuts it off. Down power lines in hot and/or dry climates could spark a fire if surrounding vegetation comes in contact with energized lines.

2.) Foreign Object – As mentioned above, dry vegetation on the ground that comes in contact with an energized downed power line can spark a fire, but this can also occur when trees become overgrown and branches come in contact with intact power lines. Objects such as tree branches can become a hazard and if contact is made with a powerline, a fire has the potential to spark.

3.) Equipment Failure – As the equipment on the overhead power lines ages, the more likely it is to become faulty or malfunction, which can cause sparks or overheating and can lead to risk of failure or fire.

There are effective fire prevention measures that can reduce or prevent utility-caused wildfire, including design considerations, regular maintenance, vegetation control, system operation prevention, and timely inspections. Design considerations can include replacing wood poles with non-combustible poles (i.e. fiberglass reinforced plastics, concrete, or steel); replacing outdated components with new, low fire options; and removing all overhead power lines and instead installing them underground.

Removing the existing overhead power lines throughout the perimeter portions of the Emerald Bay Community and burying them is something the Community has included as an Action Plan and something they would like to pursue further with SCE. Underground power lines offer several benefits for wildfire mitigation, including the elimination of nearly all ignition risks which prevent sparks caused by high winds, falling tree limbs and other debris contacting bare wires. Southern California Edison is working further to reduce the threat of wildfire by burying power lines in the highest fire-risk areas, especially where lines have not already been replaced by power conductors. SCE is targeting the highest fire-risk areas for undergrounding its power lines based on several conditions, including the difficulty for evacuating quickly during a significant wildfire event. SCE says that the targeted undergrounding efforts will make the electrical system more reliable during extreme weather conditions by protecting it from high winds, vegetation, and other hazards that could cause fires or power outages.[10] There are three (3) undergrounding work phases SCE is following during the targeted undergrounding project, including Planning, Permitting, and Construction.

In Orange County, specifically in the Laguna Beach area, there are seven (7) electric circuits that have been identified as power lines in the highest fire-risk areas. The 'Artist' circuit line provides electricity and power throughout the interior and along the perimeter of the Emerald Bay Community and has been identified as a circuit in the highest fire-risk area and a potential candidate to burying the power lines. Currently, the Planning Phase has been completed where a feasibility assessment of the 'Artist' circuit has been performed by SCE planners and surveyors to help determine the scope of work that will take in a selected community. The analysis is a critical assessment to determine if this type of work can be completed at the proposed location. It should be noted that the assessment is only to determine the feasibility of undergrounding power lines in the area identified, however, it is not guaranteed that SCE will perform this work in the community. Currently, the 'Artist' circuit is in the Permitting Phase which is in process. Once the scope of work is established, SCE can determine if permitting is required. Permitting approval may take as little as two months, or the process may be significantly longer. The 'Targeted Completion Date' for the 'Artist' circuit is 2026. To follow the Undergrounding Work Status for the 'Artist' circuit, the Emerald Bay Community can access this website: https://www.sce.com/outages-safety/wildfire-safety/targeted-undergrounding.

[10] SCE Targeted Undergrounding - https://www.sce.com/outages-safety/wildfire-safety/targeted-undergrounding

6.2.4.2 EMERALD BAY EMERGENCY ALERT SIREN WITH AI CAMERA

An emergency alert siren system is an outdoor warning system designed to alert/warn the public/Emerald Bay Community of an event or possible threat (i.e approaching wildfire event). The siren alerting systems are designed for outdoor alerting and can be used for increased emergency communication during widespread power and phone service outages that may occur during high winds, disasters of SCE Public Safety Power Shutoffs. The Emerald Bay Service District has prepared an Emergency Alert Siren presentation where the Emerald Bay Service District has proposed the installation of an outdoor emergency alert siren with the possible installation of an Artificial Intelligence (AI) fire detection camera. The Emerald Bay Service District has proposed three (3) potential sites at the Sweany Reservoir where the outdoor emergency siren could be installed, as this location was determined by experts to be the optimal location to notify the largest number of residents of an immediate threat. The three proposed locations for the proposed outdoor alert siren pole include:

- Location Optoin#1 – The lower southeast corner of the property. The main advantage of this location is the proposed site has a clear site line to Emerald Bay. However, this location provides the lowest elevation of the three proposed sites and would require the installation of a taller pole. Additionally, it was determined that this location would be the most difficult to maintain the pole and equipment.

- Location Option #2 – Located in the northwest portion of the Sweany Reservoir, close to the existing telemetry equipment area and pole owned by the Laguna Beach County Water District (LBCWD). The advantage of this location is that it is within the current cleared reservoir property and would not require additional disturbance to existing native plants and materials. However, it would be located near the entrance to the site and reservoir from the access road, potentially compromising access to the telemetry equipment.

- Location Option #3 – Located in the upper northwest corner of the Sweany Reservoir property. This location offers several advantages including being an area previously utilized for the construction of the reservoir; there are few native plants and other vegetation in this area; it would not impact the reservoir structure or reservoir operations; it located at the highest elevation, thus potentially lowering the height of the proposed pole; and there would be good access to the siren. However, the disadvantage is that it's located near communication equipment that is not associated with the LBCWD.

The Emerald Bay Service District recommends that Location Option #3 would be the best location to install the outdoor Emergency Siren System, as it would be located at the highest elevation, would not result in an significant compromise to habitat, allow easy access for installation and servicing over existing roads and easements, and the recommended location would house both the emergency siren and LBCWD telemetry equipment on one pole. The Emerald Bay Service District would work with the LBCWD on the proposed location and installation of the siren. The Emerald Bay Service District and LBCWD have agreed to place both the siren and LBCWD equipment on one new shared pole. And the Emerald Service District will work with the State Parks on mitigation measures to reduce raptor exposure at the top of the pole. The entire Emerald Bay Service District Emergency Siren presentation is included in this CWPP as Appendix H. **It should be noted that the Emerald Bay Community currently already has a fire camera installed next to the community pool near the perimeter wilderness park fence that faces**

into the canyon. This camera was installed in 2024 and provides the community with instantaneous, real-time fire alerts for faster notification and responses to a fire event. By identifying fire dangers early, the community can assist with earlier evacuation and potentially faster response to an incident and are becoming a staple in fire protection in high fire-risk areas.

6.3 Citygate Associates: Emerald Bay – Wildfire Preparedness Task Force – Initial Ideas/Suggestions

The Emerald Bay Service District hired Citygate Associates to conduct an inspection of the Community and develop various wildfire measures and recommendations to be included in an Emerald Bay – Wildfire Preparedness Task Force briefing. The initial idea/suggestions were discussed with OCFA to gain an understanding on whether OCFA was in support with the suggestions, did not support the suggestions, or did not have a position based on what they can offer or enforce. The Citygate Initial Wildfire Preparedness Taskforce Report and Community Wildfire Mitigation Planning Briefing Report are included in this CWPP as Appendix I1 and I2 for reference.

The Citygate Initial Wildfire Preparedness Taskforce Report breaks the report into various topics, including:

1) **Fuel Mitigation**

    a) Conduct more aggressive interior fuel modification

    b) Increase of Fuel Modification Zones

    c) Encourage more aggressive vegetation management of homeowners

    d) Ensure vegetation management of neighboring residents (i.e. City of Laguna Beach, Irvine Cove, and Smithcliffs residents who back onto Emerald Bay residents

    e) Consider other measures, such as anti-arson patrol untis

2) **Property/Home Hardening**

    a) Ensure all Association buildings are properly hardened

    b) Incentivize Members to harden their homes and create improved defensible space/vegetation management

    c) Investigate the possibility of undergrounding the power lines or coating them

    d) Consideration of power outage preparations

3) **Firefighting**

    a) Determine sufficiency of reservoirs and if any further improvements can be made

b) Evaluate and improve the Emerald Bay fire hydrant capabilities

c) Consider/Install water cannon/irrigation system

d) Utilization of fire retardant (Phos-Chek)

e) Consideration of private firefighters

f) Consideration of an Emerald Bay helipad

g) Consideration of water tankers and/or tank farms

h) Investigate modifications to existing canyon fire camera/siren

4) Education

a) Consider outreach to other Wildfire Preparedness Consultant Experts

b) Educate residents on Town Hall topics for those who did not attend

c) Establish Red Flag/High Wind communication and enforcement protocol

d) Educate residents based on insurance renewal information

e) Document all Wildfire Preparedness improvements and make accessible to Members for use with insurance renewals

5) Evacuation

a) Installation of an emergency siren

b) Consider efficacy of emergency communication

c) Evaluate emergency ingress/egress

d) Evaluate how to further aid ease of evacuation

6) Post-Fire Preparation

a) Investigate measures the Association would need to take post-wildfire destruction

b) Prepare a home replacement plan in event of destructive wildfire

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7 Recommendations

7.1 Fire Hazard Trees – Description

Given certain extreme fire conditions, all trees can burn during a wildfire, regardless of being under a fire-resistant classification. Whether a tree species will ignite, sustain the ignition, or spread is determined by characteristics that make them more flammable than other tree species.[11,12] Flammability can be defined as a combination of ignitability, combustibility, and sustainability, where ignitability is the ease or delay of ignition, combustibility is the rapidity with which a fire burns, and sustainability is a measure of how well a fire will continue to burn with or without an external heat source (White and Zipperer 2010). Flammability is influenced by several factors, which can be classified into two groups: physical structure (e.g., branch size, leaf size, leaf shape, surface-to-volume ratio, and/or retention of dead material) and physiological elements (e.g., volatile oils, resins, and/or moisture content) (Moritz and Svihra 1998; UCCE 2016; UCFPL 1997; White and Zipperer 2010). Trees that are less flammable have low surface-to-volume ratios, higher stored moisture contents, and minimal dead material or debris, while those that are more flammable have high surface-to-volume ratios, exhibit low moisture contents, contain volatile oils, and have high levels of dead material or debris (Moritz and Svihra 1998; UCCE 2016; UCFPL 1997; White and Zipperer 2010). Tree condition and maintenance are also important factors in flammability. Some tree species that have more flammable characteristics can become less flammable if well maintained and irrigated but can also be explosively flammable when poorly maintained or situated on south-facing slopes (high sun and heat exposure), in windy areas, or in poor soils (Moritz and Svihra 1998).

Research into plant flammability has resulted in the development of plant lists in many California fire jurisdictions intended to promote the planting and retention of less flammable plants in defensible space zones, the WUI, or areas where vegetation management aims to reduce fire hazard (UCCE 2016; UCFPL 1997; Nader et al. 2007; Moritz and Svihra 1998). Plant lists typically recommend lower flammability (or firewise) trees that are acceptable in fire hazard areas, or, conversely, highly flammable trees that are not recommended for retention or planting. Although these lists can be useful for tree selection in the urban forest, it should be noted that there are no fireproof tree species, especially if not provided proper care and maintenance. Appendix A2 shows the recommended species palette for both the urban forest and the WHAs.

7.2 Higher Flammability Trees

Tree species such as cedar (*Cedrus* spp.), cypress (*Cupressus spp*.), eucalyptus (*Eucalyptus* spp.), juniper (*Juniperus* spp.), pine (*Pinus* spp.), and various palm species are known to be more susceptible to burning due to rough or peeling bark; production of large amounts of litter; vegetation that contains oils, resin, wax, or pitch; or tree canopies that inherently include a high dead-to-live fuel ratio (e.g., large amounts of dead material in the tree canopy). These trees are deemed less resistant to ignition and widely considered by fire agencies as undesirable in wildfire hazard areas (WHAs).

11 Highly flammable tree species are also referred to as pyrophytes or pyrophytic.
12 It should be noted that tree species within the same genus do not always have the same flammability.

Existing trees of these species, along roadways or on private property, may be retainable if best management practices for maintenance in a WHA are in place. These practices include pruning, thinning, irrigation, litter removal, and ground plant maintenance, establishing and maintaining setbacks from structures, and providing spacing from other trees. Minimizing the likelihood of individual burning trees resulting in direct heat and/or flame impingement on a structure is achieved by establishing set-back distances where these trees exist or are planted. This will break any fuel chains that may facilitate fire advancing toward a structure. The description of species listed in the following sections is intended as a guide only for trees found throughout the Community and does not incorporate all flammable tree species outside of the Community. The following are characteristics for each identified genus of tree that makes them less desirable and deemed less resistant to wildfire within 100 feet of a structure or along primary emergency vehicle or evacuation routes.

7.2.1 Conifers

Conifers are evergreen tree species that have needles instead of leaves. Typical examples of conifer genera located in the Emerald Bay Community are cedar, cypress, juniper, and pine. Conifers produce needle or leaf litter and peeling bark and contain volatile oils and resins, potentially increasing their flammability.

- **Cedar** – Leaves are needle-like and contain a highly flammable resin. Cedars typically have a conic crown with level branches and drooping branchlets, which could encourage maximum updraft during a surface fire. Exhibit 9 shows an example of a typical cedar specimen growing throughout the Community.
- **Cypress** – Italian cypress are tall, upright trees, reaching 40 to 60 feet high and are trimmed or grown into many forms, ranging from broad and open, to narrow and columnar. Italian cypress are widely used in ornamental landscapes as screens, hedges, and individual plantings with their full canopy extending to the ground. The tight, columnar growth form of the tree allows for retention of dead material in the canopy, which is more likely to ignite during a wildfire event. As such, Italian cypress are known to become tall torches during wildfires. These species are commonly observed along private driveways and in close proximity to homes. Exhibit 10 shows an example of common planting arrangements for Italian cypresses seen throughout the Emerald Bay Community.
- **Pine** – Most pines are highly flammable. Fine pine needles produce a volatile organic compound or flammable gases (Gabbert 2014) that could be released and ignited. Additional features that promote ignition are heavy litter fall, flammable oils in the foliage, and retention of dead needles that promote ignition in the canopy (USFS 2013). Pine trees are common throughout the community park area. Pine trees are considered among the top priorities for reducing fire hazards, particularly on private properties, but also on public properties including evacuation corridors. Exhibit 11 shows an example of typical Canary Island pines seen sporadically throughout the Community.



Exhibit 11. Typical cedar

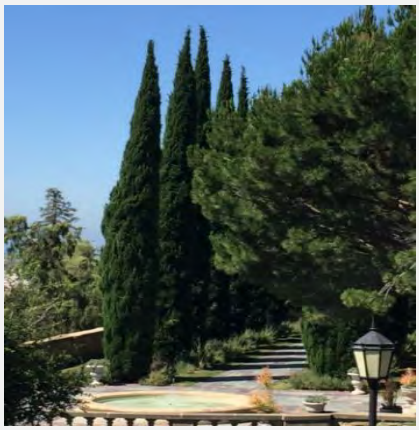


Exhibit 12. Typical Italian cypress



Exhibit 13. Typical Canary Island pines

7.2.2 Palms

Palm species contribute to increased fire hazard as evidenced by the 2007 wildfires in San Diego County. During San Diego County's damage assessment surveys, it was observed that certain species of palms increased the fire hazard due to form and lack of maintenance. It was discovered that species of palms that have fibrous tissue or leaf stem bases along the trunk can quickly ignite and consume the rest of the palm (Exhibit 12). Additionally, dried palm fronds that persist on the trunk, will form a "skirt" or petticoat of brown thatch. Such leaf-base skirts can present a high fire hazard. Once ignited, the dried palm fronds can also detach from the trunk and be carried by a wildfire's thermal column and/or strong wind for great distances, igniting anything combustible or interfering with utility lines, which can also ignite a fire. Palm species result in significant ember production that can ignite additional fires downwind. Palms are a dominant species planted throughout the Community and after pines are considered the highest priority in terms of higher flammability tree types.



Exhibit 14. Palm head burning from ember-caused fire, resulting in significant ember production

7.2.3 Eucalyptus

Eucalyptus trees occur throughout the Community, specifically along the perimeter portions of the Community, and carry sentimental and cultural significance to the Community but are considered a high priority to maintain sufficiently in WHAs. Eucalyptus trees tend to promote fire, because they produce a volatile (Gabbert 2014), highly combustible oil, and volatile organic compounds or flammable gases may be released from trees at very high temperatures, further increasing the fire hazard (Gross 2013). Fire promotion also occurs with the production of large amounts of litter, which is high in phenolics, preventing its breakdown by fungi (Reid and Potts 2005). This allows the accumulation of large amounts of dry, combustible fuel from eucalyptus trees.



Exhibit 15. Blue gum eucalyptus fire-hazardous bark

The leaves of Tasmanian bluegum (*Eucalyptus globulus*) trees may be moderately resistant to combustion under some circumstances (Dickinson and Kirkpatrick 1985). However, these trees are still considered highly flammable as the bark catches fire readily and deciduous bark streamers tend to carry fire into the canopy, producing embers that can be carried by strong winds (Exhibit 13). These flying embers are carried downwind and result in spot fires that ignite in receptive fuel beds in advance of the fire's leading edge (Ashton 1981; USFS 2015). Peeling bark is typical of many other eucalyptus species and contributes to ground-based fuels (litter) when it falls. Peeling bark is also retained on tree trunks, where it can facilitate ground-to-canopy fire transition (e.g., ladder fuel). Eucalyptus litter has a moderate surface-area-to-volume ratio, requiring moderate heat to remove fuel moisture and raise fuel to ignition temperature. Eucalyptus litter is subject to seasonal drying in the late summer and fall, but solar shading and windbreaks provided by the eucalyptus canopy can sustain high fuel moisture contents.

7.3 Fire-Resistant Trees in the Wildfire Hazard Area

Fire-resistant is a relative term used to describe trees that are "more resistant" to ignition than other tree species. For example, generally, deciduous trees are less flammable than conifers. Trees considered less flammable are less prone to ignite and sustain fire because of their physical characteristics. For the Emerald Bay Community, tree selection should be guided through a "right tree, right place, right reason" approach to ensure that fire safety is adequately considered for existing trees and new trees planted. The following is a list of general plant characteristics that contribute to their fire resistance:

- Moisture content in leaves[13] (leaves with high moisture content ignite and burn more slowly);
- Leaf type (broadleaf trees are less flammable than those with needles and bladelike leaves);

[13] Deciduous trees are generally more fire resistant than evergreens because they have higher moisture content when in leaf.

- Non-resinous material on the tree[14] (stems, leaves, or needles that are not resinous, oily, or waxy do not burn as readily);
- Leaf thickness (thick tree leaves are less flammable than fine or thin leaves);
- Sap viscosity (trees with sap that looks more like water are less flammable than trees with thick, gummy, or resinous sap);
- Branching habits (trees with open branching habits or fewer total branches with leaves provide less fuel for fires);
- Accumulation of dead plant material (trees with little or no seasonal accumulation of dead plant material are less flammable than trees that accumulate large quantities of dead plant material); and
- Litter (trees that produce a low amount of litter are less flammable than those that produce large quantities of litter).

"Right tree in the right place" depends on the site specifications of where a tree will be planted. Recommendations to avoid certain tree species throughout the Community is not necessarily a recommendation to avoid them in other parts of the urban forest, hence "right reason." In the Community, the priority is safety from wildfire, necessitating these guidelines for trees in the area. In the urban forest, considerations such as increasing canopy cover, decreasing the urban heat island effect, carbon sequestration, and cooling neighborhoods may be reasons for planting urban trees.

7.4 Selecting Appropriate Trees

Tree species selection for properties throughout the Community should be carefully considered. Sound wildfire preparation and prevention includes the proper selection of fire-resistant tree species in the landscape, suitable locations away from protected assets, and a plan for maintaining the trees throughout their lifespan by utilizing arboriculture best management practices along with WHA considerations. Fire-resistant trees, like drought-tolerant plants, should be able to withstand low water (drought) and high temperature conditions while still maintaining their overall health, aesthetic, and functional qualities. When selecting trees for a landscape within the Community, the following guidelines are recommended:

- Select fire-resistant tree species from the OCFA Fuel Modification zone Plant List in Appendix A2 and avoid species listed in Appendix A1;
- Avoid planting hazardous trees such as juniper, cypress, cedar, pine, palm, and eucalyptus;
- Group trees according to their irrigation needs;
- Consider proper setbacks from structures, roadways, and other trees; and
- Provide regular tree care, especially to ensure fire resistance (see Section 7 for arboriculture care guidelines).

Certain native species, such as oaks *(Quercus* spp.), are highly flame resistant as the leaves do not readily catch fire. Fires in oak stands tend to smolder in the duff and consume surface fuels without generating enough heat to carry fire into the oak canopy (USFS 2023). In addition, oaks also do not spread fire crown-to-crown readily like many conifers. Oak woodland litter does little to facilitate fire spread because it has

[14] Juniper, pine, spruce, fir, and cypress are resinous or oily and therefore highly flammable.

a low surface-area-to-volume ratio and requires high heat levels to remove fuel moisture and raise the fuel to ignition temperature. Oaks have a low content of volatile organic compounds, and the lack of highly combustible oils further reduces the fire hazard associated with oaks and oak woodlands. While oaks present many fire-resistant qualities, lack of routine maintenance such as pruning and crown separation may increase fire hazard. Emerald Bay and OCFA encourage the purposeful use of native plants and trees in defensible landscaping plans. These species are well adapted to the natural rainfall and wildfire cycles of the chaparral ecosystems of the Transverse Ranges. When used in a well-designed landscape, native plants and trees can provide additional wildfire resistance when combined with continuous maintenance and proper irrigation (UCFPL 1997).

7.4.1 HILLSIDES

The risks of fire and erosion, along with the costs of installation and maintenance, rise for every degree of a hill's incline (Kent 2005). Planting trees on hillsides provides value in erosion control but needs to balance hillside stability with the value of maintaining views of the valley and mountains. The best trees for hillsides produce minimal fuel, grow shorter in height, and are easier to maintain on steeper, erodible slopes. As such, these tree species survive and thrive under the site's natural conditions, including soil type and depth, sun exposure, and water availability. Likewise, these trees will not result in current or future obstruction of views.

7.4.2 FUEL MODIFICATION ZONES

Providing fuel modification zones reduces the risk of structural ignition during a wildfire event. A fuel modification zone is the area between a structure and natural vegetation where drought-tolerant, fire-resistant vegetation is planted and maintained with the intent to decrease wildfire threat. In addition to protecting structures, fuel modification should occur within 30 feet of the outer edge of usable road surfaces. Fuel modification reduces radiant and convective heat, reducing the amount of heat exposure on the roadway or structure, and provides an area for wildfire suppression operations to safely occur.

Fire-resistant and lower-flammability tree species should be planted in fuel modification areas. Fire-resistant trees are acceptable in fuel modification zones when they are properly spaced horizontally and are not subject to ladder fuels.[15] If a wildfire occurs, horizontal and vertical separation between plants and trees minimizes the spread of fire between the vegetation and structures. Additionally, it reduces the potential hazard associated with roadside vegetation, which can result in traffic flow interruption along evacuation routes.

[15] Ladder fuels are flammable plant material that can transmit fire burning in low-growing vegetation into a tree crown. Examples of ladder fuels include low-lying tree branches and shrubs, climbing vines, and tree-form shrubs underneath the canopy of a large tree.

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8 Annual Maintenance

Trees in WHAs, specifically throughout the Emerald Bay Community, require maintenance practices to increase horizontal spacing between retained trees to reduce the potential for crown fire spread. These practices remove fuel ladders by increasing the vertical spacing between surface fuels (shrubs, grasses) and tree crowns to reduce the potential for surface-to-crown fire transition. Creating more fire-resilient trees involves a three-part process: (1) reducing surface fuels, (2) reducing ladder fuels (i.e., fuel that can facilitate fire spread from ground fuels into tree crowns), and (3) reducing tree crown density through crown thinning (USFS 2013). As noted by Nunamaker et al. (2007), surface and ladder fuels should have the highest priority for management to reduce fire intensity, rate of spread, and crown fire potential. Active crown fires are initiated with torching but are ultimately sustained by the density of the overstory crowns. Reduction in potential surface fire behavior plus an increase in canopy base height minimizes torching potential (Agee and Skinner 2005).

The vegetation management and tree maintenance standards presented in this chapter are intended to reduce fire hazard by rearranging and maintaining the fuels' spatial distribution. All vegetation, including trees, will burn, given the right conditions (Reinhardt et al. 2008). Therefore, the goal of fuel treatment is not to remove all trees or vegetation, but to minimize the potential for ignitions, crown fires, and extreme fire behavior by reducing fuel loads and altering the retained vegetation structure, composition, and spacing (horizontal and vertical).

8.1 Tree Arrangement

Fire spreads both horizontally (from shrub to shrub or treetop to treetop) and vertically (from understory vegetation to tree). Greater fire hazard exists where spacing between trees and between shrubs and lower branches are close enough for fire to preheat vegetation and ignite across the gap, either horizontally or vertically. If a ground fire transitions into a tree canopy fire, it will quickly spread from one tree to closely adjacent trees. The primary goal of fuel arrangement is to break up the continuity of the fuel bed through proper tree spacing. To accomplish this, the following recommendations are provided and align with the CAL FIRE Defensible Space guidelines (CAL FIRE 2024):

- For slopes that are less than 20%, trim or space trees to provide 10 feet of space between the tips of tree limbs; trees should be limited to groupings of two to three trees with each grouping separated horizontally as described herein;
- Increase spacing to 20 feet for slopes that are 20% to 40%; and
- For steep slopes over 40%, 30 feet of spacing is needed;[16] when planting individual or small groupings of trees, allow for future growth by spacing them 20 to 30 feet apart.

Fire hazard mitigation recommendations focus on limiting the fire to the ground and preventing it from spreading into a tree canopy. To reduce the fire-spreading potential of trees taller than 18 feet, prune the lower limbs up to a height of six feet. If the tree is shorter than 18 feet, all branches and foliage should

[16] Adapted from Simmerman and Fischer (1990).

be removed from the lowest 1/3 of the tree. In addition, other ladder fuels, such as shrubs, should be removed around the base of trees.

8.2 Pruning Practices

Lack of attention to tree crowns of any species can result in trees accumulating dead twigs, leaves, and branches, regardless of being categorized as "fire resistant." This buildup of dead fuels in the canopy can easily result in trees becoming very flammable. Removing dead limbs and branches adjacent to or overhanging any building or structure decreases the potential for structure ignitions. Prune branches to remove flammable vegetation within 10 feet from a chimney outlet. It is recommended that tree pruning is completed by an International Society of Arboriculture Certified Arborist in accordance with American National Standards Institute A300 specifications (ANSI 2017). This will ensure trees will be maintained with the least amount of pruning necessary to meet WHA maintenance recommendations and support tree longevity. Although the following species are not recommended in WHAs, existing palm and eucalyptus trees can be maintained to decrease fire risk.

- **Pruning Standards for Palms** – If not properly pruned, certain species of palms, such as Mexican fan palm, can accumulate large collars of dried and highly flammable fronds. For established palms in the landscape, removing dead material and skinning their trunks minimizes ignition potential. Removing or reducing flammable vegetation adjacent to or growing along any palm eliminates an ignition source. Watch for signs of disease or stress to ensure that the palm is healthy.
- **Pruning Standards for Eucalyptus** – All vegetation should be removed around the base of individual trees. Small-diameter limbs should be removed to at least 1/3 of the tree's height, and all limbs within 10 feet of the ground should be removed. Dead wood, peeling bark, and other twiggy growth should be removed with a designated frequency to minimize potential buildup of tree debris. Individual tree canopies should be separated so that tree crowns are not touching and adequate spacing exists between trees.

8.3 Tree Removal and Replacement Recommendations

8.3.1 TREE REMOVALS

All trees in both urban and undisturbed areas have a lifespan within the landscape dependent partially on the care and maintenance they receive. When a tree's related costs (maintenance, watering, pruning, or hazard level) outweigh its benefits (aesthetics, energy conservation, air quality, etc.) tree removal should be considered with a replanting plan. Dead, declining, or diseased trees should be removed from the community before they present a hazard. However, tree removals should be justified based on a condition assessment, a cost-benefit analysis, a hazard evaluation, or by other fact-based methods that justify removal as being the best approach. Removing large trees results in a loss of valuable environmental services and economic benefits that are not easily or quickly replaced. For trees removed in the Community, replacement trees should not include highly flammable species; species such as juniper, cypress, cedar, pine, palm, and eucalyptus should be avoided.

8.3.1.1 EVACUATION CORRIDOR TREE MANAGEMENT RECOMMENDATIONS

Potential fire hazards exist along evacuation corridors throughout the Community. Some parkways and medians along evacuation corridors include species more likely to ignite from wildfire and/or embers, such as pine, palm, and eucalyptus. However, fuel receptivity to embers is a key determining factor for the likelihood of ignitions, potentially compromising evacuation routes. Fuel receptivity in tree species increases when there is a high proportion of dead plant material in the crown or in branch crotches; dry, light, and airy foliage; shaggy or peeling bark; very fine leaves; low moisture levels in foliage; high levels of internal gums, terpenes, oils, or resins available to embers; and/or accumulated dead, dry material beneath the trees. Trees along the evacuation routes vary in their overall condition. Trees exhibit some characteristics that could contribute to elevating potential flammability. However, trees are often situated in irrigated landscapes, resulting in a high internal moisture level within the foliage, twigs, and branches, decreasing potential flammability. Additionally, slow and deep watering at the establishment care phase of a newly planted tree to arboriculture best management practices, supports development of a proper root system. Proper watering after planting helps develop a root system that increases resilience of trees to storm impacts. For the most part, Emerald Bay's WHA is within a highly developed/disturbed condition that does not include large expanses of unmaintained wildland fuels. Wildfire spreads most easily through uninterrupted fuels, such as late dry season chaparral-covered slopes. This condition is limited within the Community with irrigated, high moisture level landscapes, dominating the area.

Wildfire can spread from areas north and east, toward Emerald Bay, driven by Santa Ana winds and available fuels; however, the conversion of unmaintained fuels to urban landscapes is predicted to reduce spread rates encroaching into the community. The highest risk is seen by residences not hardened against flying embers and include receptive vegetative fuels within close proximity to structures. Note that pine, eucalyptus, and other trees considered more flammable do not automatically burn in a wildfire, particularly, when they have been maintained. For example, as illustrated in Exhibits 14 and 15, some wildfire after-action reports document structure losses while the surrounding landscape, including pine and eucalyptus, remained virtually unscathed, highlighting the importance of maintaining an ignition-resistant landscape. While urban forest species composition and condition are large drivers of community wildfire risk, other factors such as ignition-resistant construction and landscaping are essential to holistic community wildfire risk reduction.



Exhibit 16. 2018 Camp Fire in Northern California's Butte County home losses amongst standing pine forest. Homes burned due to ember penetration vs. from pine trees burning and igniting the homes.



Exhibit 17. 2003 Cedar Fire in Scripps Ranch, San Diego County, with numerous burned structures while landscape trees remain largely intact.

Based on the evaluation of evacuation corridor trees, continuing the community's high level of tree maintenance along evacuation routes and further reducing the potential fuel receptivity where needed will further decrease wildfire risks during evacuations. Providing additional pruning/crown raising where trees occur close to private property and/or vertical vegetation will further decrease risk along the corridor.

Inspections of pine, palm, cypress, eucalyptus, cedar, and juniper on a twice-annual basis and providing necessary maintenance is seen as a valuable method to decrease fire risk in those areas. Because the trees are along critical evacuation corridors, it is recommended that trees identified to be in poor health or contain structural deficits should be removed and replaced with an appropriate species.

"Short-term tree removal" refers to the removal of trees considered the most likely to be hazardous based on their current condition. "Long-term tree removal phases" denotes tree removal of potentially hazardous trees with lower priority to reduce fire hazard along evacuation routes over time. The short-term actions recommend the removal of the highest priority trees and replacement with appropriate tree species that consider sustainability diversity goals, climate adaptability, fire and pest resistivity, and return on investment, amongst other benefits. These newly planted trees will offset the losses incurred

by removing older trees, while the species palette is adjusted long-term to increase fire resistance along evacuation corridors. Implementing a long-term approach to tree removal along with a short-term removal plan decreases wildfire risk in high priority areas, and enables the removal and replacement of lower priority hazardous trees over time.

8.3.1.2 WILDFIRE HAZARD AREA EVACUATION ROUTE RECOMMENDATIONS

The following list summarizes recommended actions to reduce wildfire hazard along evacuation routes.

- Remove trees that have structural deficiencies or are in poor health (leaning, poor branch attachments, stressed health condition, or others);
- Lift tree crowns even higher than their current height (approximately 20 feet aboveground) where necessary, to create separation from adjacent privately managed trees and landscaping;
- Increase maintenance levels and provide crown thinning to further reduce the wind sail effect that results in toppled trees and blocked streets during a Santa Ana wind event;
- Elevate tree monitoring levels to occur more frequently (at least twice per year and after major storm events) for structural issues;
- Implement an aggressive weekly inspection program during higher fire risk periods of May through November;
- Implement a Community-wide Emergency Management program to include documented PACE (primary, alternative, contingency, and emergency) plans should evacuation corridors be impacted by a fallen tree or tree part, vehicle accident, or another unforeseen event; and
- During wind events and periods of elevated wildfire risk, continue readiness of in-house crews, with back up reliable tree contractors, to prioritize timely removal of downed trees.

8.3.1.3 PRIVATE PROPERTY WILDFIRE HAZARD AREA TREE MAINTENANCE RECOMMENDATIONS

The occurrence of higher flammability tree species within the Community and the potential risk represented is based on the following:

- The location on the private property in relation to the residence or other structures and to the neighboring property's residence or other structures;
- The level of maintenance the trees are receiving; and
- The number and configuration of higher flammability trees and the overall density on the property.

Depending on these factors, the fire risk associated with a particular tree or group of trees may be very high or within an acceptable level. The overall approach to managing the higher flammable tree species on private property is recommended to include a layered approach. This approach would include the following:

- Enforcing fuel modification zone/defensible space policies that progressively restrict the occurrence of higher flammability tree species in the area within a minimum 100 feet of structures;

- Looking for avenues to enforce fuel modification zone/defensible space policies in communities that do not have an approved fire protection plan;
- Requiring higher flammability tree species beyond the 30-foot structure protection area to be maintained in a condition that reduces ember receptivity; this would include keeping the trees hydrated and monitored for health and crowns thinned and raised above adjacent vegetation;
- Increasing the distance from structures to at least 50 feet where groupings of higher flammability tree species occur and ensuring that the grouping of trees is separated from nearby vegetation by similar distances; all trees in the group are to be maintained to arboriculture best management practices;
- Removing uninterrupted tree fuel chains (including trees and other vegetation) from high hazard species to the structure(s), where necessary, to provide breaks (minimum 10 feet) between tree crowns and/or large shrubs;
- Requiring landscaping updates for new or remodeled homes that meet the County's fuel modification requirements and do not include higher flammability tree species; a physical site inspection should occur upon completion of landscape construction;
- Requiring adjacent property owners who have a higher flammability tree species within a neighboring property's 30- or 50-foot structure protection zone to maintain the tree species in accordance with WHA best practices; and
- Providing training, hiring expertise, or contracting with a qualified consultant to perform landscape reviews and inspections and to routinely inspect the WHAs for use of undesirable/prohibited tree species.

8.3.2 TREE REPLACEMENT

Replacement of trees in the Community should not include species listed in the OCFA Prohibited Plants and Trees list (Appendix A1) and should consider the concept of "right tree, right place, right reason" for each specific site.

8.4 Watering

When establishing new trees, deep, infrequent (weekly) watering ensures water slowly percolates into 12 inches of soil, allowing roots to establish into landscape. Once a tree is established in approximately the first three years after planting, supplemental watering is only necessary during periods of extreme heat or prolonged drought. Deep watering during the establishment period encourages root growth beyond the surface, which would occur if shallow or broadcast irrigation was used to establish the tree. Deep watering is a best practice to establish the root system of newly planted trees into the landscape, helping to reduce the likelihood of storm- or wind-related failure in the future.

When extreme heat or drought is experienced, mature trees may benefit from supplemental watering once per month around the dripline.

During predicted high heat events, dry periods, and drought, trees with shallow roots struggle to intake enough water from the top of the soil, which dries out first (Davey Tree Expert Company 2021). Deep watering stimulates trees to produce broad and deep root systems, resulting in trees that are better able to survive drought and are more solidly anchored and able to withstand significant winds. This technique

also uses less water, which provides greater security so that the tree can survive through extended drought conditions where water restrictions might be in place. Keeping trees throughout the Community sufficiently irrigated decreases the risk of ignitions and/or extreme fire behavior.

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9 Action Plan

This section identifies the goals of the CWPP and identifies recommended action items to be implemented by the Community that serve to minimize wildfire impacts to the community. These action items have been listed based on priority, with the first action item being the highest priority and a near term priority and the last action item being a long term priority. Future projects and actions identified in this section need to be funded and approved by the Community and County prior to implementation.

9.1 Goals

The goal of this CWPP is to identify action items that can be implemented by the Community that serve to protect lives, property, and natural resources threatened by wildland fire. The Community and the OCFA recognize the catastrophic impact of wildfire in the community and are committed to reducing hazards and risk through fire protection, fuel hazard reduction, public education, preparedness, and community involvement.

9.2 Action Items

The policies and actions outlined in this section are proposed for implementation under this CWPP. Action items 9.2.1 through 9.2.5 should be considered action items that are completed first and considered near term priorities, while the remaining action items should be considered longer term priorities. Recommendations for each action are provided.

9.2.1 HOME HARDENING GOALS, OBJECTIVES, AND ACTION ITEMS (PRIORITY 1)

Terrain, vegetation, and climatic conditions in the Community Plan Area combine to create a unique situation capable of supporting large-scale, high-intensity, and sometimes damaging wildfires. There are two main components to reducing structural ignitability: structural hardening and defensible space. The following sections identify actions that can be implemented by homeowners on private properties to reduce the potential for structure ignitions.

The main way in which structures ignite is via direct fire exposure (flame impingement, convection, radiation) or via ember exposure (Maranghides et al. 2022). To reduce structural ignitability, efforts need to address direct fire and ember exposure (Maranghides et al. 2022). Addressing structural ignition potential is an effective mitigation strategy for preventing wildfires and increasing WUI ignition resistance (Zhou 2013). Research has found that structural characteristics, especially roofing, play a significant role in reducing structural vulnerability to fire and the likelihood of burning (Bracmort and Gorte 2012; Kolden and Henson 2019; Manzello et al. 2011; Zhou 2013). Further, reducing a structure's likelihood of ignitions reduces the risk for individual homeowners and the risk associated with fire spreading to other homes and wildland areas (Mockrin et al. 2020).

Although fire-resistant construction standards are mandatory for new buildings, hardening of existing structures is voluntary. Hardening of the homes and other structures to enhance survivability during a

wildfire would include retrofitting the most vulnerable home features, including roofs, vents, eaves and soffits, windows, walls, decks, rain gutters, patio covers, chimneys, garages, and fences. Adopting mandatory home hardening provisions of building and fire codes is problematic because existing, nonconforming structures were typically approved and built to the codes in effect at the time of construction. A burning structure contributes to wildfire spread via radiant heat generation (to nearby structures) and ember generation (to downwind structures). Retrofits to existing structures can reduce fire risk, and some cost-sharing and grant programs may be available to offset costs. Resources for hardening structures can be found on the following websites:

- IBHS Wildfire Prepared Neighborhood and Home Technical Standards
- Wildfire Home Retrofit Guide
- Protect Your Property from Wildfire
- Prepare for Wildfire

In addition to the resources above, the following actions are recommended to address structural ignitability throughout the Community:

- Evaluate opportunities for engaging residents in structural retrofit programs. Encourage structure retrofitting projects at the community scale to reduce costs.
- Encourage structural retrofits for structures through inspections, community education, and grant funding opportunities.
- Work to increase the quantity of structures inspected and increase compliance levels resulting from Fire Hazard Reduction Inspection efforts through quarterly inspection goal setting.
- Educate community members about structural hardening actions, including cost-effective measures in community education and outreach materials and campaigns.
- Include structure inspections in tandem with existing defensible space inspection programs.
- Explore the feasibility of requiring certain components of existing homes to meet structural hardening requirements when triggered by a set standard - i.e., when building permit are required or when a large remodel occurs.

9.2.2 FUEL MODIFICATION ZONE/DEFENSIBLE SPACE GOAL, OBJECTIVES, AND ACTION ITEM (PRIORITY 2)

9.2.2.1 GOAL: INCREASE THE PERIMETER FUEL MODIFICATION ZONE/DEFENSIBLE SPACE WIDTHS FROM OCFA-REQUIRED 170 FEET UP TO 400 FEET

The primary goal is to gradually increase the perimeter fuel modification zone widths around the northern and western property boundaries from the OCFA-required and California State Parks/County of Orange Parks maximum 170 feet up to 400 feet, as justified by the fire modeling results presented in Section 4.2. As described above, the Emerald Bay Community currently provides fuel modifications up to 170 feet around

the perimeter of the community. Specifically, the Emerald Bay Service District provides fuel modification on an annual basis up to 170 feet outside the Emerald Bay property lines within naturally-vegetated open space areas on both California State Parks' property (along the western portion of the community) and County of Orange Parks and Recreations' property (along the northern portion of the community).

The potential for damaging wildfire exists within the Emerald Bay Community due to the terrain, existing vegetation types and fuel load amounts, and local climate north and west of the Emerald Bay Community. The Model Results presented in Section 4.2 show that a wildfire originating 1- to- 2 miles north of the Emerald Bay Community driven by 35 mph winds, was modeled to spread in a southwest direction rapidly towards the Community, potentially reaching the Community within approximately 45-minutes. The wildfire spread towards the Community is amplified through high load shrubs and topography that funnels and accelerates northeastern winds. Within the Community's perimeter fuel modification zones, flame lengths range from approximately 12 to 25 feet depending on fuel types, slope, and local wind speeds. As a result, there is a considerable risk of direct flame exposure to the structures along the perimeter edges of the Emerald Bay Community with areas of concentrated extreme fire behavior within approximately 400 feet of the Community Boundary. Because of this, one of the Action Plan Goals of this CWPP is to increase the perimeter Fuel Modification Zone widths from 170 feet up to 400 feet with certain limitations. See Action Plan Goals and Objectives above and below. Expanding the fuel modification zone widths around the northern and western perimeters of the Emerald Bay Community offers numerous benefits, including a wider buffer between human development and the naturally-vegetated open space areas, reducing the intensity and speed of a wildfire as it approaches the perimeter of the Community, and creating an overall safer environment for those living in the Community and firefighters.

9.2.2.2 OBJECTIVE: INCREASE THE PERIMETER FUEL MODIFICATION/DEFENSIBLE SPACE FROM 170 FEET UP TO 400 FEET

- **Action Item 1** – After conducting the Wildfire Hazard Assessment for the Emerald Bay Community, it was concluded that there is a considerable risk of direct flame exposure to the structures along the perimeter edges of the Community with areas of extreme fire behavior within approximately 400 feet of the Community. It would be beneficial to the Community to increase the fuel modification/defensible space around the northern and western perimeter edges to up to 400 feet where possible. Within the areas between 170 feet and up to 400 feet, selective pruning to the existing vegetation would be performed to reduce the overall fuel load within 400 feet of the perimeter structures and create appropriate vertical and horizontal spacing between shrub and plant species.

  This is in alignment with the Citygate recommendations and would require agreement with California State Parks and Orange County Parks.

- **Action Item 2** – To mitigate for the increase of an additional 230 feet of fuel modification/defensible space, the installation of more optutia throughout the thinning areas would be proposed to the California State Parks and Orange County Parks. In addition to more opuntia, the planting of coast live oak (*Quercus agrifolia)* as fire mitigation measures would be proposed and the canopies would act as potential ember catchers.

9.2.2.3 GOAL: ENCOURAGE MORE AGGRESSIVE VEGETATION MANAGEMENT OF HOMEOWNERS

9.2.2.4 OBJECTIVE: REDUCE THE AMOUNT OF VEGETATION IN CLOSE PROXIMITY TO STRUCTURES

- **Action Item 1** – Require greater vegetation management and defensible space around each individual structure. Residents should be required to start implementing the Immediate Zone 0 requirements (0 to 5 feet of the structure) by removing combustible vegetation such as combustible mulches and maintaining that trees are pruned 10 or more feet from touching roof and eaves. Furthermore, in alignment with OCFA, it's recommended to remove palm trees and cypress trees in close proximity to structures.

9.2.3 IMPLEMENTATION OF AN OUTDOOR EMERGENCY SIREN SYSTEM WITH AI CAMERA (PRIORITY 3)

9.2.3.1 GOAL: ADOPT AND INSTALL AN OUTDOOR EMERGENCY SIREN SYSTEM WITH AI CAMERA

An emergency alert siren system is an outdoor warning system designed to alert/warn the public/Emerald Bay Community of an event or possible event (i.e wildfire event). The siren alerting systems are designed for outdoor alerting and can be used for increased emergency communication during widespread power and phone service outages that may occur during high winds, disasters of SCE Public Safety Power Shutoffs.

9.2.3.2 OBJECTIVE 1: INSTALL OUTDOOR EMERGENCY SIREN

- **Action Item 1 –** Implement the Emergency Alert Siren plan prepared by the Emerald Bay Service District where the Emerald Bay Service District has proposed the installation of an outdoor emergency alert siren with the possible installation of an Artificial Intelligence (AI) fire detection camera.
- **Action Item 2 –** Determine the best location for the installation of the outdoor emergency siren system. The Emerald Bay Service District has proposed three (3) potential sites at the Sweany Reservoir where the outdoor emergency siren could be installed, with option #3 located in the upper northwest corner being determined as the best location. This option was determined by experts to be the optimal location to notify the largest number of residents of an immediate threat.
- **Action Item 3 –** Work with LBCWD and California State Parks to finalize the appropriate location for the siren.
- **Action Item 4 –** After determining the best location for the installation of the siren, work with the LBCWD and California State Parks to finalize the documentation needed to complete the installation of an outdoor emergency siren.

9.2.4 CODES AND STANDARDS: GOALS, OBJECTIVES, AND ACTION ITEMS (PRIORITY 4)

9.2.4.1 GOAL 1: INCREASE THE SURVIVABILITY OF COMMUNITY HOMES IN THE VERY HIGH FIRE HAZARD SEVERITY ZONE AREAS THROUGH THE ADOPTION OF FIRE SAFE BUILDING CODES.

- Monitor changes in Fire, Building, and Residential codes. Modify and adopt codes as needed.
- Encourage structural hardening retrofits for existing structures in the VHFHSZ Areas, consistent with the standards in the most current version of Chapter 7A of the California Building Code or other resources (Section 5.2.2.1). Structural retrofits may include, but are not limited to, the following:
  - Class A roof system
  - Ember-resistant vents
  - Plug all openings to prevent ember intrusion
  - Multi-paned windows with at least one or both panes tempered
  - Noncombustible, ignition-resistant-compliant exterior siding and decks
  - Automatic closing exterior doors
  - Battery backup for garage door opener (works when power is out)

9.2.4.2 GOAL 2: INCREASE THE SURVIVABILITY OF HOMES IN THE VERY HIGH FIRE HAZARD SEVERITY ZONE AREAS THROUGH THE ADOPTION OF DEFENSIBLE SPACE STANDARDS AND LANDSCAPE GUIDELINES ON NEW, REMODELED, AND EXISTING HOMES.

- Require additions or remodels of existing residential properties in the VHFHSZ Areas to comply with the OCFA Fuel Modification Zone and Defensible requirements and Fire Hazard Reduction Programs.
- Routinely review and update, as necessary, the County's Fuel Modification Zone and Defensible Space Landscape Requirements document (for defensible space), including the Plant Selection Guidelines and Plant Right document.

9.2.4.3 GOAL 3: CREATE A DEFENSIBLE COMMUNITY BY INCREASING THE NUMBER OF HOMES THAT COMPLY WITH THE OCFA DEFENSIBLE SPACE REQUIREMENTS.

- Complete a survey of all homes in the VHFHSZ Areas to determine the percentage of homes that comply with the OCFA Defensible Space and Fuel Modification Requirements. This typically is completed annually by an OCFA Fire Technician.
- Continue vacant lot brush management and defensible enforcement on undeveloped and developed properties within the VHFHSZ Areas.
- Evaluate ways to allow OCFA to work with insurance companies and private property owners in reducing fire hazard on individual properties and within neighborhoods.

9.2.5 ACCESS AND EVACUATION: GOAL, OBJECTIVES, AND ACTION ITEMS (PRIORITY 5)

The Community Plan Area presents unique challenges for evacuation due to limited radio and cellular communication capabilities in some portions of the Community, narrow/winding road networks throughout the Community, dead-end roads, and emergency evacuation routes that lead south to Pacific Coast Highway and include locked access gates into and out of the Community. Providing and maintaining road access throughout the Community (I.e. maintain narrow roads with red curbing free of parked cars) can help facilitate fire suppression efforts during wildfire events and support pre-fire mitigation activities. Finally, controlling public access in strategic areas, and at strategic times (e.g., during Red Flag Warnings), can minimize wildfire ignition potential.

The following summarizes different components of wildfire evacuation in the Community Plan Area:

- Prioritizing the maintenance of red curbs (no parking zones) is crucial for community evacuation because it ensures streets remain clear for rapid emergency vehicle access and maximizes traffic capacity during mass evacuations. Unobstructed roads prevent congestion, allowing emergency vehicles the proper access to reach threats and residents to evacuate safely without being blocked by parked cars. Having clearly marked red curbs on narrow and dead-end roads help manage traffic flow, reducing congestion and enabling a faster, more organized exit for residents.

- The Orange County Sheriff's Department (OCSD) is responsible for alerting and warning the public, coordinating evacuations, enforcing laws and emergency orders, establishing safe traffic routes, ensuring that security is provided at incident facilities, ensuring access control to damaged areas, ordering and coordinating appropriate mutual aid resources, and assuming responsibility for the coroner function. The OCSD works in conjunction with the Laguna Beach Police Department (LBPD) to order and lift evacuation notices within the Community Plan Area.

- The City of Laguna Beach and Orange County use AlertOC as its primary reverse 911 system for emergency notifications. AlertOC is Orange County's regional mass notification system designed to keep residents and businesses informed of emergencies that may require immediate life-saving actions. By registering with AlertOC, time-sensitive voice messages from the County or City in which you live may be sent to your home or cell phone. Visit the AlertOC website to sign up for alerts: https://member.everbridge.net/453003085613900/login

- The LBPD communicates the need for evacuation to the public using various communication methods, including AlertOC, Alert Laguna Beach, outdoor warning system Alerts, the Emergency Alert System (EAS) supported by the National Weather Service broadcast, radio and television announcements, public address systems and announcements from emergency responders, door-to-door notifications, and social media.

- LBPD and OCFA/LBFD have an Incident Evacuation Plan and Incident Re-Entry Plan that assist law enforcement and fire department personnel in the implementation of evacuation plans. These plans guide agencies in the decision-making process for evacuation and re-entry of residents, and small and large animals. Evacuation levels defined in the existing plan are as follows:

- Evacuation Order – Movement of community members out of a defined area due to an immediate threat to life and property from an emergency incident. An Evacuation Order should be used when there is a potential or actual threat to civilian life within 1 to 2 hours.
- Evacuation Warning – Alerting residents in a defined area of a potential threat to life and property from an emergency incident. An Evacuation Warning may be issued when the potential or actual threat to civilian life is more than 2 hours away.
- Shelter in Place – Directs residents to stay secured inside their current location. This direction is only used if the safety of the citizens can be assured if they remain or if an evacuation will cause a higher potential for loss of life.
- Safe Refuge Area – A temporary safe location to hold evacuees until evacuation routes are open.

The City of Laguna Beach is broken down into 20 different Evacuation Management Zones. Each zone has a specific evacuation map which can be found here: https://www.lagunabeachcity.net/live-here/emergency-management/evacuation-planning. The Emerald Bay Community is part of Laguna Beach Evacuation Zone 12. See exhibit below that identifies the Emerald Bay evacuation routes.

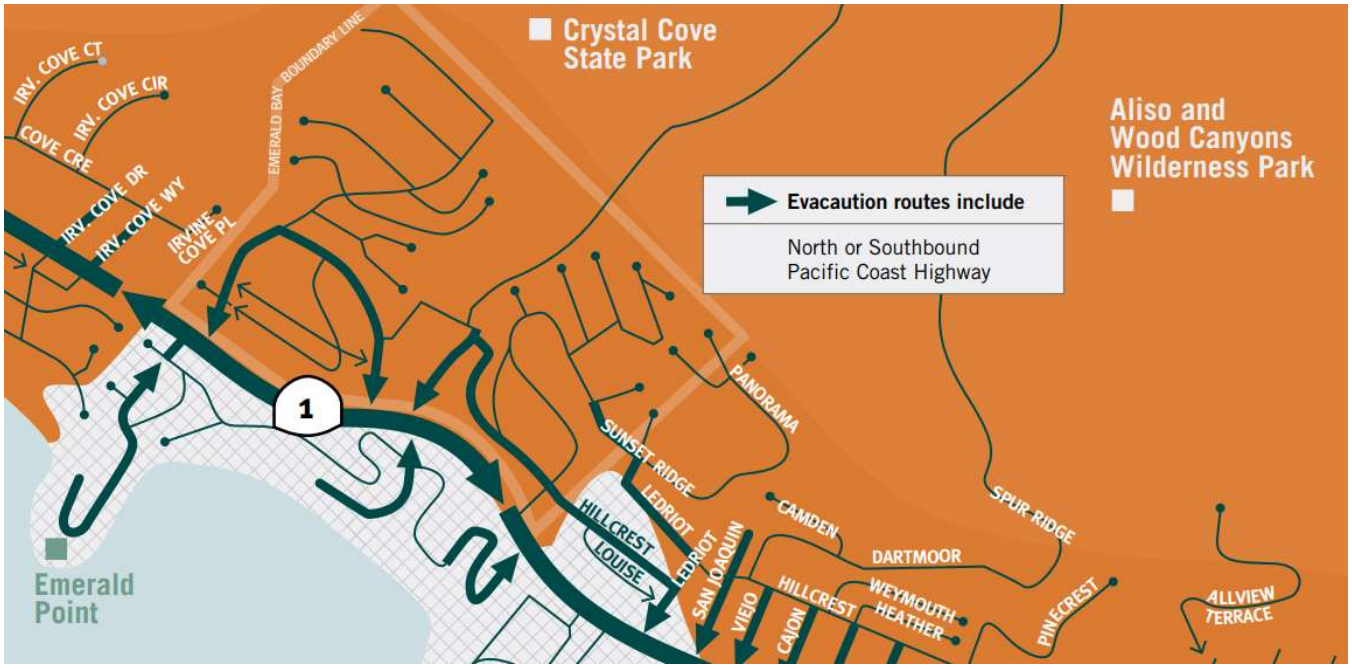


Exhibit 18. Zone 12 – Emarald Bay Evacuation Map

9.2.5.1 GOAL: INCREASE EVACUATION SAFETY FOR RESIDENTS AND THE GENERAL PUBLIC IN THE VERY HIGH FIRE HAZARD SEVERITY AREAS.

- Continue educational campaign to make residents and the public aware of evacuation planning and hazards.

- Promote an educational campaign with property owners' on the creation of a Red Flag Warning Plan. Manage access throughout the Community down to Pacific Coast Highway during Red Flag Warnings, or other high fire hazard periods, to minimize ignition potential.

- Continue to ensure that vegetation road clearance is implemented along primary response routes in the VHFHSZ Areas.

- Facilitate emergency vehicle access and evaluate the need for road maintenance throughout the Community that can be conducted though OCFA's Emergency Vehicle Access Road guidelines.

- Investigate methods for publicly identifying evacuation routes in the VHFHSZ area roadways.

- Work with OCFA to evaluate opportunities for creating designated fallback zones where the potential exists for road blockage due to wildfire, flood, downed trees, and other emergencies. These fallback zones could be used as temporary staging areas until obstructions are cleared and it is safe to evacuate.

- Identify specific roads that do not meet OCFA and LBPD Access Standards and develop feasible mitigations and/or appropriate tools that can be used to reduce fire risk in these areas. Tools may include, but are not limited to, expanding roadside vegetation clearance requirements, enacting on-street parking restrictions, installing and maintaining warning and notification signage, enacting parking or traffic flow restrictions during Red Flag Warnings, identifying turnouts for vehicle passage, and establishing one-way traffic flows to facilitate evacuation traffic.

- Routinely update the OCFA "Ready! Set! Go!" brochures to reflect changing conditions, policies, and best practices.

9.2.6 FUNDING: GOALS, OBJECTIVES, AND ACTION ITEMS (ON-GOING PRIORITY)

Funding is critical to implementing projects identified in this CWPP. Development of funding sources and incentive programs for the Community Association and residents of the Community Plan Area can encourage reduction of wildfire hazards and risks. The following provides information on potential project funding opportunities:

- **California Department of Forestry and Fire Protection (CAL FIRE):** CAL FIRE provides grant funding for various project types, including Forest Health, Wildfire Prevention, and Wildfire Resilience projects. Eligible project types under these grant programs include fuels management, fire reintroduction, treatment of degraded areas, conservation of forests, hazardous fuels reduction, wildfire prevention planning, and wildfire prevention education. More information regarding CAL FIRE grants can be found at https://www.fire.ca.gov/grants/.

- **State Fire Assistance Grants:** Program to support fire risk reduction activities by landowners and residents in at-risk communities to restore and maintain resilient landscapes and create fire-adapted communities. Projects may include fuel hazard mitigation (chipping, thinning, burning, or grazing), community hazard mitigation planning (CWPPs, Firewise assessments, hazard assessments, and similar types of planning activities), prevention, mitigation, and education (outreach, mailings, workshops, events, project-specific analysis, and other educational programs). More information regarding State Fire Assistance Grants can be found at https://cafiresafecouncil.org/grants-and-funding/2022-sfa-grant-opportunity/.

- **California Wildfire Mitigation Program:** This program, developed by the California Governor's Office of Emergency Services and CAL FIRE, institutes a home hardening initiative to retrofit, harden, and create defensible space for homes at high risk to wildfires, focusing on high socially vulnerability communities and providing financial assistance for low- and moderate-income households. This project is in its pilot phase and currently operating only in San Diego, Shasta, and Lake Counties. More information can be found at https://www.caloes.ca.gov/cal-oes-divisions/recovery/disaster-mitigation-technical-support/californiawildfire-mitigation-program.

- **Coastal Conservancy Wildfire Resilience Program:** This program funds on-the-ground activities to restore the health and increase resilience of California forests, grasslands, and natural lands to wildfire, and for planning and capacity building to increase wildfire resilience. More information regarding Coastal Conservancy grants can be found at https://scc.ca.gov/2021/12/03/rfp-for-wildfire-resilience-projects-announced/.

- **Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance Grants:** FEMA's hazard mitigation assistance provides funding for eligible mitigation measures that reduce disaster losses. The following programs are applicable to wildfire:

    - Hazard Mitigation Grant Program (HMGP): Provides funding to state, local, tribal, and territorial governments to implement hazard mitigation projects. Eligible projects include creation of defensible space, application of ignition-resistant and/or non-combustible materials on new and existing homes, and treatment of hazardous fuels proximate to at-risk structures. More information regarding FEMA's Hazard Mitigation Grant Program can be found at https://www.fema.gov/grants/mitigation/hazard-mitigation.

    - Hazard Mitigation Grant Program Post-Fire Grant: Post-fire assistance to help communities implement hazard mitigation measures after wildfire disasters. Eligible projects include wildfire mitigation (e.g., removal of burned trees), infrastructure retrofits (e.g., water system repairs), soil/slope stabilization, and post-fire flood prevention/sediment reduction. More information regarding FEMA's Hazard Mitigation Grant Program Post-Fire Grants can be found at https://www.fema.gov/grants/mitigation/post-fire.

    - Building Resilient Infrastructure and Communities (BRIC) Grants: Support states, local communities, tribes, and territories in hazard mitigation projects to reduce the risks faced from disasters and natural hazards. A wide variety of projects are eligible for Building Resilient Infrastructure and Communities Grant funding. More information regarding these grants can be found at https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities.

The following actions are recommended to address funding in the Community Plan Area:

- Research grant funding opportunities for wildfire projects and apply for appropriate grants or cost-share programs. Wildfire projects may include those associated with vegetation management, structural retrofits (structural hardening), planning, and community education or engagement.
- Pursue efforts to get the Community Plan Area on California's Fire Risk Reduction Communities List to be prioritized for CAL FIRE Fire Prevention Grant Funding.
- Coordinate with and support grant funding efforts for structural hardening projects in the Community Plan Area.
- Coordinate with and support landowners in applying for grant funding for vegetation management and other wildfire risk reduction projects in the Community Plan Area.
- Evaluate opportunities for subsidies for property owners to complete and maintain defensible space vegetation management work.

9.2.7 FIRE HAZARD TREE GOAL, OBJECTIVES, AND ACTION ITEMS (LONG-TERM PRIORITY)

9.2.7.1 GOAL: REDUCE TREE-RELATED FIRE HAZARD POTENTIAL IN THE WILDFIRE HAZARD AREA

The primary goal is to gradually reduce the tree contribution to wildfire risk throughout the Community. Since Emerald Bay manages its trees, the community is at a lower risk through controlled maintenance and species selection. Existing trees within the Community, particularly those along rights-of-way, including primary evacuation routes, are high priorities to reduce wildfire risk through maintenance practices. Higher flammability trees on private property cannot be managed by Emerald Bay, but property owners have the responsibility to conform to County fire protection requirements to be a community partner in wildfire risk reduction. Specific actions that can be taken include avoiding planting trees identified as hazardous or undesirable species and providing ongoing maintenance to minimize opportunities for ignition, sustained fire, and fire spread. Community education on the wildfire risk reduction principles and how trees are managed in these areas will play a large role in private property maintenance that will reduce risk. Recommendations for community education and outreach methods are found in Section 8.3.1.2, Objective 2: Reduce Risk Associated with Private Property Trees in the Wildfire Hazard Area.

9.2.7.2 OBJECTIVE 1: REDUCE PUBLICLY MANAGED TREES' POTENTIAL FIRE HAZARD IN THE WILDFIRE HAZARD AREA

- **Action Item 1 –** Continue public tree management to include raised crowns, thinned branch structure, minimal leaf litter accumulation, and crown separation from neighboring trees.
- **Action Item 2 –** Evaluate the ability to provide additional crown raising where adjacent private vegetation provides ladder fuels into community trees. Conversely, where further crown raising is not possible (i.e., would leave too low of a live crown ratio), then evaluate the efficacy of working with the private landowner to reduce the height and/or remove hazardous trees directly adjacent to the community trees, specifically along evacuation corridors.

- **Action Item 3 –** Increase monitoring of retained trees with semi-annual inspections and after significant storm events. Community trees that exhibit structural or health deficiencies should be considered for removal and replacement. Trees with poor branch structure that cannot be corrected through traditional arboricultural methods should be removed to avoid large branch failures that could interrupt an evacuation. Trees that are leaning, stressed, declining, or otherwise high risk, as determined by an International Society of Arboriculture Tree Risk Assessment Qualification qualified arborist, are recommended for removal as a proactive evacuation safety approach. It is not considered critical for the community to remove trees along evacuation corridors for fire purposes only. However, it must be considered that a downed tree or tree part could interrupt an evacuation effort, necessitating the need for increased monitoring.
- **Action Item 4 –** Continue to develop a short-term tree management plan that increases tree maintenance and inspections throughout the Community to decrease immediate risk. The longer-term management plan should aim to gradually modify the species palette to be appropriate for the Community and future longevity. Utilizing both short- and long-term plans allows newly planted trees time to mature and absorb some of the benefits lost from removing mature trees throughout a landscape.
- **Action Item 5 –** Monitor the WHAs to help achieve the goals of reducing potential landscape-related fire threats. Specialists who understand fire behavior and vegetative fuels should be involved in landscape and fuel modification plan reviews. This will help ensure that new landscapes do not include higher flammability tree species and have the required separation. Site inspections should occur throughout the private areas such that recommended tree setbacks from structure requirements are achieved and maintained and that over time, as trees are lost due to health, age, or other factors, they are replaced with more appropriate trees.
- **Action Item 6 –** Consider preparation of a community-approved landscape manual to provide details for desirable landscapes with a section focusing on the WHA and specifically related to developing fire-adaptive and hardened landscapes in accordance with OCFA standards.
- **Action Item 7 –** Identify and address staffing shortages to accomplish the action items listed above.

9.2.7.3 OBJECTIVE 2: REDUCE RISKS ASSOCIATED WITH PRIVATE PROPERTY TREES IN THE WILDFIRE HAZARD AREA

- **Action Item 1 –** Provide educational outreach to homeowners as well as landscape and tree contractors regarding the importance of properly maintained trees throughout the Community. Information provided to residents could include the following:
  - Maintain trees on your property; trees that are more ignitable must be maintained to avoid accumulations of leaf litter, twigs, and dead components. Trees that are not considered higher fire hazard species must also be maintained to a determined standard by the community and OCFA because of their location in a Fire Hazard Severity Zone. Any tree will burn if it is receptive to embers or experiences direct flame contact.
    a. Raise tree crowns to provide separation from understory (see details herein);
    b. Thin crowns and remove overly “twiggy” growth and leaf litter buildup;
    c. Trim crowns away from roofs (horizontal and/or vertical separation);
    d. Trim trees away from overhead electrical distribution lines so that windy weather would not cause vegetation to come in contact with the lines and cause an arc;

e. Keep trees hydrated and promote high internal leaf moisture;
f. Avoid overly fertilizing trees as it can lead to stimulated overgrowth or to stress and decline, raising susceptibility to ignition;
g. Monitor for pest/disease presence and treat as necessary; and
h. Provide an inspection at least annually and after wind events and rainstorms and have maintenance provided as needed to result in low likelihood of ignition.
i. Break up continuous fuel chains leading from wildlands to structures or from non-wildland edges of a property to structures. When trees are positioned close enough that their crowns overlap or are within several feet, it is easier for fire to become a crown fire, which generates significant ember storms that, in turn, make homes more vulnerable to ignition and, if ignited, can burn toward homes. Break up fuel chains by strategically removing trees to create adequate spacing between tree crowns.
j. Evaluate the property (or have it evaluated) and use the evaluation to create an overall fuel modification zone plan. It is recommended that the fuel modification zone plan create zones where less vegetation and other fuel sources occur in the first 30 feet from structures/residences. This zone is critical for minimizing direct flame impingement.

9.2.8 ADDITIONAL COMMUNITY WILDFIRE DEFENSE MEASURE: GOALS, OBJECTIVES, AND ACTION ITEMS (LONG-TERM PRIORITY)

Water is often used in wildfires to cool flames, reduce the radiating heat, and deprive a fire of oxygen. The primary source of water typically comes from sources like fire hydrants, tankers, lakes, and pools, using ground crews and air support for direct attack and creating wet lines. However, the use of water cannons is considered another feasible tool for application on wildfires. The following actions are recommended to address additional community wildfire defense measures in the Community Plan Area:

9.2.8.1 GOAL: CONSIDER THE INSTALLATION OF WATER CANNONS ALONG THE PERIMETER OF THE COMMUNITY

- Evaluate the opportunity to install water cannons along the perimeters of the Emerald Bay Community.
- Identify and establish locations along the perimeter of the Emerald Bay Community where individual water cannons may possibly be able to be installed.
- Evaluate the water supply and pressure needed to efficiently work a water cannon.
- Evaluate the effectiveness of a water cannon during extreme weather conditions; in extreme weather conditions (i.e. high winds, low humidity, or high temperatures) a wildfire can produce embers that can spread miles ahead of a fire front, making a fixed water cannon type feature less effective.
- Evaluate the cost to purchase, install, and maintain a water cannon system.

9.2.8.2 GOAL: CONSIDER THE INSTALLATION OF A WATER PUMP FOR THE EMERALD BAY COMMUNITY POOL

- Evaluate the opportunity to install water pumps within the Emerald Bay Community pool to be used to fight wildfire approaching the Community from the north.
- Identify and establish the number of water pumps that may be needed.
- Evaluate the cost to purchase, install, and maintain a water pump system.
- Consider providing educational resources to community members who might be interested in purchasing a water pump to have available for firefighting resources in the event of a wildfire.
- Evaluate opportunities for installing additional water supplies pipelines/hydrants at key locations (i.e., within the Canyon Park area near the community pool) where gaps exist to facilitate supplying water to responding fire agencies during fire suppression efforts. It should be analyzed if the extension of a pipeline from the Community pool fire hydrant out to a new Community Park hydrant would be effective in providing an additional water supply to fight fires approaching the Community from the north.

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10 CWPP Authorization

The Emerald Bay CWPP was collaboratively developed and interested parties were consulted. This document identifies and prioritizes areas for hazardous fuel reduction treatments, provides recommendations for other project types that will reduce wildfire risk to the Community, and recommends measures to reduce the ignitability of structures throughout the Community.

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

Scott Swensen, President
Emerald Bay Community Association

Susan Thomas, President
Emerald Bay Service District

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Appendix A1

OCFA Guideline C-05 - Undesirable and Invasive Plant Species

ATTACHMENT 7

Undesirable and Invasive Plant Species

Certain plants are considered to be undesirable and invasive due to their physical or chemical characteristics. Physical properties that would contribute to high flammability include large amounts of dead material retained within the plant, rough or peeling bark, and the production of copious amounts of litter. Chemical properties include the presence of volatile substances such as oils, resins, wax, and pitch. Certain native plants are notorious for containing these volatile substances.

Plants with these characteristics shall not be planted in any fuel modification zones or anywhere within the area covered by Alternate Methods & Materials agreements (see Section 4: Alternate Materials & Methods). Should these species already exist within these areas, they shall be removed because of their invasiveness or potential threat they pose to structures.

PLANT SPECIES (MANDATORY REMOVAL)

Botanical Name	Common Name
Adenostoma Fasciculatum	Chamise
Adenostoma Sparsifolium	Red Shanks
Anthemix Cotula	Mayweed
Artemisia Californica	California Sagebrush
Brassica Nigra	Black Mustard
Brassica Rapa	Wild Turnip, Yellow Mustard, Field Mustard
Cardaria Draba	Hoary Cress, Perennial Peppergrass
Cirsium Vulgare	Wild Artichoke
Conyza Canadensis	Horseweed
Cynara Cardunculus	Artichoke Thistle
Eriogonum Fasciculatum	Common Buckwheat
Heterothaca Grandiflora	Telegraph Plant
Lactuca Serriola	Prickly Lettuce
Nassella/Stipa tenuissima	Mexican Feathergrass
Nicotiana Bigelevil	Indian Tobacco
Nicotiana Glauca	Tree Tobacco
Pennisetum alopecuroides	Fountain Grass
Ricinus Communis	Castor Bean Plant
Sacsola Austails	Russian Thistle/Tumbleweed
Salvia Mellifera	Black Sage
Silybum Marianum	Milk Thistle
Tamarix Ramosissima	Salt Cedar
Urtica Urens	Burning Nettle
Ornamental:	
Arecaceae (all palm species)	Palms
Cycas Revoluta	Sago Palms
Cortaderia	Pampas Grass
Cupressus sp	Cypress
Eucalyptus sp	Eucalyptus
Juniperus sp	Juniper
Pinus sp	Pine

Appendix A2

OCFA Guideline C-05 – FMZ Plant List

ATTACHMENT 8
Fuel Modification Zone Plant List

Symbol Legend

X = Plant species prohibited in wet and dry FMZs adjacent to reserve lands. Acceptable on all other fuel modification locations and zones.

W = Plant species appropriate for use in wet FMZs adjacent to reserve lands. Acceptable in all other wet and irrigated dry (manufactured slopes) fuel modification locations and zones.

o = Plant species native to Orange County. Acceptable in all fuel modification wet and dry zones in all locations.

N = Plant species acceptable on a limited basis (maximum 30% of the area) in wet FMZs adjacent to reserve lands. Acceptable on all other FMZs.

* = If locally collected.

** = Not native but can be used in all zones.

n = Plant species acceptable on a limited use basis. Refer to qualification requirements following plant palette.

Yellow row = Plant species susceptible to Invasive Shot Hole Borers (ISHB) infestation.

	Code	Botanical Name	Common Name	Plant Form
1.	W	Abelia x grandiflora	Glossy Abelia	Shrub
2.	n	Acacia redolens desert carpet	Desert Carpet	Ground Cover
3.	o	Acer macrophyllum	Big Leaf Maple	Tree
4.	X	Achillea millefolium	Common Yarrow	Low Shrub
5.	W	Achillea tomentosa	Woolly Yarrow	Low Shrub
6.	X	Aeonium decorum	Aeonium	Ground cover
7.	X	Aeonium simsii	no common name	Ground cover
8.	W	Agave attenuata	Century Plant	Succulent
9.	W	Agave shawii	Shaw's Century Plant	Succulent
10.	N	Agave victoriae-reginae	no common name	Ground Cover
11.	X	Ajuga reptans	Carpet Bugle	Ground Cover
12.	W	Alnus cordata	Italian Alder	Tree
13.	o	Alnus rhombifolia	White Alder	Tree
14.	N	Aloe arborescens	Tree Aloe	Shrub
15.	N	Aloe aristata	no common name	Ground Cover
16.	N	Aloe brevifoli	no common name	Ground Cover
17.	W	Aloe Vera	Medicinal Aloe	Succulent
18.	W	Alogyne huegeii	Blue Hibiscus	Shrub
19.	o	Ambrosia chammissonis	Beach Bur-Sage	Perennial

	Code	Botanical Name	Common Name	Plant Form
20.	o	Amorpha fruticosa	Western False Indigobush	Shrub
21.	W	Anigozanthus flavidus	Kangaroo Paw	Perennial/accent
22	o	Antirrhinum nuttalianum ssp.	no common name	Subshrub
23.	X	Aptenia cordifolia x ‘Red Apple’	Red Apple Aptenia	Ground cover
24.	W	Arbutus unedo	Strawberry Tree	Tree
25.	W	Arctostaphylos ‘Pacific Mist’	Pacific Mist Manzanita	Ground Cover
26.	W	Arctostaphylos edmundsii	Little Sur Manzanita	Ground Cover
27.	o	Arctostaphylos glandulosa ssp.	Eastwood Manzanita	Shrub
28.	W	Arctostaphylos hookeri ‘Monterey Carpet’	Monterey Carpet Manzanita	Low Shrub
29.	N	Arctostaphylos pungens	no common name	Shrub
30.	N	Arctostaphylos refugioensis	Refugio Manzanita	Shrub
31.	W	Arctostaphylos uva-ursi	Bearberry	Ground Cover
32.	W	Arctostaphylos x ‘Greensphere’	Greensphere Manzanita	Shrub
33.	N	Artemisia caucasica	Caucasian Artesmisia	Ground Cover
34.	X	Artemisia pycnocephala	Beach Sagewort	Perennial
35.	X	Atriplex canescens	Four-Wing Saltbush	Shrub
36.	X	Atriplex lentiformis ssp. breweri	Brewer Saltbush	Shrub
37.	o	Baccharis emoyi	Emory Baccharis	Shrub
38.	W o	Bacharis pilularis ssp. Consanguinea	Chaparral Bloom	Shrub
39.	X	Baccharis pilularis var. pilularis	Twin Peaks #2	Ground Cover
40.	o	Baccharis salicifolia	Mulefat	Shrub
41.	N	Baileya Multiradiata	Desert Marigold	Ground Cover
42.	N n	Bougainvillea spectabilis	Bougainvillea	Shrub
43.	o	Brickellia californica	no common name	Subshrub
44.	W o	Bromus carinatus	California Brome	Grass
45.	o	Camissonia cheiranthifiloa	Beach Evening Primrose	Perennial Shrub
46.	N	Carissa macrocarpa	Green Carpet Natal Plum	Ground Cover/Shrub
47.	X	Carpobrotus chilensis	Sea Fig Ice Plant	Ground Cover
48.	W	Ceanothus gloriosus ‘Point Reyes’	Point Reyes Ceanothus	Shrub
49.	W	Ceanothus griseus ‘Louis Edmunds’	Louis Edmunds Ceanothus	Shrub
50.	W	Ceanothus griseus horizontalis	Yankee Point	Ground Cover
51.	W	Ceanothus griseus var. horizontalis	Carmel Creeper Ceanothus	Shrub
52.	W	Ceanothus griseus var. horizontalis	Yankee Point Ceanothus	Shrub
53.	o	Ceanothus megarcarpus	Big Pod Ceanothus	Shrub
54.	W	Ceanothus prostratus	Squaw Carpet Ceanothus	Shrub
55.	o	Ceanothus spinosus	Green Bark Ceanothus	Shrub
56.	W	Ceanothus verrucosus	Wart-Stem Ceanothus	Shrub
57.	W	Cerastium tomentosum	Snow-in-Summer	Ground cover/Shrub
58.	W	Ceratonia siliqua	Carob	Tree
59.	W	Cercis occidentalis	Western Redbud	Shrub/Tree

	Code	Botanical Name	Common Name	Plant Form
60.	X	Chrysanthemum leucanthemum	Oxeye Daisy	Ground Cover
61.	W	Cistus Crispus	no common name	Ground Cover
62.	W	Cistus hybridus	White Rockrose	Shrub
63.	W	Cistus incanus	no common name	Shrub
64.	W	Cistus incanus ssp. Corsicus	no common name	Shrub
65.	W	Cistus salviifolius	Sageleaf Rockrose	Shrub
66.	W	Cistus x purpureus	Orchid Rockrose	Shrub
67.	W	Citrus species	Citrus	Tree
68.	o	Clarkia bottae	Showy Fairwell to Spring	Annual
69.	o	Cneoridium dumosum	Bushrue	Shrub
70.	o	Collinsia heterophyllia	Chinese Houses	Annual
71.	W o	Comarostaphylis diversifolia	Summer Holly	Shrub
72.	N	Convolvulus cneorum	Bush Morning Glory	Shrub
73.	W	Coprosma kirkii	Creeping Coprosma	Ground Cover/Shrub
74.	W	Coprosma pumila	Prostrate Coprosma	Low shrub
75.	o	Coreopsis californica	Califiornia Coreopsis	Annual
76.	W	Coreopsis lanceolata	Coreopsis	Ground Cover
77.	N	Corea pulchella	Australian Fuscia	Ground Cover
78.	W	Cotoneaster buxifolius	no common name	Shrub
79.	W	Cotoneaster congestus ‘Likiang’	Likiang Cotoneaster	Ground Cover/Vine
80.	W	Cotoneaster aprneyi	no common name	Shrub
81.	X	Crassula lactea	no common name	Ground Cover
82.	X	Crassula multicava	no common name	Ground Cover
83.	X	Crassula ovata	Jade Tree	Shrub
84.	X	Crassula tetragona	no common name	Ground Cover
85.	W o	Croton californicus	California Croton	Ground Cover
86.	X	Delosperma ‘alba’	White trailing Ice Plant	Ground Cover
87.	o	Dendromecon rigida	Bush Poppy	Shrub
88.	o	Dichelostemma capitatum	Blue Dicks	Herb
89.	N	Distinctis buccinatoria	Blood-Red Trumpet Vine	Vine/Climbing vine
90.	N	Dodonaea viscosa	Hopseed Bush	Shrub
91.	X	Drosanthemum floribundum	Rosea Ice Plant	Ground Cover
92.	X	Drosanthemum hispidum	no common name	Ground Cover
93.	X	Drosanthemum speciosus	Dewflower	Ground Cover
94.	o	Dudleya lanceolata	Lance-leaved Dudleya	Succulent
95.	o	Dudleya pulverulenta	Chalk Dudleya	Succulent
96.	W	Elaeagnus pungens	Silverberry	Shrub
97.	o	Encelia californica	California Encelia	Small Shrub
98.	o *	Epilobium canum [Zauschneria californica]	Hoary California Fuschia	Shrub
99.	o	Eriastrum Sapphirinum	Mojave Woolly Star	Annual
100.	N	Eriobotrya japonica	Loquat	Tree

	Code	Botanical Name	Common Name	Plant Form
101.	o	Eriodictycon trichocalyx	Yerba Santa	Shrub
102.	W o	Eriophyllum confertiflorum	no common name	Shrub
103.	W	Erythrina species	Coral Tree	Tree
104.	N	Escallonia species	Several varieties	Shrub
105.	W o	Eschscholzia californica	California Poppy	Flower
106.	X	Eschscholzia mexicana	Mexican Poppy	Herb
107.	N	Euonymus fortunei	Winter Creeper Euonymus	Ground Cover
108.	N	Feijoa sellowiana	Pineapple Guava	Shrub/Tree
109.	N	Fragaria chiloensis	Wild Strawberry/Sand Strawberry	Ground Cover
110.	o	Frankenia salina	Alkali Heath	Ground Cover
111.	W	Fremontondendron californicum	California Flannelbush	Shrub
112.	X	Gaillardia x grandiflora	Blanketflower	Ground Cover
113.	W	Galvezia speciosa	Bush Snapdragon	Shrub
114.	W	Garrya ellipta	Silktassel	Shrub
115.	X	Gazania hybrids	South African Daisy	Ground Cover
116.	X	Gazania rigens leucolaena	Training Gazania	Ground Cover
117.	o	Gilia capitata	Globe Gilia	Perennial
118.	W	Gilia leptantha	Showy Gilia	Perennial
119.	W	Gilia tricolor	Bird’s Eyes	Perennial
120.	W	Ginkgo biloba	Maidenhair Tree	Tree
121.	o	Gnaphalium californicum	California Everlasting	Annual
122.	W	Grewia occidentalis	Starflower	Shrub
123.	o	Grindelia stricta	Gum Plant	Ground Cover
124.	N n	Hakea suaveolens	Sweet Hakea	Shrub
125.	W	Hardenbergia comptoniana	Lilac Vine	Shrub
126.	N	Heliathemum muutabile	Sunrose	Ground Cover/Shrub
127.	o	Helianthemum scoparium	Rush Rose	Shrub
128.	o	Heliotropium curassavicum	Salt Heliotrope	Ground Cover
129.	X	Helix Canariensis	English Ivy	Ground Cover
130.	W	Hesperaloe parviflora	Red Yucca	Perennial
131.	o n	Heteromeles arbutifolia	Toyon	Shrub
132.	X	Hypericum calycimum	Aaron’s Beard	Shrub
133.	N	Iberis sempervirens	Edging Candytuft	Ground Cover
134.	N	Iberis umbellatum	Globe Candytuft	Ground Cover
135.	o	Isocoma menziesii	Coastal Goldenbush	Small Shrub
136.	o	Isomeris arborea	Bladderpod	Shrub
137.	W	Iva hayesiana	Poverty Weed	Ground Cover
138.	N	Juglans californica	California Black Walnut	Tree
139.	o	Juncus acutus	Spiny Rush	Perennial
140.	o	Keckiella antirrhinoides	Yellow Bush Penstemon	Subshrub
141.	o	Keckiella cordifolia	Heart Leaved Penstemon	Subshrub

	Code	Botanical Name	Common Name	Plant Form
142.	o	Keckiella ternata	Blue Stemmed Bush Penstemon	Subshrub
143.	W	Kniphofia uvaria	Red Hot Poker	Perennial
144.	W	Lagerstroemia indica	Crape Myrtle	Tree
145.	W	Lagunaria patersonii	Primrose Tree	Tree
146.	X	Lamprathus aurantiacus	Bush Ice Plant	Ground Cover
147.	X	Lampranthus filicaulis	Redondo Creeper	Ground Cover
148.	X	Lampranthus spectabilis	Trailing Ice Plant	Ground Cover
149.	W	Lantana camara cultivars	Yellow Sage	Shrub
150.	W	Lantana montevidensis	Trailing Lantana	Shrub
151.	o	Lasthenia californica	Dwarf Goldfields	Annual
152.	W	Lavandula dentata	French Lavender	Shrub
152.	W	Leptospermum laevigatum	Australian Tea Tree	Shrub
154.	W	Leucophyllum frutescens	Texas Ranger	Shrub
155.	o	Leymus condensatus	Giant Wild Rye	Large Grass
156.	N	Ligustrum japonicum	Texas privet	Shrub
157.	X	Limonium pectinatum	no common name	Ground Cover
158.	X	Limonium perezii	Sea Lavender	Shrub
159.	W n	Liquidambar styraciflua	American Sweet Gum	Tree
160.	W	Liriodendron tulipfera	Tulip Tree	Tree
161.	X	Lonicera japonica ‘Halliana’	Hall’s Japanese Honeysuckle	Vining Shrub
162.	o	Lonicera subspicata	Wild Honeysuckle	Vining Shrub
163.	X	Lotus corniculatus	Bird’s Foot Trefoil	Ground Cover
164.	o	Lotus hermannii	Northern Woolly Lotus	Perennial
165.	o	Lotus scoparius	Deerweed	Shrub
166.	W	Lupinus arizonicus	Desert Lupine	Annual
167.	W	Lupinus benthamii	Spider Lupine	Annual
168.	o	Lupinus bicolor	Sky Lupine	Flowering annual
169.	o	Lupinus sparsiflorus	Loosely Flowered Annual Lupine or Coulter’s Lupine	Annual
170.	W	Lyonothamnus floribundus ssp. Asplenifolius	Fernleaf Ironwood	Tree
171.	W	Macadamia integrifolia	Macadamia Nut	Tree
172.	W	Mahonia aquifolium ‘Golden Abundance’	Golden Abundance Oregon Grape	Shrub
173.	W	Mahonia nevenii	Nevin Mahonia	Shrub
174.	o	Malacothamnus fasciculatus	Chapparal Mallow	Shrub
175.	X	Malephora luteola	Training Ice Plant	Ground Cover
176.	W	Maytenus boaria	Mayten Tree	Tree
177.	W	Melaleuca nesophila	Pink Melaleuca	Shrub
178.	N	Metrosideros excelsus	New Zealand Christmas Tree	Tree
179.	o *	Mimulus species	Monkeyflower	Flower
180.	o	Mirabilis californica	Wishbone Bush	Perennial
181.	N	Myoporum debile	no common name	Shrub

	Code	Botanical Name	Common Name	Plant Form
182.	W	Myoporum insulare	Boobyalla	Shrub
183.	W	Myoporum parvilfolium	no common name	Ground Cover
184.	W	Myoporum ‘Pacificum’	no common name	Ground Cover
185.	o	Nassella (stipa) lepidra	Foothill Needlegrass	Ground Cover
186.	o	Nassella (stipa) pulchra	Purple Needlegrass	Ground Cover
187.	o	Nemophilia menziesii	Baby Blue Eyes	Annual
188.	X	Nerium Oleander	Oleander	Shrub
189.	o	Nolina cismontana	Chapparal Nolina	Shrub
190.	N	Nolina species	Mexican Grasstree	Shrub
191.	W	Oenothera belandieri	Mexican Evening Primrose	Ground Cover
192.	N	Oenothera hookeri	California Evening Primrose	Flower
193.	W	Oenothera speciosa	Show Evening Primrose	Perennial
194.	X	Ophiopogon japonicus	Mondo Grass	Ground Cover
195.	o *	Opuntia littoralis	Prickly Pear	Cactus
196.	o *	Opuntia oricola	Oracle Cactus	Cactus
197.	o *	Opuntia prolifera	Coast Cholla	Cactus
198.	W	Osmanthus fragrans	Sweet Olive	Shrub
199.	X	Osteospermum fruticosum	Training African Daisy	Ground Cover
200.	X	Parkinsonia aculeata	Mexican Palo Verde	Tree
201.	W	Pelargonium peltatum	Ivy Geranium	Ground Cover
202.	X	Penstemon species	Beard Tongue	Shrub
203.	W	Photinia fraseria	no common name	Shrub
204.	W	Pistacia chinesis	Chinese Pistache	Tree
205.	X	Pittosporum undulatum	Victorian Box	Tree
206.	o	Plantago erecta	California Plantain	Annual
207.	**	Plantago insularis	Woolly Plantain	Annual
208.	X	Plantago sempervirens	Evergreen Plantain	Ground Cover
209.	W	Plantanus racemosa	California Sycamore	Tree
210.	W	Plumbago auritulata	Plumbago Cape	Shrub
211.	o	Popolus fremontii	Western Cottonwood	Tree
212.	X	Portulacaria afra	Elephant’s Food	Shrub
213.	o	Potentilla glandulosa	Sticky Cinquefoil	Subshrub
214.	X	Potentilla tabernaemontanii	Spring Cinquefoil	Ground Cover
215.	X	Prunus caroliniana	Carolina Cherry Laurel	Shrub/Tree
216.	o	Prunus ilicifolia ssp. Ilicifolia	Holly Leafed Cherry	Shrub
217.	X	Prunus lyonii	Catalina Cherry	Shrub/Tree
218.	N	Punica granatum	Pomegranate	Shrub/Tree
219.	W	Puya species	Puya	Succulent/Shrub
220.	W	Pyracantha species	Firethorn	Shrub
221.	o	Quercus agrifolia	Coast Live Oak	Tree
222.	o n *	Quercus berberdifolia	California Scrub Oak	Shrub
223.	o n *	Quercus dumosa	Coastal Scrub Oak	Shrub

	Code	Botanical Name	Common Name	Plant Form
224.	X	Quercus engelmannii	Engelmann Oak	Tree
225.	X	Quercus suber	Cork Oak	Tree
226.	X	Rhamnus alaternus	Italian Buckthorn	Shrub
227.	o	Rhamnus californica	California Coffee Berry	Shrub
228.	o	Rhamnus crocea	Redberry	Shrub
229.	o	Rhamnus crocea ssp. Ilicifolia	Hollyleaf Redberry	Shrub
230.	N	Rhaphiolepis species	Indian Hawthorne	Shrub
231.	o	Rhus integrifolia	Lemonade Berry	Shrub
232.	N	*Searsia Lancea*	African Sumac	Tree
233.	o n	Rhus ovata	Sugar bush	Shrub
234.	o	Ribes aureum	Golden Currant	Shrub
235.	o	Ribes indecorum	White Flowering Currant	Shrub
236.	o	Ribes speciosum	Fuschia Flowering Gooseberry	Shrub
237.	W	Ribes viburnifolium	Evergreen currant	Shrub
238.	o *	Romneya coulteri	Matilija Poppy	Shrub
239.	X	Romneya coulteri ‘White Cloud’	White Cloud Matilija Poppy	Shrub
240.	W n	Rosmarinus officinalis	Rosemary	Shrub
241.	W n	Salvia greggii	Autums Sage	Shrub
242.	W n	Salvia sonomensis	Creeping Sage	Ground Cover
243.	o	Sambucus mexicana	Mexican Elderberry	Tree
244.	W	Santolina chamaecyparissus	Lavender Cotton	Ground Cover
245.	W	Santolina virens	Green Lavender Cotton	Shrub
246.	o	Satureja chandleri	San Miguel Savory	Perennial
247.	o	Scirpis scutus	Hard Stem Bulrush	Perennial
248.	o	Scirpus californicus	California Bulrush	Perennial
249.	X	Sedum acre	Goldmoss Sedum	Ground Cover
250.	X	Sedum album	Green Stonecrop	Ground Cover
251.	X	Sedum confusum	no common name	Ground Cover
252.	X	Sedum lineare	no common name	Ground Cover
253.	X	Sedum x rubrotinctum	Pork and Beans	Ground Cover
254.	X	Senecio serpens	no common name	Ground Cover
255.	o	Sisyrinchium bellum	Blue Eyed Grass	Ground Cover
256.	o	Solanum douglasii	Douglas Nightshade	Shrub
257.	o	Solanum xantii	Purple Nightshade	Perennial
258.	W	Stenicarpus sinuatus	Firewheel Tree	Tree
259.	W	Strelitzia nicolai	Giant Bird of Paradise	Perennial
260.	W	Strelitzia reginae	Bird of Paradise	Perennial
261.	o	Symphoricarpos mollis	Creeping Snowberry	Shrub
262.	W	Tecoma stans (Stenolobium stans)	Yellow Bells	Shrub/Small Tree
263.	X	Tecomaria capensis	Cape Honeysuckle	Ground Cover
264.	N	Teucarium chamedrys	Germander	Ground Cover
265.	N	Thymus serpyllum	Lemon Thyme	Ground Cover

	Code	Botanical Name	Common Name	Plant Form
266.	N	Trachelospermum jasminoides	Star Jasmine	Shrub
267.	o	Trichosstems lanatum	Woolly Blue Curls	Shrub
268.	X	Trifolium hirtum ‘Hyron’	Hyron Rose Clover	Ground Cover
269.	X	Trifolium fragerum ‘O’Connor’s’	O’Connor’s Legume	Ground Cover
270.	o	Umbellularia californica	California Laurel	Tree
271.	o	Verbena lasiostachys	Western Vervain	Perennial
272.	N	Verbena peruviana	no common name	Ground Cover
273.	X	Verbena species	Verbena	Ground Cover
274.	X	Vinca minor	Dwarf Periwinkle	Ground Cover
275.	o	Vitis girdiana	Desert Wild Grape	Vine
276.	X	Vulpia myuros ‘Zorro’	Zorro Annual Fescue	Grass
277.	W	Westringia fruticosa	no common name	Shrub
278.	W	Xannithorrhoea species	Grass Tree	Perennial, Accent shrub
279.	W	Xylosma congestum	Shiny Xylosma	Shrub
280.	X	Yucca Species	Yucca	Shrub
281.	o	Yucca whipplei	Yucca	Shrub

Approved Plant Palette Qualification Statements for Select Plant Species

2. Acacia redolens desert carpet: May be used in the furthest ½ of the "B" FMZ from the structure, and no closer than 25 feet from the edge of the zone nearest the structure. The plants may be planted with a minimum spacing at 10 feet on center, maximum spacing in meandering zones not to exceed a mature width of 24 feet and mature height of 24 inches. If acacia redolens desert carpet is used in the roadway protection zone, it shall be maintained at a minimum of 25 feet from the curb face. At the time of precise plan review, the mature spacing shall be accounted for.

42. Bougainvillea spectabilis (procumbent varieties): Procumbent to mounding varieties may be used in the mid "B" FMZ. The plants may be planted in groups at 6 feet on center spacing not to exceed eight plants per group. Mature spacing between individual plants or groups shall be at a 30 foot minimum.

125. Hakea suaveolens: May be used in the mid "B" FMZ. The plants shall be used as single specimens with mature spacing between plants of 30 feet minimum.

132. Heteromeles arbutifolia: May be used in the mid to lower "B" FMZ. The plants may be planted in groups of up to 3 plants per group. Mature spacing between individual plants or groups shall be at a 30 foot minimum.

160. Liquidambar styraciflua: May be used in the mid "B" FMZ. The plant shall be used as single specimens with mature spacing between trees and a 30 foot minimum.

223. Quercus berberdifolia: Additional information may be required as directed by the OCFA unless approved on the plan as shown.

224. Quercus dumosa: May be used in the mid to lower "B" FMZ. The plants may be planted in groups of up to 3 plants per group. Mature spacing between individual plants or groups shall be at a 30 foot minimum.

234. Rhus ovata & Rhus integrifolia: May be used in the mid to lower "B" FMZ of inland areas only. The plants may be planted in groups of up to 3 plants per group. Mature spacing between individual plants or groups shall be at a 30 foot minimum.

241. Rosmarinus officinalis: When used as a ground cover, it shall be maintained at 2 feet in height. Additional information may be required as directed by the OCFA.

242. Salvia greggii: Additional information may be required as directed by the OCFA unless approved on the plan as shown.

243. Salvia sonomensis: May be used in the mid to upper "B" FMZ. The plants may be planted in groups of up to 3 plants per group. Mature spacing between individual plants or groups shall be at a 15 foot minimum.

Appendix B

OCFA Guideline C-05

Orange County Fire Authority

Community Risk Reduction

1 Fire Authority Road, Building A, Irvine, CA 92602 • www.ocfa.org • 714-573-6100

Vegetation Management Guideline: Technical Design for New Construction Fuel Modification Plans and Maintenance Program

Guideline C-05

Serving the Cities of Aliso Viejo • Buena Park • Cypress • Dana Point • Garden Grove • Irvine • Laguna Hills • Laguna Niguel • Laguna Woods • Lake Forest • La Palma • Los Alamitos • Mission Viejo • Rancho Santa Margarita • San Clemente • San Juan Capistrano • Seal Beach • Santa Ana • Stanton • Tustin • Villa Park • Westminster • Yorba Linda • and Unincorporated Areas of Orange County

Vegetation Management Guideline: Technical Design for New Construction Fuel Modification Plans and Maintenance Program

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Technical Design for New Construction Fuel Modification Plans and Maintenance Program

INTRODUCTION

Vegetation management has proven to be a major factor in reducing the probability of buildings igniting from wildfires. When combined with special building construction features, the potential for ignition is further reduced.

PURPOSE

Managing the design and placement of vegetation in and around new structures will reduce the effects of a wildfire. For this reason, codes are adopted that require vegetation management and special construction features. The Fuel Modification Plan is a vegetation management code that requires landscaped areas adjacent to new structures be dedicated for permanent vegetation management activities.

The Fuel Modification Program brings fire-safe landscaping and construction features together to improve community safety and reduce property loss during wildfire emergencies. This guideline provides you with the information and steps needed to prepare a Fuel Modification Plan and maintain vegetation in Fuel Modification areas for a successful long-term outcome. Furthermore, it covers the timing of plans for construction, plan criteria needed for approval, plant lists for the zones, new construction inspection requirements, and introductory maintenance information.

SCOPE

All new single-family homes, multi-family residential, Accessory Dwelling Unit (ADU), utility, and commercial structures built in, or adjacent to, a wildfire-risk area or such areas designated by the fire code official, require a Fuel Modification Plan in conjunction with the 2022 California Fire Code (CFC), Chapter 49. However, a Fuel Modification Plan may or may not be required based on lot size, configuration, or your property's connection and proximity to grass, brush, and ornamental vegetation. For questions regarding the Fuel Modification requirements and your project, contact the OCFA RSG line at (714) 573-6774.

The plan requires permanent vegetation management in dedicated land areas and is used indefinitely to facilitate on-going maintenance requirements. For existing structures that were not developed with a fuel modification plan or condition, maintenance shall be completed as required in the Vegetation Management Maintenance Guideline for Property Owners.

For new structures proposed within the State Responsibility Area (SRA), as defined in the Public Resource Code Sections 4126-4127 or within the Local Responsibility Area (LRA) - Very High Fire Hazard Severity Zone (VHFHSZ), as defined in the Government Code Section 51175 – 51189, and the California Code of Regulations, Title 14, Division 1.5, Chapter 7, Subchapter 2, Articles 1-5, a 30-foot setback from the structures to the property line shall be required.

FUEL MODIFICATION PLAN OVERVIEW & SEQUENCING

There are two types of Fuel Modification Plans, conceptual and precise. Each type is submitted at a different time during the development and construction process.

1. Conceptual (see Section 1: Conceptual Fuel Modification Plans for requirements)
    a. Infrastructure of the zone widths and program
    b. Land use restrictions
    c. Tract and property line information
    d. When to submit
        1) Concurrent with Environmental Impact Report (EIR) processing
        2) Prior to tentative tract map, parcel map, or final tract map approval
        3) Prior to fire master plan submittal
2. Precise (see Section 2: Precise Fuel Modification Plans for requirements)
    a. Approval of planting plans
    b. Final details
    c. Inspection information
    d. When to submit
        1) Prior to approval of planting plans from other permitting agencies
        2) Prior to precise grading or building permit issuance, whichever comes first
        3) Prior to Fire Master Plan approval

FUEL MODIFICATION ZONES

The Fuel Modification area is comprised of three zones with specific design criteria. The standard Fuel Modification area is 170 feet in width, measured out horizontally from the structure in all directions on the site (see Attachment 3: Incline Measurement for Selected Slopes). Many developments have interior slopes with Special Maintenance Areas (SMA). See below for specific unique requirements for each zone. The fuel modification plan may be altered if conditions change. Any alterations to the fuel modification areas shall have prior approval from the fire code official.

Note: Additional planting restrictions may be required for certain plant species (see Approved Plant Palette Qualification Statements for Select Plant Species on page 31).

1. Zone “A” (20-foot minimum width, with the first 5 feet as the Immediate Zone)
    a. Flat level ground requirement
    b. Building foundation setback (no design alternatives allowed)
    c. Zone “A” (20 feet wide – measured from the structure out)
        1) Setback from the slope nearest the foundation
        2) No combustible construction is allowed within Zone “A”
        3) Automatic irrigation systems to maintain healthy vegetation with high moisture content and to be regularly irrigated
        4) Plants in this zone shall be highly fire resistant and selected from Attachment 8: Fuel Modification Zone Plant List (also refer to Section 3: Plant Palette Information)
        5) If all Zones “A-D” are to be maintained by the structure owner, then Zone “A” shall begin at the wall of the structure

d. Immediate Zone (First 5 feet measured from the structure out, in all directions)
    1) No combustible bark or mulch
    2) Plants in this area to be irrigated, naturally low growing (below 2 feet in height), and non-woody
    3) No combustible construction is allowed, fencing, gates, patio covers, etc.

2. Zone “B” (50 -150 feet in width): Slope design requires a minimum 50-foot irrigated zone

Note: A dry Zone “B” may be used if plants and design are appropriate

a. Required at the nearest slope adjoining Zone “A”
b. Irrigated and planted per Attachment 6: Requirements for Planting Installation in Fuel Modification Zones
c. May replace Zones “C/D” when grading plans require larger replanted areas
d. All plant species designed for Zone “B” shall be selected from Attachment 8: Fuel Modification Zone Plant List. Existing fuel modification maintenance programs are limited to the plants listed on the approved plans unless a revision is requested. Planting and maintenance shall be in accordance with planting restrictions from Attachment 6: Requirements for Planting Installation in Fuel Modification Zones, Attachment 7: Undesirable and Invasive Plant Species, and Attachment 8: Fuel Modification Zone Plant List.
e. No combustible construction is allowed within Zone “B”

3. Zone “C/D” (0-100 feet in width)
    a. One natural vegetation thinning (Zone “C”) or two thinning zones (Zone “ C/D”)
        1) Zone “C” shall be 50% thinning of vegetation
        2) Zone “D” shall be 30% thinning of vegetation
    b. Planting installation per Attachment 6, if installing plants
        1) Existing plants that will remain shall be in accordance with *Attachment 6: Requirements for Planting Installation in Fuel Modification Zones* and *Attachment 7: Undesirable and Invasive Plant Species* (see *Section 3: Plant Palette Information*)
    c. See Section 4*:* Alternative *Material & Methods*
    d. Plant species introduced into Zone “C” and “D” shall be selected from Attachment 8: Fuel Modification Zone Plant List. Maintenance shall be in accordance with Attachment 6: Requirements for Planting Installation in Fuel Modification Zones and Attachment 7: Undesirable and Invasive Plant Species (see Section 3: Plant Palette Information)
    e. No combustible construction is allowed within Zone “C” and “D”

Note: A clear, brush-free area of 10 ft shall be required around the perimeter of the ground-mounted photovoltaic arrays. A noncombustible base, approved by the fire code official, shall be installed and maintained under the photovoltaic arrays and associated electrical equipment installations, per the 2022 CFC Chapter 1205.5.1.

TYPES OF INTERIOR SLOPES: RESIDENTIAL TRACT

1. SMA Interior Slopes
    a. 100 feet maximum width
    b. Slopes and common areas interior from the community perimeter (see Section 5: Special Maintenance Areas and Roadside Protection Zones)
    c. Located in commonly owned land areas, beginning at the property lines of the privately owned lot
    d. Areas shall be irrigated
2. Roadside Protection Zones (RPZ)
    a. 50 feet maximum width measured from the edge of the roadway
    b. Can be designed as RPZ or SMA, depending if the road is at the perimeter or interior of the community
    c. Streetscape designs that are not community perimeter edges may not be regulated unless a distinct hazard is created
    d. Areas shall be irrigated

When an SMA or RPZ is within 100 feet of a structure, the SMA or RPZ will be considered a defensible space area. The defensible space area shall comply with Attachment 2: Introductory Maintenance Information, Attachment 6: Requirements for Planting Installation in Fuel Modification Zones, and Attachment 7: Undesirable and Invasive Plant Species. Alternative design methods may be approved through the Alternate Materials & Methods process.

FUEL MODIFICATION PLANS: REQUIRED INFORMATION

Section 1: Conceptual Fuel Modification Plans

Plans shall be prepared by a licensed landscape architect or other design professional with equivalent credentials. First submittal requires only <u>two</u> sets of plans. Each subsequent submittal shall include an <u>electronic PDF</u> copy of the plan and <u>three</u> sets of paper plans.

Note: If the designer is prepared to submit Precise Fuel Modification Plans with the planting plans, conceptual plans are not required to be submitted. If the designer forgoes the conceptual submittal and submits the precise plan, the required conceptual plan information shall be provided on the precise plan.

The following information shall be included on Conceptual Fuel Modification Plans:

☒ Check each box, after providing the information on your design plans:

A. ☐ Identify the total size of the development by showing all tract boundary lines, property lines, slope contour lines, and structure foundation footprints.

B. ☐ Place descriptive notes of the land uses adjoining the development property on all sides (e.g., future construction, existing structures, natural vegetation, restoration plans, roads, parks, etc.).

C. ☐ Add a note on the plan stating the project is or is not located in a LRA - VHFHSZ or in an SRA.

D. ☐ Add a note stating the structure(s) shall be built to the California Building Code (CBC) Chapter 7A standard if the project is located in a LRA - VHFHSZ or in an SRA area.

E. ☐ Add a note stating combustible fencing is not allowed within any Fuel Modification Zone.

F. ☐ Contour lines shall be provided on the plan to show valleys and hills, and the steepness or gentleness of slopes for all Fuel Modification Zones.

G. ☐ Ensure all foundations have a minimum 20-foot setback from edge of slope.

H. ☐ Select an on-slope option from the choices of <u>Fuel Modification Zones</u> from pages 4 and 5. Delineate the width as described.

I. ☐ All plants in fuel modification zones shall be selected from <u>Attachment 8: Fuel Modification Zone Plant List</u>.

J. ☐ Label all interior slopes and all common areas as “Special Maintenance Areas” and/or “Roadside Protection Zones”, if applicable. If SMA planting plans are

designed, they shall be submitted with the conceptual FMZ plans. If not designed yet, place a note that all planting plans require plan review and approval (see Section 5: Special Maintenance Areas and Roadside Protection Zones for more information). When a SMA or RPZ is within 100 feet of a structure, the SMA or RPZ will be considered a defensible space area. The defensible space area shall comply with Attachment 2: Introductory Maintenance Information, Attachment 6: Requirements for Planting Installation in Fuel Modification Zones, and Attachment 7: Undesirable and Invasive Plant Species. Alternative design methods may be approved through the Alternate Materials & Methods process (see Section 4: Alternate Materials & Methods).

K. ☐ SMA and RPZ shall not have plants from Attachment 7: Undesirable and Invasive Plant Species.

L. ☐ Delineate RPZ with either a maximum irrigated 50-foot wide FMZ "B" when located on community perimeter areas or SMA when roads are interior to perimeter.

M. ☐ Each FMZ, SMA, and RPZ shall be symbolized and referenced on the plan clearly and on a distinct legend.

N. ☐ Notate all FMZ, SMA, and RPZ as irrigated or non-irrigated landscaping.

O. ☐ Provide the name of the entity/entities responsible for the maintenance of all FMZ, SMA, and RPZ.

P. ☐ Show the name and location of any existing plant species you are proposing to retain on the plan (If no existing plant species are shown, existing vegetation shall be removed from the plan entirely).

Q. ☐ Design dedicated emergency and maintenance access paths on **commonly owned** property, from the street frontage to lettered lots, to facilitate access behind the homes. This requires:

1. Paths every 500 lineal feet of FMZ or SMA length to have access, with a minimum 7-foot clear **width** and a dedicated **flat** path.
2. Covenants for FMZ and SMA access and maintenance to be recorded concurrently with all planning maps and referenced in Covenants, Conditions & Restrictions (CC&Rs).

R. ☐ Covenants will be required to be recorded for FMZ, SMA, and RPZ located on private homeowner lots prior to Precise Fuel Modification Plan approval (place as a note on plan if applicable).

S. ☐ Copy Attachment 1: New Construction Inspection Requirements, Attachment 2: Introductory Maintenance Information, Attachment 3: Incline Measurement for Selected Slopes, Attachment 6: Requirements for Planting Installation in Fuel Modification Zones, and Attachment 7: Undesirable and Invasive Plant Species on the plans for on-going maintenance requirements.

T. ☐ If there are limited areas in which you cannot meet Fuel Modification distance requirements, follow the plan submittal requirement directions in Section 4: Alternate Materials & Methods.

U. ☐ If the project has an area within the project boundary or adjacent areas affecting the project which would fall under the restriction of an agency (e.g., Army Corps of Engineers, California Coastal Commission, a Specific Plan, a Habitat Management & Monitoring Plan, etc.), the agency name; along with the maintenance, scope of work and management plan for those restricted areas shall be provided on the plan and documentation to support the management plan and maintenance allowed in the restricted areas provided at the time of submittal. If an area is discovered at any point in the submittal process, which would limit the design and/or maintenance requirements of the plan, the project will need to be re-evaluated to determine whether the limitations will impact the Fuel Modification design. If there are no restricted areas, make a note stating to the fact on the plans.

V. ☐ The following notes (1-6) shall be copied on the plans:

1. The owner/developer will obtain planting plan approval from OCFA prior to receiving final approval from all other landscape permitting agencies within FMZ, interior slopes/common area landscaping SMA, and RPZ.
2. FMZ, SMA, and RPZ land areas were purchased and dedicated for the purposes of wildfire maintenance activities, beautification, and erosion control. Protected plants and habitat identified after Fuel Modification Plan approval through surveys or other biological programs cannot be retrofitted back within the limits of these areas.
3. The developer is responsible for ensuring that the calculated revenue from homeowner dues is sufficient to cover the cost of future maintenance, based on the originally approved design. After the final landowner has accepted the long-term maintenance responsibility, changes to the fuel modification areas or interrupted maintenance activities by the final landowner become the responsibility of the final landowner.
4. When a required maintenance area is located on commonly owned land, while the required Zone "A" is located on homeowner's land, a written disclosure regarding the Zone "A" and vegetation requirement is required to be signed by the homeowner and the lot number referenced in the CC&Rs.
5. The FMZ, SMA, and RPZ shall be maintained in perpetuity for fire safety purposes, in accordance with recorded covenants, CC&Rs, and property title restrictions.
6. Prior to dropping of lumber, call for a Vegetation Clearance Inspection. The developer/builder shall provide a separation of combustible vegetation for a minimum distance of 100 feet from the location of the structures and lumber stock-pile.

W. ☐ A copy of the CC&Rs shall be provided to ensure the language regarding maintenance and responsibility is clearly defined, prior to approval of a conceptual plan.

X. ☐ For certain projects, photographs of existing vegetation may be required.

Y. ☐ Provide the degree or percentage of slope on the plan at the location of the zone markers to indicate the actual distance. The marker shall be placed when using Attachment 3: Incline Measurement for Selected Slopes.

Section 2: Precise Fuel Modification Plans

Plans shall be prepared by a licensed landscape architect or other design professional with equivalent credentials. First submittal requires only two sets of plans. Subsequent plan submittals shall include an electronic PDF copy of the plans and minimum of three sets of paper plans.

The following information shall be included on the Precise Fuel Modification Plan:

☒ Check each box, after providing the information on your design plans:

A. ☐ If there was not a Conceptual Fuel Modification Plan approved, the Precise Fuel Modification Plans shall include all criteria required for the Conceptual Fuel Modification Plans (refer to Section 1: Conceptual Fuel Modification Plans).

B. ☐ Show the location of permanent zone markers. (The goal is to install the lowest number of markers possible to ensure maintenance workers stay within the correct property lines when performing vegetation management. Generally, markers are only required to indicate side property lines and where zones end).

C. ☐ Copy Attachment 4: Zone Marker Details and Attachment 5: Sample CC&R Maintenance Language on the plans, if applicable.

D. ☐ Submit written proof that the CC&R's reference the fuel modification areas and associated maintenance and restrictions (see Attachment 5: Sample CC&R Maintenance Language), if applicable.

E. ☐ Provide supporting documentation that demonstrates the Fuel Modification Zones, SMA, RPZ, access and maintenance points have been legally recorded on the Tentative Tract Maps.

F. ☐ Irrigation plan sheets shall be submitted to demonstrate the wet zones are irrigated.

G. ☐ The planting plans for FMZ, SMA, and RPZ are required to be reviewed and approved (see Section 5: Special Maintenance Areas and Roadside Protection Zones for more information).

H. ☐ **Plant Palette Legend for FMZ, SMA, RPZ:**
Provide a separate plant palette legend for each bulleted point below:

1. Trees
2. Shrubs
3. Ground Cover (maximum natural growth height shall be no taller than 2 feet)
4. Grasses
5. If proposing plant species not on the Attachment 8: Fuel Modification Zone Plant List, follow the submittal directions from Section 3.B.

I. ☐ Each legend shall include:

1. Plant Symbol (separate symbol for each plant)
2. Plant Form
3. Botanical Name
4. Common Name
5. Plant # from Attachment 8: Fuel Modification Zone Plant List
6. Symbol Code from Attachment 8: Fuel Modification Zone Plant List
7. Expected Max Growth Height
8. Expected Max Growth Width
    a. *See Sample #1: Plant Legend

J. ☐ Planting Plans:

1. On the installation Planting Plans, all plants shall be horizontally and vertically spaced to meet the formula from Attachment 6: Requirements for Planting Installation in Fuel Modification Zones of this guideline, using the heights and widths in your legend.
2. Refer to the Attachment 8: Fuel Modification Zone Plant List code symbols and qualification statements for design installation before you place plants on the plan.
3. See Section 3: Plant Palette Information for plant species not on the OCFA list and follow directions.

K. ☐ For alternative proposals that do not meet minimum requirements, see Section 4: Alternate Materials & Methods and follow the plan submittal requirements.

L. ☐ Create a heading titled "Required Inspections," then copy Attachment 1: New Construction Inspection Requirements on the plans underneath the heading.

Sample #1: Plant Legend

Example Required Plant Legends

Plant Form	Plan Symbol	Botanical Name	Common Name	Plant # from Attach 8	Symbol Code from Attach 8	Expected Max Growth Height	Expected Max Growth Width
TREES							
Plant Form	Plan Symbol	Botanical Name	Common Name	Plant # from Attach 8	Symbol Code from Attach 8	Expected Max Growth Height	Expected Max Growth Width
SHRUBS							
Plant Form	Plan Symbol	Botanical Name	Common Name	Plant # from Attach 8	Symbol Code from Attach 8	Expected Max Growth Height	Expected Max Growth Width
GROUND COVER							
Plant Form	Plan Symbol	Botanical Name	Common Name	Plant # from Attach 8	Symbol Code from Attach 8	Expected Max Growth Height	Expected Max Growth Width
GRASSES							
SPECIES NOT ON ATTACH 8	Plan Symbol	Botanical Name	Common Name			Expected Max Growth Height	Expected Max Growth Width

Section 3: Plant Palette Information

A. The plant list from Attachment 8: Fuel Modification Zone Plant List was approved by various resource agencies responsible for environmental protection. All plants installed shall be selected from Attachment 8: Fuel Modification Zone Plant List and be grouped and spaced for initial installation in accordance with Attachment 6: Requirements for Planting Installation in Fuel Modification Zones of this guideline. Specific installation requirements are included for various plant species (see plant code, legend, and qualification statements in Attachment 8: Fuel Modification Zone Plant List). Retained plants shall be proposed for approval on the conceptual FMZ plans or on the precise plan (see above for plant palette legends demonstrated for plan design).

B. Proposing Alternate Species:
If alternate plant species are proposed, the landscape architect shall provide photographs and data on the size, fire resistive characteristics, and invasiveness for installation criteria. A maximum of 10 alternate species may be proposed per project.

Alternative species need to have similar/equal properties to the plants from Attachment 8: Fuel Modification Zone Plant List). OCFA will make a case-by-case determination as to the acceptability of the proposed species. Some species that are equal in combustibility to pre-approved species on the list may not be allowed due to the invasiveness of the species. The proposed species must be spaced based on size and characteristics.

If the plant materials are proposed to be planted within 300 feet of reserve lands (except plants on the interior of the tract), concurrence from the permitting resource agencies shall be required. If the proposed plants have received previous resource-agency approval, no concurrence letter will be required, but supporting documentation shall be provided. Contact OCFA prior to your submittal if needed.

Section 4: Alternative Materials & Methods Construction Features, and Fire Protection Plans

If there are limits to areas in which you cannot meet fuel modification width distance requirements or if you are proposing a non-irrigated FMZ, follow the performance based design direction below for conceptual FMZ plans:

1. Performance Based Design:
    a. A detailed technical fire behavior analysis report by a qualified wildland fire behavior professional is required (qualifications of the professional must be approved by OCFA prior to their design). The report shall include BehavePlus fuel modeling outputs at a minimum.
    b. A one to two-page Alternative Materials & Methods (AM&M) request letter to OCFA must be submitted with the detailed technical report. The report and letter shall be drafted by the fire behavior professional and submitted with the plans.
    c. The applicant shall propose compensating factors to demonstrate equivalency to the distance required (see building construction features and fire protection plans below).
    d. Locate OCFA Guideline A-01 at www.ocfa.org. Use the information within A-01 as a model for drafting your letter. If an alternative means of protection is approved by the OCFA, copy the OCFA signed AM&M request letter onto the plans. You will be required to resubmit the plans again for review and final approval with the letters incorporated into the plans.
2. Building Construction Features and Fire Protection Plans:
    a. Building Construction Features designed in accordance with Chapter 7A of the California Building Code (CBC)/Residential Code Section 337 are required for all structures.
    b. Additional compensating factors will also be required. These include but are not limited to: additional building construction features, solid block wall or block wall with tempered glass measuring a minimum of 6 feet on both sides of the wall, increased structure setbacks, special planting designs, rockscapes and plant restrictions, and reduced planting and increased hardscape areas. If a maintenance/ fire access gate is being shown along a solid block wall or block wall with tempered glass, a gate detail shall be provided on the plan that demonstrates the same applied effect as the solid wall.
3. A Fire Protection Plan (OCFA Fee Code PR 146) shall be submitted with or prior to the conceptual FMZ plan and does not take the place of the Fire Master Plan (OCFA Fee Code PR 145). Special 7A code section screening forms are available by request from the OCFA Community Wildfire Mitigation section and shall be placed on the plan to indicate which buildings and lots will meet specific Chapter 7A code sections. OCFA does not review the architectural plans for one- and two-family dwellings. Approved Fire Protection Plans are provided to the applicant and to the Building Department by OCFA, for design and plan review approval of the construction features.
4. Offsite Landowner Recorded Easements (for extreme cases):
    a. All fuel modification should be located within the property or tract of the protected structure(s).

b. Proper on-site Fuel Modification design should be set back from the tract or property boundary lines for a distance of 170 feet.
c. When the required distance is not within the property, as a last option, a legally recorded easements shall be signed by the adjoining property owner and integrated into fuel modification plans, giving rights to the beneficiary to maintain the recorded area in perpetuity. The easement shall show the distance designed on the plans.
d. The conceptual FMZ plans will not be approved until the legally recorded agreements are copied on the plans.

Section 5: Special Maintenance Areas and Roadside Protection Zones

The interior landscaped portions of a community and roadsides may not be standard FMZs but are subject to planting restrictions, irrigation, and maintenance requirements. This is to ensure structures are reasonably protected from fire continuing into interior areas of the community and from flying embers that may land and start spot fires.

The Planting Plans submitted with the Fuel Modification Plans shall indicate the plant palette and planting design for these areas. The plans will be evaluated to determine if the areas have the potential to increase the hazard to structures or if they will lessen the hazard.

1. The SMA determination will occur during the Conceptual Fuel Modification review. The review will use the following OCFA initial hazard assessment criteria:
    a. Roadside planting does not sufficiently protect vital main evacuation routes
    b. There are no proposed planting restrictions on lots
    c. Proximity between structures and slopes is such that fire travel is probable
    d. The area/slope is not proposed to be irrigated
    e. Plant palette contains plant species from the OCFA undesirable plant list
    f. Plant spacing arrangement creates “Ladder Fuels”
    g. Slope/area is contiguous with community perimeter FMZs
    h. Use of special construction features on all structures throughout the community as required in CBC Chapter 7A and California Residential Code 337

2. When it is determined by the OCFA that the design of an SMA may contribute to an increased wildfire risk, the first 100 feet of the SMA, measured from the structure out, is considered defensible space. The defensible space area shall comply with Attachment 2: Introductory Maintenance Information, Attachment 6: Requirements for Planting Installation in Fuel Modification Zones, Attachment 7: Undesirable and Invasive Plant Species and Attachment 8: Fuel Modification Zone Plant List).

ATTACHMENT 1

New Construction Inspection Requirements

The Builder or Developer shall call OCFA Inspection Scheduling at (714) 573-6150 for the three new construction inspections listed below:

1. Prior to dropping of lumber: Schedule a Vegetation Clearance Inspection – the developer/builder shall provide a separation of combustible vegetation for a minimum distance of 100 feet from the location of the structures and lumber stock-pile, generators, and fuel tanks/dispensers. An inspection sign-off and/or release letter to the building department is required.

2. Prior to occupancy of the building: Schedule a Final Fuel Modification Inspection – the FMZ, SMA, and RPZ adjacent to structures must be installed, irrigated, and inspected. This includes physical installation of features identified in the approved precise fuel modification plans including, but not limited to, plant establishment, thinning, irrigation, zone markers, special mitigation measures, and access easements. An OCFA Inspector will provide written approval of completion at the time of this final inspection on the building card. A written disclosure will be requested by the OCFA Inspector indicating that the landowner is aware of the FMZ on their land.

3. Prior to Homeowners Association (HOA) or Landowner Maintenance Acceptance from Developer/Builder: Schedule an Owner Turnover Inspection – This inspection/ meeting must happen with OCFA staff prior to accepting the maintenance responsibility from the developer or builder.

    a. The inspection/meeting must include the following representatives:
        1) Landscape architect
        2) Community manager or homeowner
        3) HOA board member
        4) Installing landscape company
        5) HOA landscape company
    b. At the time of turnover, the Fuel Modification areas shall be maintained by the developer or builder as originally installed and approved.
    c. The accepting landowner is responsible for ensuring the developer or builder sufficiently calculated the amount of revenue needed to perform the on-going maintenance of the FMZs and any SMAs per the approved plans.
    d. A copy of the approved plans must be provided to the HOA representatives or homeowner at this time.
    e. The Landscape Architect must convey ongoing maintenance requirements to HOA representatives or homeowner and provide OCFA a document stating the fuel modification has been installed per plan.
    f. An OCFA written disclosure will be required to be signed by the HOA representatives or homeowner indicating that the HOA or homeowner is aware of the FMZ on their land and that they are aware of the importance of retaining the plans and the ongoing maintenance.
    g. The responsibility and necessary language for maintenance must also be stated within the CC&Rs (Refer to Attachment 5: Sample CC&R Maintenance Language).

ATTACHMENT 2

Introductory Maintenance Information

The FMZ, SMA, RPZ shall be maintained in perpetuity for fire safety purposes and shall cause a covenant to be recorded and referenced in the CC&Rs or on the property title when there is no HOA involvement.

Emergency access covenants shall be identified on the tract map indicating the reservation and restriction for permanent entry by the HOA or Fire Authority.

Select either Option #1 or #2 below

1. Option #1 Maintenance Method:
    a. On-going maintenance shall occur to preserve the originally approved design found on the approved plans. Attachment 6: Requirements for Planting Installation in Fuel Modification Zones spacing is required and only approved planting species and arrangements on the plans are perpetually preserved.
    b. The property owner is responsible for all maintenance of FMZ, SMA, and RPZ.
    c. **Two maintenance activities** shall be performed each year.
        1) The first during middle- to late-Spring and the second in early- to middle-Fall.
    d. Other activities include:
        1) Grasses cut to 4 inches after annual seeding
        2) Dead and dying, all vegetation litter, and Attachment 7: Undesirable and Invasive Plant Species removed from all zones
        3) Maintenance of irrigation systems
        4) Replacement of dead or dying vegetation with approved species (proposed changes shall be approved by OCFA)
        5) Removal of trees and shrubs not on the approved plans
    e. If maintained by an HOA, the landscape maintenance company and/or property manager shall inspect the FMZs throughout the year to identify where specific maintenance activities need to take place.
    f. The OCFA may conduct inspections of established fuel modification areas. Ongoing maintenance shall be conducted a minimum of twice each year regardless of the dates of these inspections.
    g. The property owner shall retain all approved Fuel Modification Plans. The design and information on the plans shall be used as the basis for maintenance.

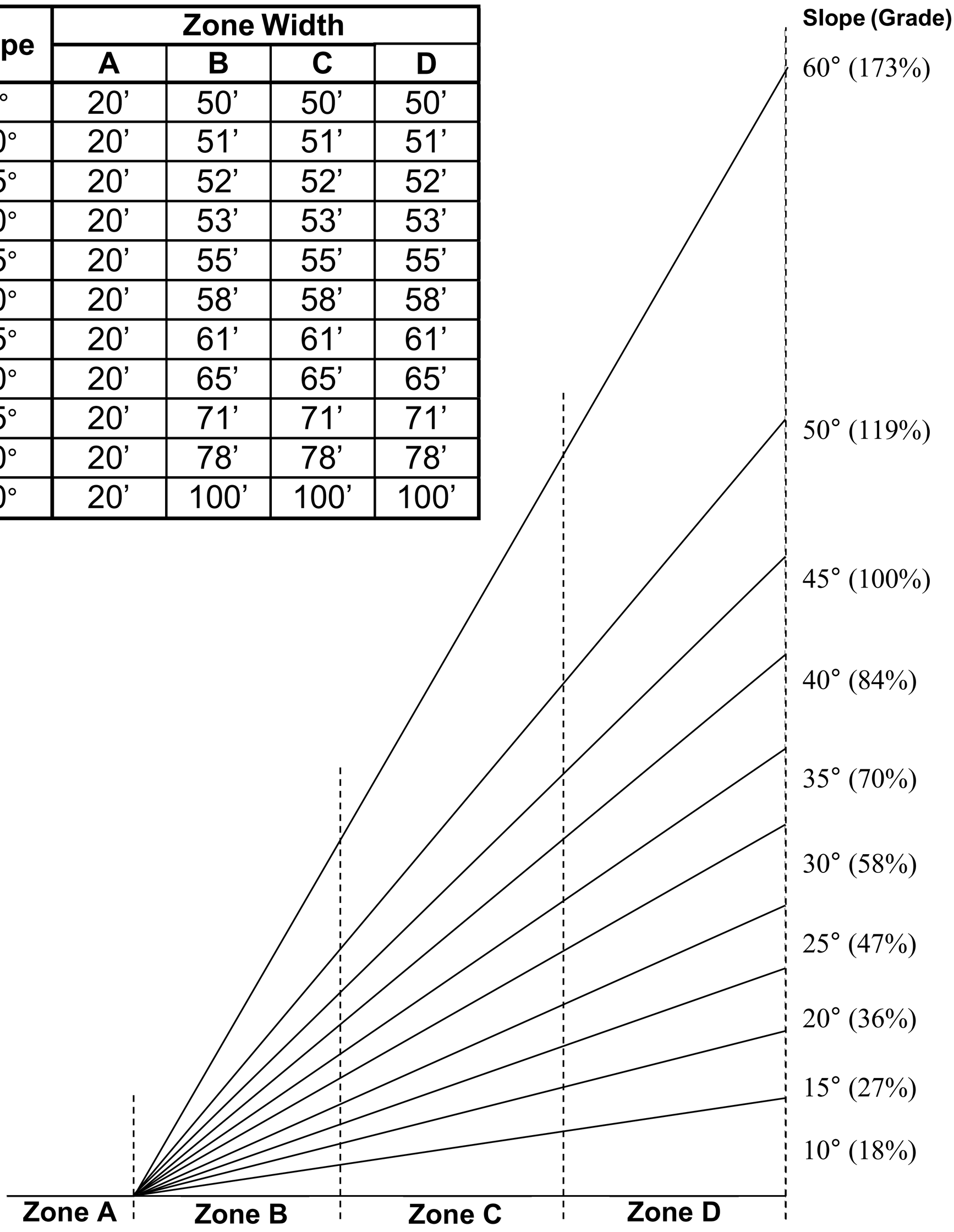
2. Option #2 Maintenance Method (when approved by OCFA):
    Ongoing maintenance shall occur per the current posted OCFA Vegetation Management Maintenance Guidelines at www.ocfa.org. Distances of FMZ, SMA, and RPZ will always remain required and will be specific to the approved Fuel Modification Plan.

ATTACHMENT 3

Incline Measurement for Selected Slopes

(See Attachment 4: Zone Marker Details**)**

Slope	Zone Width			
	A	B	C	D
0°	20’	50’	50’	50’
10°	20’	51’	51’	51’
15°	20’	52’	52’	52’
20°	20’	53’	53’	53’
25°	20’	55’	55’	55’
30°	20’	58’	58’	58’
35°	20’	61’	61’	61’
40°	20’	65’	65’	65’
45°	20’	71’	71’	71’
50°	20’	78’	78’	78’
60°	20’	100’	100’	100’

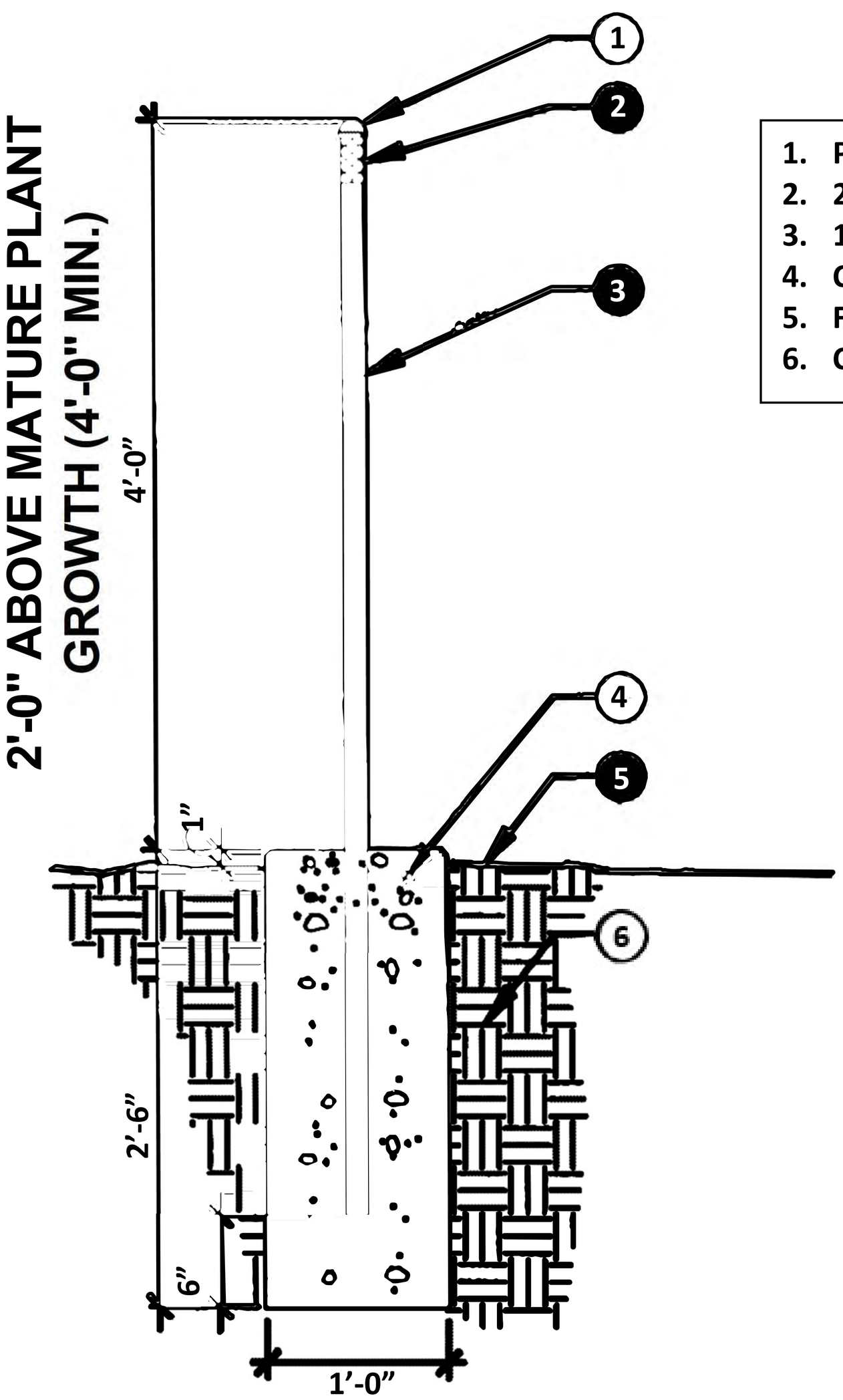


ATTACHMENT 4

Zone Marker Details

(Marker Distances Shall Be Increased on Slopes to Accommodate Incline Measurements in Accordance with Attachment 3: Incline Measurement for Selected Slopes)

Note: An alternate design may be proposed and approved on a case-by-case basis (e.g., using a large boulder, existing fencing, permanent fixtures, etc.).



1. POST CAP
2. 2”X5” ZONE INDICATOR
3. 1 ½” DIAMETER GALVANIZED POST
4. CONCRETE FOOTING 2500 PSI @ 28 DAYS
5. FINISH GRADE
6. COMPACTED SUBGRADE

ATTACHMENT 5
Sample CC&R Maintenance Language

It is recommended that the following language be included in the CC&Rs recorded for a common interest development:

"The duty of the homeowners' association to perform 'Fire Prevention Maintenance' (as defined below) for all Fuel Modification Zones, Special Maintenance Areas, Roadway Protection Zone, and manufactured interior slopes within the development shall be included as an express obligation in the recorded CC&Rs for the development. Similarly, each Owner whose Lot (or Condominium) is subject to FMZ restrictions (e.g., non-combustible structure setback, etc.) shall be obligated to comply with such restrictions."

1. The OCFA will be designated as a third-party beneficiary of an HOA's duty to perform "Fire Prevention Maintenance" (as defined below) for all portions of the Association Property or Common Area that constitute FMZs and designated interior/manufactured slopes to be maintained by the H O A , and of any Owner's duty to comply with any FMZ restrictions applicable to their lot or condominium. Additionally, OCFA shall have the right, but not the obligation, to enforce the HOA's duty to perform such Fire Prevention Maintenance, and to enforce compliance by any owner with any FMZ restrictions applicable to their lot or condominium. In furtherance of such right, the OCFA shall be entitled to recover its costs of suit, including its actual attorneys' fees, if it prevails in an enforcement action against an HOA and/or an individual owner (a sample third-party beneficiary provision to be incorporated into the CC&Rs is attached hereto as Addendum "1").

2. As used herein, "Fire Prevention Maintenance" shall mean the following:
    a. All portions of the Association Property or Common Area that constitute FMZs or designated interior/manufactured slopes shall be regularly maintained by the HOA on a year-round basis in accordance with the fuel modification plan on file with the property manager for the development.
    b. The irrigation system for FMZs or designated interior/manufactured slopes shall be kept in good condition and proper working order at all times. The irrigation system shall not be turned off except for necessary repairs and maintenance.

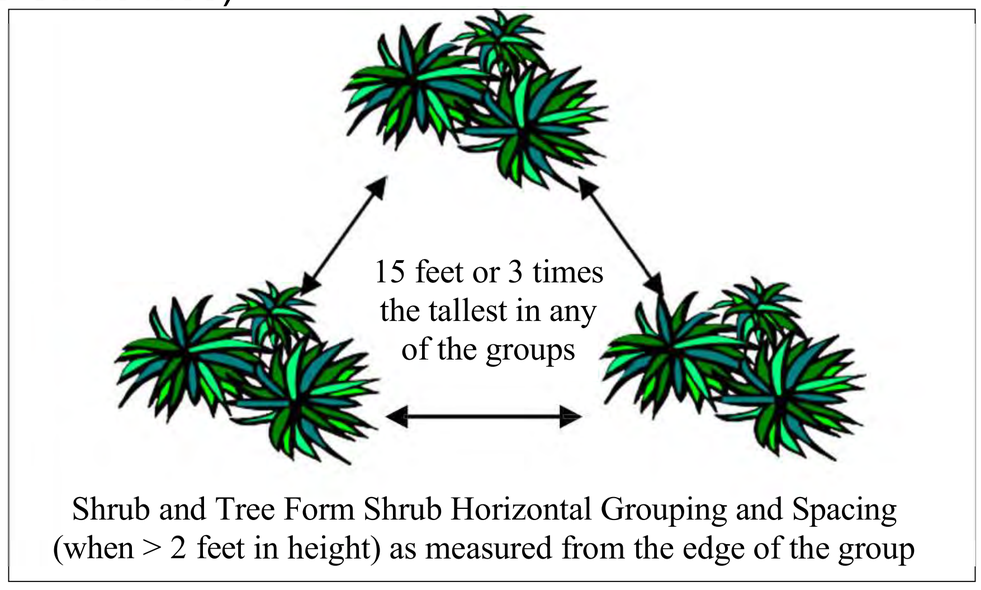
ADDENDUM "1"

Enforcement by the Orange County Fire Authority (OCFA): The OCFA is hereby designated as an intended third-party beneficiary of the Association's duties to perform "Fire Prevention Maintenance" for all portions of the Association Property or Common Areas consisting of FMZs or designated interior/manufactured slopes in accordance with the fuel modification plan, and of each owner's duty to comply with any FMZ or designated interior/manufactured slopes restrictions applicable to their lot or condominium as set forth in the fuel modification plan. In furtherance thereof, the OCFA shall have the right, but not the obligation, to enforce the performance by the association of its duties and any other fire prevention requirements which were imposed by the OCFA or other public agency as a condition of approval for the development (e.g., prohibition of parking in fire lanes, maintenance of the blue reflective markers indicating the location of fire hydrants, etc.). The OCFA shall also have the right, but not the obligation, to enforce compliance by any owner with any FMZ or designated interior/manufactured slopes restrictions applicable to their lot or condominium as set forth in the fuel modification plan. If in its sole discretion, the OCFA shall deem it necessary to take legal action against the association or any owner to enforce such duties or other requirements, and prevails in such action, the OCFA shall be entitled to recover the full costs of said action including its actual attorneys' fees, and to impose a lien against the association property, or an owner's lot or condominium, as the case may be, until said costs are paid in full.

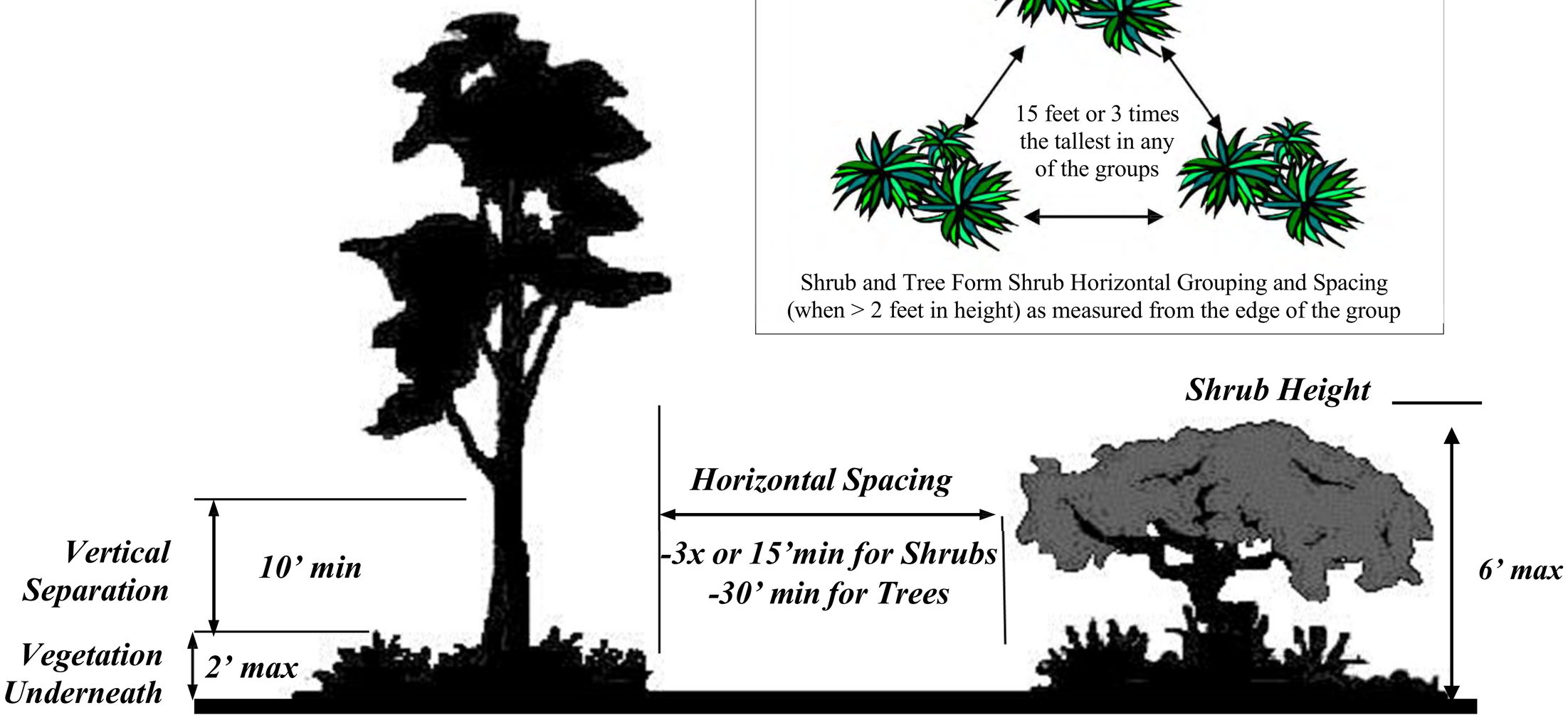
ATTACHMENT 6

Requirements for Planting Installation in Fuel Modification Zones

(For ongoing requirements, see Attachment 2: Introductory Maintenance Information and the OCFA Vegetation Management Maintenance Guidelines)



Shrub and Tree Form Shrub Horizontal Grouping and Spacing
(when > 2 feet in height) as measured from the edge of the group



Horizontal Spacing

Vegetation Less than 2 Feet in Height:

- No horizontal spacing or vertical separation is required. Ground cover shall not exceed 2 feet in height. In Zone "B" ground cover shall cover the entire ground between groups of shrubs, trees, or grasses and grasses are not considered ground cover. Limited compartments of grasses are acceptable as approved on the planting plans. In Zone "C/D" grasses can cover the entire area.

Vegetation 2 Feet in Height or Greater:

- Shrub Group Size & Spacing:
  - Shrubs shall not exceed 6ft in height.
  - Groupings of shrubs are limited to a maximum aggregate diameter of 10 feet.
  - Groups of shrubs shall be spaced by the greater of the following two measurements: A distance of 15 feet minimum (or) 3 times the height of the tallest specimen in any of the groups.
  - Groupings of shrubs are not allowed within 30 feet of structures. Only single specimen shrubs are allowed, with a minimum 15 feet of separation between each shrub specimen.
  - No shrubs over 2 feet in height are allowed within 5 feet of combustible structures.
  - No vegetation over 2 feet in height is allowed within 15 feet from the edge of tree canopy(s).
- Tree Group Size & Spacing:
  - Groupings of trees are limited to a maximum number of 3 specimens or less.
  - Groups of trees shall be spaced by a minimum distance of 30 feet regardless of height. In Zone "A," full growth tree branches are not allowed within 10 feet of combustible structures.
  - Horizontal spacing is required inside the group with a minimum 10 feet separation between each tree canopy.

Vertical Separation

Trees Less than 15 Feet in Height:

- When the fuel modification zone is within 30 feet of the structure, a vertical separation of 2 feet minimum is required from the vegetation below.

Trees 15 Feet in Height or Greater:

- A vertical separation of 10 feet minimum is required to be maintained from the vegetation below.
- All vegetation located underneath trees, shall be a maximum of 2 feet in height.

ATTACHMENT 7

Undesirable and Invasive Plant Species

Certain plants are considered to be undesirable and invasive due to their physical or chemical characteristics. Physical properties that would contribute to high flammability include large amounts of dead material retained within the plant, rough or peeling bark, and the production of copious amounts of litter. Chemical properties include the presence of volatile substances such as oils, resins, wax, and pitch. Certain native plants are notorious for containing these volatile substances.

Plants with these characteristics shall not be planted in any fuel modification zones or anywhere within the area covered by Alternate Methods & Materials agreements (see Section 4: Alternate Materials & Methods). Should these species already exist within these areas, they shall be removed because of their invasiveness or potential threat they pose to structures.

PLANT SPECIES (MANDATORY REMOVAL)

Botanical Name	Common Name
Adenostoma Fasciculatum	Chamise
Adenostoma Sparsifolium	Red Shanks
Anthemix Cotula	Mayweed
Artemisia Californica	California Sagebrush
Brassica Nigra	Black Mustard
Brassica Rapa	Wild Turnip, Yellow Mustard, Field Mustard
Cardaria Draba	Hoary Cress, Perennial Peppergrass
Cirsium Vulgare	Wild Artichoke
Conyza Canadensis	Horseweed
Cynara Cardunculus	Artichoke Thistle
Eriogonum Fasciculatum	Common Buckwheat
Heterothaca Grandiflora	Telegraph Plant
Lactuca Serriola	Prickly Lettuce
Nassella/Stipa tenuissima	Mexican Feathergrass
Nicotiana Bigelevil	Indian Tobacco
Nicotiana Glauca	Tree Tobacco
Pennisetum alopecuroides	Fountain Grass
Ricinus Communis	Castor Bean Plant
Sacsola Austails	Russian Thistle/Tumbleweed
Salvia Mellifera	Black Sage
Silybum Marianum	Milk Thistle
Tamarix Ramosissima	Salt Cedar
Urtica Urens	Burning Nettle
Ornamental:	
Arecaceae (all palm species)	Palms
Cycas Revoluta	Sago Palms
Cortaderia	Pampas Grass
Cupressus sp	Cypress
Eucalyptus sp	Eucalyptus
Juniperus sp	Juniper
Pinus sp	Pine

ATTACHMENT 8
Fuel Modification Zone Plant List

Symbol Legend

X = Plant species prohibited in wet and dry FMZs adjacent to reserve lands. Acceptable on all other fuel modification locations and zones.

W = Plant species appropriate for use in wet FMZs adjacent to reserve lands. Acceptable in all other wet and irrigated dry (manufactured slopes) fuel modification locations and zones.

o = Plant species native to Orange County. Acceptable in all fuel modification wet and dry zones in all locations.

N = Plant species acceptable on a limited basis (maximum 30% of the area) in wet FMZs adjacent to reserve lands. Acceptable on all other FMZs.

* = If locally collected.

** = Not native but can be used in all zones.

n = Plant species acceptable on a limited use basis. Refer to qualification requirements following plant palette.

Yellow row = Plant species susceptible to Invasive Shot Hole Borers (ISHB) infestation.

	Code	Botanical Name	Common Name	Plant Form
1.	W	Abelia x grandiflora	Glossy Abelia	Shrub
2.	n	Acacia redolens desert carpet	Desert Carpet	Ground Cover
3.	o	Acer macrophyllum	Big Leaf Maple	Tree
4.	X	Achillea millefolium	Common Yarrow	Low Shrub
5.	W	Achillea tomentosa	Woolly Yarrow	Low Shrub
6.	X	Aeonium decorum	Aeonium	Ground cover
7.	X	Aeonium simsii	no common name	Ground cover
8.	W	Agave attenuata	Century Plant	Succulent
9.	W	Agave shawii	Shaw's Century Plant	Succulent
10.	N	Agave victoriae-reginae	no common name	Ground Cover
11.	X	Ajuga reptans	Carpet Bugle	Ground Cover
12.	W	Alnus cordata	Italian Alder	Tree
13.	o	Alnus rhombifolia	White Alder	Tree
14.	N	Aloe arborescens	Tree Aloe	Shrub
15.	N	Aloe aristata	no common name	Ground Cover
16.	N	Aloe brevifoli	no common name	Ground Cover
17.	W	Aloe Vera	Medicinal Aloe	Succulent
18.	W	Alogyne huegeii	Blue Hibiscus	Shrub
19.	o	Ambrosia chammissonis	Beach Bur-Sage	Perennial

	Code	Botanical Name	Common Name	Plant Form
20.	o	Amorpha fruticosa	Western False Indigobush	Shrub
21.	W	Anigozanthus flavidus	Kangaroo Paw	Perennial/accent
22	o	Antirrhinum nuttalianum ssp.	no common name	Subshrub
23.	X	Aptenia cordifolia x ‘Red Apple’	Red Apple Aptenia	Ground cover
24.	W	Arbutus unedo	Strawberry Tree	Tree
25.	W	Arctostaphylos ‘Pacific Mist’	Pacific Mist Manzanita	Ground Cover
26.	W	Arctostaphylos edmundsii	Little Sur Manzanita	Ground Cover
27.	o	Arctostaphylos glandulosa ssp.	Eastwood Manzanita	Shrub
28.	W	Arctostaphylos hookeri ‘Monterey Carpet’	Monterey Carpet Manzanita	Low Shrub
29.	N	Arctostaphylos pungens	no common name	Shrub
30.	N	Arctostaphylos refugioensis	Refugio Manzanita	Shrub
31.	W	Arctostaphylos uva-ursi	Bearberry	Ground Cover
32.	W	Arctostaphylos x ‘Greensphere’	Greensphere Manzanita	Shrub
33.	N	Artemisia caucasica	Caucasian Artesmisia	Ground Cover
34.	X	Artemisia pycnocephala	Beach Sagewort	Perennial
35.	X	Atriplex canescens	Four-Wing Saltbush	Shrub
36.	X	Atriplex lentiformis ssp. breweri	Brewer Saltbush	Shrub
37.	o	Baccharis emoyi	Emory Baccharis	Shrub
38.	W o	Bacharis pilularis ssp. Consanguinea	Chaparral Bloom	Shrub
39.	X	Baccharis pilularis var. pilularis	Twin Peaks #2	Ground Cover
40.	o	Baccharis salicifolia	Mulefat	Shrub
41.	N	Baileya Multiradiata	Desert Marigold	Ground Cover
42.	N n	Bougainvillea spectabilis	Bougainvillea	Shrub
43.	o	Brickellia californica	no common name	Subshrub
44.	W o	Bromus carinatus	California Brome	Grass
45.	o	Camissonia cheiranthifiloa	Beach Evening Primrose	Perennial Shrub
46.	N	Carissa macrocarpa	Green Carpet Natal Plum	Ground Cover/Shrub
47.	X	Carpobrotus chilensis	Sea Fig Ice Plant	Ground Cover
48.	W	Ceanothus gloriosus ‘Point Reyes’	Point Reyes Ceanothus	Shrub
49.	W	Ceanothus griseus ‘Louis Edmunds’	Louis Edmunds Ceanothus	Shrub
50.	W	Ceanothus griseus horizontalis	Yankee Point	Ground Cover
51.	W	Ceanothus griseus var. horizontalis	Carmel Creeper Ceanothus	Shrub
52.	W	Ceanothus griseus var. horizontalis	Yankee Point Ceanothus	Shrub
53.	o	Ceanothus megarcarpus	Big Pod Ceanothus	Shrub
54.	W	Ceanothus prostratus	Squaw Carpet Ceanothus	Shrub
55.	o	Ceanothus spinosus	Green Bark Ceanothus	Shrub
56.	W	Ceanothus verrucosus	Wart-Stem Ceanothus	Shrub
57.	W	Cerastium tomentosum	Snow-in-Summer	Ground cover/Shrub
58.	W	Ceratonia siliqua	Carob	Tree
59.	W	Cercis occidentalis	Western Redbud	Shrub/Tree

	Code	Botanical Name	Common Name	Plant Form
60.	X	Chrysanthemum leucanthemum	Oxeye Daisy	Ground Cover
61.	W	Cistus Crispus	no common name	Ground Cover
62.	W	Cistus hybridus	White Rockrose	Shrub
63.	W	Cistus incanus	no common name	Shrub
64.	W	Cistus incanus ssp. Corsicus	no common name	Shrub
65.	W	Cistus salviifolius	Sageleaf Rockrose	Shrub
66.	W	Cistus x purpureus	Orchid Rockrose	Shrub
67.	W	Citrus species	Citrus	Tree
68.	o	Clarkia bottae	Showy Fairwell to Spring	Annual
69.	o	Cneoridium dumosum	Bushrue	Shrub
70.	o	Collinsia heterophyllia	Chinese Houses	Annual
71.	W o	Comarostaphylis diversifolia	Summer Holly	Shrub
72.	N	Convolvulus cneorum	Bush Morning Glory	Shrub
73.	W	Coprosma kirkii	Creeping Coprosma	Ground Cover/Shrub
74.	W	Coprosma pumila	Prostrate Coprosma	Low shrub
75.	o	Coreopsis californica	Califiornia Coreopsis	Annual
76.	W	Coreopsis lanceolata	Coreopsis	Ground Cover
77.	N	Corea pulchella	Australian Fuscia	Ground Cover
78.	W	Cotoneaster buxifolius	no common name	Shrub
79.	W	Cotoneaster congestus ‘Likiang’	Likiang Cotoneaster	Ground Cover/Vine
80.	W	Cotoneaster aprneyi	no common name	Shrub
81.	X	Crassula lactea	no common name	Ground Cover
82.	X	Crassula multicava	no common name	Ground Cover
83.	X	Crassula ovata	Jade Tree	Shrub
84.	X	Crassula tetragona	no common name	Ground Cover
85.	W o	Croton californicus	California Croton	Ground Cover
86.	X	Delosperma ‘alba’	White trailing Ice Plant	Ground Cover
87.	o	Dendromecon rigida	Bush Poppy	Shrub
88.	o	Dichelostemma capitatum	Blue Dicks	Herb
89.	N	Distinctis buccinatoria	Blood-Red Trumpet Vine	Vine/Climbing vine
90.	N	Dodonaea viscosa	Hopseed Bush	Shrub
91.	X	Drosanthemum floribundum	Rosea Ice Plant	Ground Cover
92.	X	Drosanthemum hispidum	no common name	Ground Cover
93.	X	Drosanthemum speciosus	Dewflower	Ground Cover
94.	o	Dudleya lanceolata	Lance-leaved Dudleya	Succulent
95.	o	Dudleya pulverulenta	Chalk Dudleya	Succulent
96.	W	Elaeagnus pungens	Silverberry	Shrub
97.	o	Encelia californica	California Encelia	Small Shrub
98.	o *	Epilobium canum [Zauschneria californica]	Hoary California Fuschia	Shrub
99.	o	Eriastrum Sapphirinum	Mojave Woolly Star	Annual
100.	N	Eriobotrya japonica	Loquat	Tree

	Code	Botanical Name	Common Name	Plant Form
101.	o	Eriodictycon trichocalyx	Yerba Santa	Shrub
102.	W o	Eriophyllum confertiflorum	no common name	Shrub
103.	W	Erythrina species	Coral Tree	Tree
104.	N	Escallonia species	Several varieties	Shrub
105.	W o	Eschscholzia californica	California Poppy	Flower
106.	X	Eschscholzia mexicana	Mexican Poppy	Herb
107.	N	Euonymus fortunei	Winter Creeper Euonymus	Ground Cover
108.	N	Feijoa sellowiana	Pineapple Guava	Shrub/Tree
109.	N	Fragaria chiloensis	Wild Strawberry/Sand Strawberry	Ground Cover
110.	o	Frankenia salina	Alkali Heath	Ground Cover
111.	W	Fremontondendron californicum	California Flannelbush	Shrub
112.	X	Gaillardia x grandiflora	Blanketflower	Ground Cover
113.	W	Galvezia speciosa	Bush Snapdragon	Shrub
114.	W	Garrya ellipta	Silktassel	Shrub
115.	X	Gazania hybrids	South African Daisy	Ground Cover
116.	X	Gazania rigens leucolaena	Training Gazania	Ground Cover
117.	o	Gilia capitata	Globe Gilia	Perennial
118.	W	Gilia leptantha	Showy Gilia	Perennial
119.	W	Gilia tricolor	Bird’s Eyes	Perennial
120.	W	Ginkgo biloba	Maidenhair Tree	Tree
121.	o	Gnaphalium californicum	California Everlasting	Annual
122.	W	Grewia occidentalis	Starflower	Shrub
123.	o	Grindelia stricta	Gum Plant	Ground Cover
124.	N n	Hakea suaveolens	Sweet Hakea	Shrub
125.	W	Hardenbergia comptoniana	Lilac Vine	Shrub
126.	N	Heliathemum muutabile	Sunrose	Ground Cover/Shrub
127.	o	Helianthemum scoparium	Rush Rose	Shrub
128.	o	Heliotropium curassavicum	Salt Heliotrope	Ground Cover
129.	X	Helix Canariensis	English Ivy	Ground Cover
130.	W	Hesperaloe parviflora	Red Yucca	Perennial
131.	o n	Heteromeles arbutifolia	Toyon	Shrub
132.	X	Hypericum calycimum	Aaron’s Beard	Shrub
133.	N	Iberis sempervirens	Edging Candytuft	Ground Cover
134.	N	Iberis umbellatum	Globe Candytuft	Ground Cover
135.	o	Isocoma menziesii	Coastal Goldenbush	Small Shrub
136.	o	Isomeris arborea	Bladderpod	Shrub
137.	W	Iva hayesiana	Poverty Weed	Ground Cover
138.	N	Juglans californica	California Black Walnut	Tree
139.	o	Juncus acutus	Spiny Rush	Perennial
140.	o	Keckiella antirrhinoides	Yellow Bush Penstemon	Subshrub
141.	o	Keckiella cordifolia	Heart Leaved Penstemon	Subshrub

	Code	Botanical Name	Common Name	Plant Form
142.	o	Keckiella ternata	Blue Stemmed Bush Penstemon	Subshrub
143.	W	Kniphofia uvaria	Red Hot Poker	Perennial
144.	W	Lagerstroemia indica	Crape Myrtle	Tree
145.	W	Lagunaria patersonii	Primrose Tree	Tree
146.	X	Lamprathus aurantiacus	Bush Ice Plant	Ground Cover
147.	X	Lampranthus filicaulis	Redondo Creeper	Ground Cover
148.	X	Lampranthus spectabilis	Trailing Ice Plant	Ground Cover
149.	W	Lantana camara cultivars	Yellow Sage	Shrub
150.	W	Lantana montevidensis	Trailing Lantana	Shrub
151.	o	Lasthenia californica	Dwarf Goldfields	Annual
152.	W	Lavandula dentata	French Lavender	Shrub
152.	W	Leptospermum laevigatum	Australian Tea Tree	Shrub
154.	W	Leucophyllum frutescens	Texas Ranger	Shrub
155.	o	Leymus condensatus	Giant Wild Rye	Large Grass
156.	N	Ligustrum japonicum	Texas privet	Shrub
157.	X	Limonium pectinatum	no common name	Ground Cover
158.	X	Limonium perezii	Sea Lavender	Shrub
159.	W n	Liquidambar styraciflua	American Sweet Gum	Tree
160.	W	Liriodendron tulipfera	Tulip Tree	Tree
161.	X	Lonicera japonica ‘Halliana’	Hall’s Japanese Honeysuckle	Vining Shrub
162.	o	Lonicera subspicata	Wild Honeysuckle	Vining Shrub
163.	X	Lotus corniculatus	Bird’s Foot Trefoil	Ground Cover
164.	o	Lotus hermannii	Northern Woolly Lotus	Perennial
165.	o	Lotus scoparius	Deerweed	Shrub
166.	W	Lupinus arizonicus	Desert Lupine	Annual
167.	W	Lupinus benthamii	Spider Lupine	Annual
168.	o	Lupinus bicolor	Sky Lupine	Flowering annual
169.	o	Lupinus sparsiflorus	Loosely Flowered Annual Lupine or Coulter’s Lupine	Annual
170.	W	Lyonothamnus floribundus ssp. Asplenifolius	Fernleaf Ironwood	Tree
171.	W	Macadamia integrifolia	Macadamia Nut	Tree
172.	W	Mahonia aquifolium ‘Golden Abundance’	Golden Abundance Oregon Grape	Shrub
173.	W	Mahonia nevenii	Nevin Mahonia	Shrub
174.	o	Malacothamnus fasciculatus	Chapparal Mallow	Shrub
175.	X	Malephora luteola	Training Ice Plant	Ground Cover
176.	W	Maytenus boaria	Mayten Tree	Tree
177.	W	Melaleuca nesophila	Pink Melaleuca	Shrub
178.	N	Metrosideros excelsus	New Zealand Christmas Tree	Tree
179.	o *	Mimulus species	Monkeyflower	Flower
180.	o	Mirabilis californica	Wishbone Bush	Perennial
181.	N	Myoporum debile	no common name	Shrub

	Code	Botanical Name	Common Name	Plant Form
182.	W	Myoporum insulare	Boobyalla	Shrub
183.	W	Myoporum parvilfolium	no common name	Ground Cover
184.	W	Myoporum ‘Pacificum’	no common name	Ground Cover
185.	o	Nassella (stipa) lepidra	Foothill Needlegrass	Ground Cover
186.	o	Nassella (stipa) pulchra	Purple Needlegrass	Ground Cover
187.	o	Nemophilia menziesii	Baby Blue Eyes	Annual
188.	X	Nerium Oleander	Oleander	Shrub
189.	o	Nolina cismontana	Chapparal Nolina	Shrub
190.	N	Nolina species	Mexican Grasstree	Shrub
191.	W	Oenothera belandieri	Mexican Evening Primrose	Ground Cover
192.	N	Oenothera hookeri	California Evening Primrose	Flower
193.	W	Oenothera speciosa	Show Evening Primrose	Perennial
194.	X	Ophiopogon japonicus	Mondo Grass	Ground Cover
195.	o *	Opuntia littoralis	Prickly Pear	Cactus
196.	o *	Opuntia oricola	Oracle Cactus	Cactus
197.	o *	Opuntia prolifera	Coast Cholla	Cactus
198.	W	Osmanthus fragrans	Sweet Olive	Shrub
199.	X	Osteospermum fruticosum	Training African Daisy	Ground Cover
200.	X	Parkinsonia aculeata	Mexican Palo Verde	Tree
201.	W	Pelargonium peltatum	Ivy Geranium	Ground Cover
202.	X	Penstemon species	Beard Tongue	Shrub
203.	W	Photinia fraseria	no common name	Shrub
204.	W	Pistacia chinesis	Chinese Pistache	Tree
205.	X	Pittosporum undulatum	Victorian Box	Tree
206.	o	Plantago erecta	California Plantain	Annual
207.	**	Plantago insularis	Woolly Plantain	Annual
208.	X	Plantago sempervirens	Evergreen Plantain	Ground Cover
209.	W	Plantanus racemosa	California Sycamore	Tree
210.	W	Plumbago auritulata	Plumbago Cape	Shrub
211.	o	Popolus fremontii	Western Cottonwood	Tree
212.	X	Portulacaria afra	Elephant’s Food	Shrub
213.	o	Potentilla glandulosa	Sticky Cinquefoil	Subshrub
214.	X	Potentilla tabernaemontanii	Spring Cinquefoil	Ground Cover
215.	X	Prunus caroliniana	Carolina Cherry Laurel	Shrub/Tree
216.	o	Prunus ilicifolia ssp. Ilicifolia	Holly Leafed Cherry	Shrub
217.	X	Prunus lyonii	Catalina Cherry	Shrub/Tree
218.	N	Punica granatum	Pomegranate	Shrub/Tree
219.	W	Puya species	Puya	Succulent/Shrub
220.	W	Pyracantha species	Firethorn	Shrub
221.	o	Quercus agrifolia	Coast Live Oak	Tree
222.	o n *	Quercus berberdifolia	California Scrub Oak	Shrub
223.	o n *	Quercus dumosa	Coastal Scrub Oak	Shrub

	Code	Botanical Name	Common Name	Plant Form
224.	X	Quercus engelmannii	Engelmann Oak	Tree
225.	X	Quercus suber	Cork Oak	Tree
226.	X	Rhamnus alaternus	Italian Buckthorn	Shrub
227.	o	Rhamnus californica	California Coffee Berry	Shrub
228.	o	Rhamnus crocea	Redberry	Shrub
229.	o	Rhamnus crocea ssp. Ilicifolia	Hollyleaf Redberry	Shrub
230.	N	Rhaphiolepis species	Indian Hawthorne	Shrub
231.	o	Rhus integrifolia	Lemonade Berry	Shrub
232.	N	*Searsia Lancea*	African Sumac	Tree
233.	o n	Rhus ovata	Sugar bush	Shrub
234.	o	Ribes aureum	Golden Currant	Shrub
235.	o	Ribes indecorum	White Flowering Currant	Shrub
236.	o	Ribes speciosum	Fuschia Flowering Gooseberry	Shrub
237.	W	Ribes viburnifolium	Evergreen currant	Shrub
238.	o *	Romneya coulteri	Matilija Poppy	Shrub
239.	X	Romneya coulteri ‘White Cloud’	White Cloud Matilija Poppy	Shrub
240.	W n	Rosmarinus officinalis	Rosemary	Shrub
241.	W n	Salvia greggii	Autums Sage	Shrub
242.	W n	Salvia sonomensis	Creeping Sage	Ground Cover
243.	o	Sambucus mexicana	Mexican Elderberry	Tree
244.	W	Santolina chamaecyparissus	Lavender Cotton	Ground Cover
245.	W	Santolina virens	Green Lavender Cotton	Shrub
246.	o	Satureja chandleri	San Miguel Savory	Perennial
247.	o	Scirpis scutus	Hard Stem Bulrush	Perennial
248.	o	Scirpus californicus	California Bulrush	Perennial
249.	X	Sedum acre	Goldmoss Sedum	Ground Cover
250.	X	Sedum album	Green Stonecrop	Ground Cover
251.	X	Sedum confusum	no common name	Ground Cover
252.	X	Sedum lineare	no common name	Ground Cover
253.	X	Sedum x rubrotinctum	Pork and Beans	Ground Cover
254.	X	Senecio serpens	no common name	Ground Cover
255.	o	Sisyrinchium bellum	Blue Eyed Grass	Ground Cover
256.	o	Solanum douglasii	Douglas Nightshade	Shrub
257.	o	Solanum xantii	Purple Nightshade	Perennial
258.	W	Stenicarpus sinuatus	Firewheel Tree	Tree
259.	W	Strelitzia nicolai	Giant Bird of Paradise	Perennial
260.	W	Strelitzia reginae	Bird of Paradise	Perennial
261.	o	Symphoricarpos mollis	Creeping Snowberry	Shrub
262.	W	Tecoma stans (Stenolobium stans)	Yellow Bells	Shrub/Small Tree
263.	X	Tecomaria capensis	Cape Honeysuckle	Ground Cover
264.	N	Teucarium chamedrys	Germander	Ground Cover
265.	N	Thymus serpyllum	Lemon Thyme	Ground Cover

	Code	Botanical Name	Common Name	Plant Form
266.	N	Trachelospermum jasminoides	Star Jasmine	Shrub
267.	o	Trichosstems lanatum	Woolly Blue Curls	Shrub
268.	X	Trifolium hirtum ‘Hyron’	Hyron Rose Clover	Ground Cover
269.	X	Trifolium fragerum ‘O’Connor’s’	O’Connor’s Legume	Ground Cover
270.	o	Umbellularia californica	California Laurel	Tree
271.	o	Verbena lasiostachys	Western Vervain	Perennial
272.	N	Verbena peruviana	no common name	Ground Cover
273.	X	Verbena species	Verbena	Ground Cover
274.	X	Vinca minor	Dwarf Periwinkle	Ground Cover
275.	o	Vitis girdiana	Desert Wild Grape	Vine
276.	X	Vulpia myuros ‘Zorro’	Zorro Annual Fescue	Grass
277.	W	Westringia fruticosa	no common name	Shrub
278.	W	Xannithorrhoea species	Grass Tree	Perennial, Accent shrub
279.	W	Xylosma congestum	Shiny Xylosma	Shrub
280.	X	Yucca Species	Yucca	Shrub
281.	o	Yucca whipplei	Yucca	Shrub

Approved Plant Palette Qualification Statements for Select Plant Species

2. Acacia redolens desert carpet: May be used in the furthest ½ of the "B" FMZ from the structure, and no closer than 25 feet from the edge of the zone nearest the structure. The plants may be planted with a minimum spacing at 10 feet on center, maximum spacing in meandering zones not to exceed a mature width of 24 feet and mature height of 24 inches. If acacia redolens desert carpet is used in the roadway protection zone, it shall be maintained at a minimum of 25 feet from the curb face. At the time of precise plan review, the mature spacing shall be accounted for.

42. Bougainvillea spectabilis (procumbent varieties): Procumbent to mounding varieties may be used in the mid "B" FMZ. The plants may be planted in groups at 6 feet on center spacing not to exceed eight plants per group. Mature spacing between individual plants or groups shall be at a 30 foot minimum.

125. Hakea suaveolens: May be used in the mid "B" FMZ. The plants shall be used as single specimens with mature spacing between plants of 30 feet minimum.

132. Heteromeles arbutifolia: May be used in the mid to lower "B" FMZ. The plants may be planted in groups of up to 3 plants per group. Mature spacing between individual plants or groups shall be at a 30 foot minimum.

160. Liquidambar styraciflua: May be used in the mid "B" FMZ. The plant shall be used as single specimens with mature spacing between trees and a 30 foot minimum.

223. Quercus berberdifolia: Additional information may be required as directed by the OCFA unless approved on the plan as shown.

224. Quercus dumosa: May be used in the mid to lower "B" FMZ. The plants may be planted in groups of up to 3 plants per group. Mature spacing between individual plants or groups shall be at a 30 foot minimum.

234. Rhus ovata & Rhus integrifolia: May be used in the mid to lower "B" FMZ of inland areas only. The plants may be planted in groups of up to 3 plants per group. Mature spacing between individual plants or groups shall be at a 30 foot minimum.

241. Rosmarinus officinalis: When used as a ground cover, it shall be maintained at 2 feet in height. Additional information may be required as directed by the OCFA.

242. Salvia greggii: Additional information may be required as directed by the OCFA unless approved on the plan as shown.

243. Salvia sonomensis: May be used in the mid to upper "B" FMZ. The plants may be planted in groups of up to 3 plants per group. Mature spacing between individual plants or groups shall be at a 15 foot minimum.

Appendix C

IBHS - Wildfire Prepared Neighborhood Guide

WILDFIRE PREPARED®
NEIGHBORHOOD

TECHNICAL STANDARD

VERSION 2025

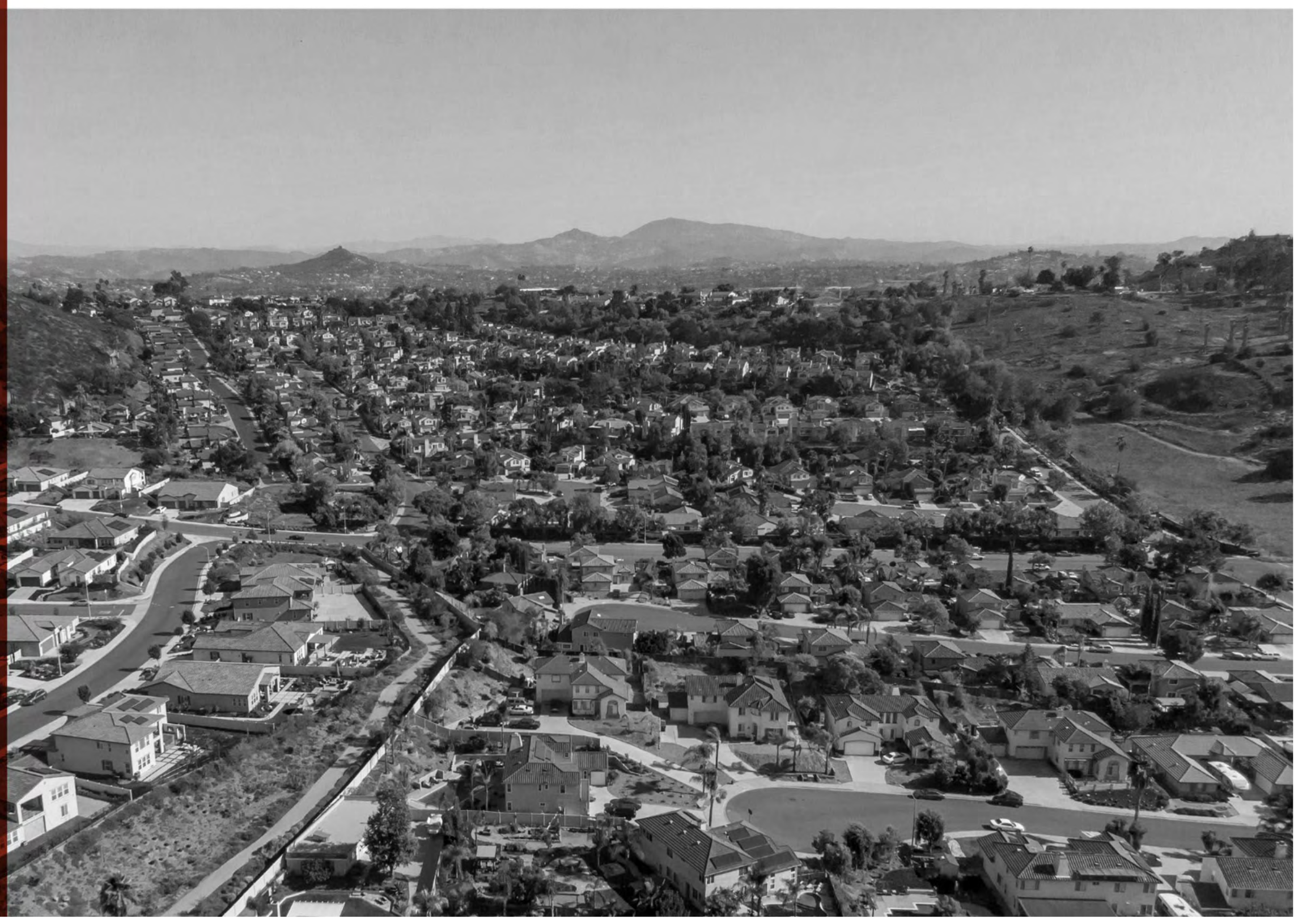


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FOREWORD

Roy Wright, President & CEO of the Insurance Institute for Business & Home Safety

Mother Nature can intrude into communities bringing all manner of disasters, each with its own unique challenges.

Wildfires—unlike wind, flood, or hail—intensify when they encounter our built environment. While adding hurricane clips and straps to a home's structure can reduce its vulnerability to a high wind event, the construction quality of a home against wind has only small impacts on the next-door neighbor and does not affect the strength of the hurricane itself. However, the wildfire risk of adjacent homes not only correlates to its exposure but can also amplify the vulnerability. When one home ignites and then sets the next structure on fire, it triggers a cascade of destruction.

This significant wildfire risk did not develop overnight. We are addressing a multi-generational issue that has been evolving for over 75 years in neighborhoods adjacent to lands where fire has been part of their ecosystems for millennia.

Yet we are neither helpless nor hopeless in the face of wildfire's fierce effects.

Our understanding of wildfire science, especially its interaction with the built environment, is advancing rapidly. The equation requires adaptation at both the parcel and community scale. Effective strategies to reduce wildfire risk for individual properties are proving their value. Now, we are tackling the next piece of the wildfire risk puzzle: addressing the neighborhood risks that drive large-scale conflagrations.

Each neighborhood is unique, even those developed by volume builders. They have different surrounding fuels, layouts, and connective fuels. To address these realities, **we need a mitigation system that can adapt to these characteristics while providing protections to reduce the probability of a conflagration that leads down the path to catastrophe.**

We can envision a scenario where the neighborhood, with its passive defense features, acts as a fuelbreak rather than a fuel source.

***The Wildfire Prepared Neighborhood Standard* by *IBHS* moves toward a community-scale, performance-based design rather than prescriptive elements.**

Adapting to wildfire is not easy. **These requirements of the standard will be tough for new neighborhoods and require extraordinary efforts for existing neighborhoods. However, intentional choices, targeted redesigns, and communal commitments offer the clearest path to wildfire survivability and enduring home insurability.**

Join us in preparing your neighborhood for wildfire. Together, we can create survivable, more resilient communities.

PREFACE

Wildfires, more than any other weather-related peril, become intrinsically connected to the built environment upon encounter. The built environment can serve as a fuel source, influence fire behavior, and govern fire spread. The progression of fire through the built environment highlights how each *structure* and its probability of ignition are influenced by its surroundings. In *neighborhoods* within the *wildland-urban interface*, where buildings may be separated by only feet or tens of feet, the survivability of a *structure* is highly influenced by its *neighbors*.

To address this critical need, the Insurance Institute for Business & Home Safety (*IBHS*) developed the *IBHS Wildfire Prepared Neighborhood Standard*. This technical standard aims to meaningfully reduce the probability of a built-environment conflagration in the *neighborhoods* where it is applied.

The standard focuses on the following core principles:

- Reducing the probability of initial ignitions along the perimeter of the *neighborhood* from an approaching wildfire, where direct flame and radiant heat can first impinge on homes.
- Protect the *neighborhood* from embers.
- If ignitions occur, reduce the rate of fire spread.
- Enable the entire n*eighborhood* to act as a passive system to defend against wildfire in all directions and to not serve as a volatile fuel source.

In developing this technical standard, a performance-based design approach was utilized, recognizing that all *neighborhoods* are different. Factors such as surrounding fuels, layout, size, shape, and the arrangement of *structures* and spaces between them can influence fire spread and fire behavior.
The *IBHS Wildfire Prepared Neighborhood Standard* integrates the current state of knowledge on how wildfire interacts with the built environment. It combines insights from post-event analyses, dynamical modeling, and experimental testing. The adaptive and objective process provided here determines the most beneficial mitigation strategies for each specific *neighborhood*, aligning with the core principles of the standard. The standard is also designed to incorporate new scientific knowledge and data sources while maintaining an objective approach and accounting quickly and efficiently for the uniqueness of each *neighborhood*.

This technical standard document is intended for use by builders, practitioners, code officials, engineers, developers, community planners, and fire officials for wildfire mitigation in both new developments and retrofits of existing *neighborhoods*. The standard consists of five main chapters covering applicability, definitions specific to this standard, a user guide, objective assessment processes, mitigation requirements, and associated references. Three appendices accompany the standard: *Appendix A* provides the data requirements and recommendations necessary to apply the standard. *Appendix B* focuses on scientific commentary on the methodology behind the standard and *Appendix C* is an additional practitioner guide including process diagrams for using the standard. Italicized words within the document indicate terms with standard-specific definitions, which are found in *Chapter 2*.

The *IBHS* Wildfire Prepared Neighborhood Technical Working Group is acknowledged for their contributions towards developing this standard:
Ian Giammanco, PhD
Steve Hawks
Faraz Hedayati, PhD
Xareni Sanchez Monroy, PhD
Murray Morrison, PhD
William Pogorzelski
Milad Shabanian, PhD
Evan Sluder

IBHS would also like to thank several external stakeholders that reviewed draft versions of this standard and assisted in testing technical processes.

IBHS Wildfire Prepared Neighborhood
Technical Standard
Version 2025

CHAPTER 1. Administration, applicability, and limitations

This section provides the prequalification requirements and application procedures for the *IBHS Wildfire Prepared Neighborhood Standard*. The standard mitigation requirements at the *neighborhood* community spatial scale the characteristics of surrounding fuels and of the defined n*eighborhood* itself. It is designed to meaningfully reduce the probability of *conflagration* within the defined *neighborhood* through reducing the probability of initial ignitions where direct flame contact and radiant heat may impact perimeter *structures* from *external fuel* sources and to reduce the probability of ember-driven ignitions from *external fuels* and fuels internal to the neighborhood.

1.1 Applicability

The *IBHS Wildfire Prepared Neighborhood Standard* shall be administered for an area defined by a specific, single, and closed polygon boundary. The provisions set forth in this standard apply to the dwelling types specified in *Section 1.1.1* within the defined boundary. All dwelling units within the defined boundary must be one of the dwelling types defined in *Section 1.1.1*.

The *IBHS Wildfire Prepared Neighborhood Standard* can be applied to a minimum of a single "*cluster*" of *qualified dwelling units* and where 90% or more *structures* have a minimum distance to the nearest surrounding structure of greater than 10 feet within the defined boundary.

The *IBHS Wildfire Prepared Neighborhood Standard's* mitigation requirements are not applicable if 90% or more of the defined neighborhood has a minimum *structure separation* distance of greater than 100 ft. The threat of *conflagration* is diminished, individual parcel level mitigation actions govern ignition probabilities, and dependencies on neighboring *structures* are reduced. This criterion follows the foundational Cohen (2000, 2008) *wildland-urban interface* fire conceptual model and *the Wildfire Mitigation Framework* described in Maranghides et al. (2022).

1.1.1 Qualified dwelling types

Single-family detached home: A freestanding residential building occupied by one family, limited to three stories above grade. This also includes detached single-family factory-built modular homes on a permanent foundation that are designed, built, and sited to meet all local building code requirements. It also includes *accessory dwelling unit(s)* (ADU)*, efficiency* co-located with other qualified dwelling types.

Two-family dwelling units (duplex): A freestanding residential building occupied by two families, limited to three stories above grade. Each individual unit must have the same number of stories within the overall structure, limited to three stories above grade. **NOTE:** The entire building, including the dwelling units, must be evaluated under the appropriate requirements and the entire building must meet all requirements specified in the *IBHS Wildfire Prepared Neighborhood Standard*.

Townhouse: A single-family dwelling unit is constructed in a group of three or more attached units in which each unit extends from foundation to roof, has a yard or public way on not less than two sides, and limited to three stories above grade. Mixed use (commercial and residential) buildings are not applicable. **NOTE:** The entire townhouse building, which includes all townhouse units composing the building, must be evaluated under the *IBHS Wildfire Prepared Neighborhood Technical Standard's* requirements and the entire *structure* must meet all requirements.

1.2 Limitations

1.2.1 Building codes

The requirements specified in the *IBHS Wildfire Prepared Neighborhood Technical Standard* currently exceed typical *Wildland-Urban Interface* model building codes (2024 International Wildland-Urban Interface Code – IWUIC, 2022 California Building Code Chapter 7A, 2022 NFPA 1140) through the requirement of a fully *0–5 Foot Noncombustible Zone* in both *neighborhood flame zone* and *neighborhood ember zone* requirements. The *IBHS Wildfire Prepared Neighborhood Standard* is designed to be implemented as a voluntary mitigation standard.

1.2.2 Conflagration

The standard is not intended to prevent large wildfires or eliminate conflagrations in the built-environment. It does seek to mitigate the impact of wildfires and meaningfully reduce the probability of built environment conflagration in neighborhoods where it is applied by establishing minimum requirements for structures, defensible space, and fuel management at a *neighborhood* spatial scale.

1.2.3 Connective fuel management

This standard provides minimum neighborhood requirements for management of fuels (both vegetative and built-environment elements) between structures. It does not seek to characterize vegetative fuels or species that may exhibit reduced combustibility at both the parcel and neighborhood scales.

1.2.4 External fuels

The standard currently assumes, through its processes and subsequent mitigation requirements, that fire can impinge on the neighborhood from all directions and that the worst-case fuels ignite. Currently, structural fuels within what could be a nearby neighborhood that has mitigation elements or another neighborhood which meets this standard are evaluated to the same criteria as if there were no mitigation present. If ignited, these fuels would impart the same flame/radiant heat and ember exposure as an un-mitigated neighborhood.

1.2.5 Fire Response

Advancements in technology, firefighting equipment capabilities, firefighter staffing levels, and training have increased the overall effectiveness of emergency response, structure defense, and wildfire suppression. Data suggests that 90% to 95% of all structures damaged during wildfire are defended, primarily by fire suppression resources. However, when a wildfire enters a vulnerable community under drought and high wind conditions, fire suppression resources cannot be expected to defend every individual structure threatened by embers, flames, and radiant heat. This illustrates the need for homes and communities to have a system of passive mitigations that can significantly aid in increasing the effectiveness of the fire suppression response under extreme conditions. This standard is designed to be applied as a passive mitigation system; therefore, it does not include provisions or requirements for fire service response.

1.2.6 Hazard Mapping

This standard does not provide mapping of *wildland-urban interface* areas, identify the fire hazard potential of locations under consideration, nor provide a specific wildfire risk assessment metric.

1.2.7 Location

The *IBHS Wildfire Prepared Neighborhood Technical Standard* is designed to apply to *neighborhoods* and communities with high to medium structure density, with most *structure separation* distances between 10 to 100 feet. Maranghides et al. (2022) provides a useful

definition of the *wildland-urban interface*, *WUI* Types 1-7, that incorporate structure separation distances and if the community is considered wildland "interface" or "intermixed." *WUI* types 1-5, characterized by *structure separation* distances from 6 to 100 feet and typical building densities of less than two *structures* per acre up to eight *structures* per acre, in interface and intermixed areas reflect the *neighborhoods* for which this standard is intended. It is not designed to be used as a construction standard in areas that span the entire built environment and/or large tracts of wildland areas or in dense urban corridors. (For more details see *Appendix B, Section B1.1)*

1.2.8 Maintenance
Buildings, *structures*, landscape materials, vegetation, defensible space or other devices or safeguards required by this standard shall be maintained in conformance to the standard edition under which it is installed.

1.2.9 Structure separation
Experimental research indicates that when *structure separation* is 10 feet or less, fire spread between two structures is highly likely. Therefore, the *IBHS Prepared Neighborhood Standard* contains applicability requirements related to *structure separation* distances. There are neighborhoods/communities that the standard does not apply to, given their small *structure separation* distances. Additional details and scientific reasoning are provided in *Appendix B*.

1.2.10 Topography
Topography is not considered within the *IBHS Wildfire Prepared Neighborhood Standard* in the determination of the *neighborhood flame zone* calculation within *Section 3.3*.

1.2.11 Units of measure
Within the *IBHS Wildfire Prepared Neighborhood Standard,* English units of measure are generally stated and shall be the units used and stated for any mitigation requirement. However, for processes described in *Chapter 3 and* within *Appendix B*, metric units are required for several of those calculations and are therefore presented as such.

1.2.12 Weather
This standard is intended to address wildfire and its impact on the built environment under weather conditions and fuel moisture characteristics typically observed during *conflagration* events. For specific calculations relative to mitigation requirements, an open terrain exposure, peak 3-second gust wind speed at 10 meters (33 ft) height of 70 mph is applied.

CHAPTER 2. Definitions & user guide

2.1 Definitions

0–5 Foot Noncombustible Zone (also referred to as Immediate Zone, Zone 0, or Ember-Resistant Zone). The area which surrounds a structure extending from the base of any exterior wall radially outward along the ground 5 feet and vertically to the sky. In this standard, this shall be referred to as the 0–5 Foot Noncombustible Zone.

Accessory dwelling unit (ADU). An attached or detached residential dwelling unit that provides complete independent living facilities for one or more persons and is located on a lot with a proposed or existing primary residence. It shall include permanent provisions for living, sleeping, eating, cooking, and sanitation on the same parcel as the *single-family* or *multifamily dwelling* is or will be situated (CA Government Code (GOV) 66313). The total floor area for a detached *accessory dwelling unit* shall not exceed 1,200 ft^2 (GOV 66314). A local agency shall not establish by ordinance any of the following: 1) A minimum square footage requirement for either an attached or detached accessory dwelling unit that prohibits an efficiency unit, 2) A maximum square footage requirement for either an attached or detached accessory dwelling unit that is less than either 850 ft^2 or 1,000 ft^2 for an *accessory dwelling unit* that provides more than one bedroom (GOV 66321).

Accessory structure. A detached building or *structure* used to shelter or support any material, equipment, chattel, or occupancy other than a habitable building (i.e., non-dwelling unit). Any detached *structure*, that is accessory and incidental to a *primary dwelling unit* located on the same *parcel* or lot that has a surface area coverage or footprint of greater than or equal to 15 ft^2 and less than 200 ft^2. A structure less than 15 ft^2 is not considered an *accessory structure* for *structure separation* applicability statistics, *structure separation* in the *neighborhood flame zone*, and *cluster* assessments but is considered in the *connective fuel* assessment.

Built environment fuel element. Built environment fuel elements are any combustible material, item, *accessory structure*, etc. An *accessory structure* is considered a *built environment fuel element*. Examples include but are not limited to fences, playhouses, sheds, pergolas, gazebos, detached decks, *accessory structures*, etc.

Cluster. Set of *structures* that are separated from other *structures* in the community by one of the following:
1) The following physical *noncombustible* barriers: any paved, maintained (city, town, county) road, any non-paved but gravel or bare soil roads, or natural barriers that are noncombustible such as creeks, rivers, lakes, ponds etc. with a minimum width of 20 feet.
2) 100 feet or more from other *structures* inside the defined *neighborhood* boundary, or
3) Separated from other *structures* inside the defined *neighborhoo*d by a combination of barriers or physical distance.
See *section 3.5.1*

Conflagration. Specific to the usage of this term within this standard, an especially large and destructive fire that produces uncontrolled structure-to-structure fire spread and mass *structure* losses.

Connective fuels. *Any fuel element* or group of fuel elements that aid in fire spread between structures.

Connective fuel flag. Assigned to a *cluster* where 10% or more of homes within a *cluster* have more than one *connected fuel pathway* to any neighboring structure.

Connective fuel flagged cluster. An identified *cluster* of *structures* where more than 10% of *structures* have more than one elevation with a *connective fuel pathway* to a neighboring *structure*.

Connective fuel pathway. Series of *fuel elements* or single fuel *elements* that connect two or more neighboring *structures* with no breaks greater than two times the width of the fuel element. If a break in a *fuel element/s* greater than two times the width of the *fuel element* is present, the pathway is considered broken. Any combustible fence which connects to two or more *structures* shall be considered a *connected fuel pathway* independent of other additional *fuel elements*. The presence of *noncombustible* fencing as an element of a *0–5 Foot Noncombustible Zone* shall be considered to have broken the specific *connective fuel pathway* associated with the fence; however other *fuel elements* present shall also be considered in identifying other paths.

Crown fire. Fire that burns canopy forest fuels like foliage, branches, and tall shrubs. Crown fires burn fuels above surface fuels.

Defensible space. An area either natural or man-made where material capable of allowing a fire to spread unchecked has been treated, cleared or modified to slow the rate and intensity of an advancing wildfire and to create an area for fire suppression operations to occur (IWUI 2024).

Dwelling unit, efficiency. *Structure* where all permanent provisions for living, sleeping, eating and cooking are contained in a single room.

Neighborhood ember zone (*NEz*). The area of the defined *neighborhood* determined by the process described in Section 3.4 which has a likelihood of ember exposure.

External fuels. Any *fuel element* or *fuel model type* identified using at a minimum the *LANDFIRE* dataset which is identified within a 4.25-mile buffer beyond the defined *neighborhood* boundary.

External fuel sector. 45° azimuthal sector extending radially outward from the *neighborhood centroid* to a maximum distance of 4.25 miles.

Firebrand. Combustible fragments of material from a fire source with the capacity to ignite other materials. For the purposes of the *IBHS Wildfire Prepared Neighborhood Standard, **firebrand*** and ***ember*** terminologies will be used interchangeably, despite technical nuance as described by Manzello and Suzuki (2022).

Firebreak. *Parcels* of land, linear in shape, where all combustible fuels are totally removed down to mineral soil through a combination of physical treatments (thinning, mechanical clearing, prescribed burning, slashing, mastication, mowing, plowing) or pavement such as roads, highways etc. In the case of a boulevard or any divided highway, if the area which is not paved (typically in the center) has no identified *connective fuel nodes*, the entire width of the boulevard and/or divided highway shall be considered a *firebreak*. If this condition is not met and *fuel elements* are present, the roadway width closest to the defined *neighborhood* boundary shall be considered the *firebreak*.

Fire-resistance-rated construction. The use of materials and systems in the design and construction of a building or structure to safeguard against the spread of fire within a building or *structure* and the spread of fire to or from buildings or *structures*. Where this standard requires 1-hour fire-resistance-rated construction, the fire-resistance rating of building elements, components or assemblies shall be determined in accordance with the test procedures set forth in ASTM E119 or UL 263.
Exceptions:

1) The fire-resistance rating of *structure* elements, components or assemblies based on the

designs prescribed in Section 721 of the International Building Code.

2) The fire-resistance rating of structure elements, components or assemblies based on the calculation procedures in accordance with Section 722 of the International Building Code.

Flame fuel assessment zone. Buffer zone that extends 0.25 miles (approximately 300 meters) radially outward from the boundary of the defined *neighborhood*. This area is used to determine fuels that are relevant for the flame fuel assessment process.

Fuel element. Any combustible item such as but not limited to plants, materials (e.g., children's playhouses, racks of firewood, plastic storage bins, etc.), combustible ground cover (i.e., mulch), *structures*, trees, shrubs, sheds, fences, etc. Fuel elements also include any defined vegetative fuel element but do not include grass/vegetation with a height or depth less than 4 inches above the ground. Tree fuel elements, due to their height and canopy have specific requirements. Trees are distinguished as vegetative *fuel element* with a trunk of 4 inches in diameter or greater when measured at a height of 4.5 feet above the ground.

Fuelbreak. Fuelbreaks are *parcels* of land, linear or in blocks, on which the vegetation, debris and detritus have been reduced and/or modified that could control or diminish the risk of the spread of fire crossing the strip or block of land.

Fire behavior fuel model type (also fuel model type). A set of inputs to define a fuel bed for a specific fire behavior model.

IBHS. Insurance Institute for Business & Home Safety.

IBHS Wildfire Prepared Home Standard. The latest version of the *IBHS* Wildfire Prepared Home Technical Standard. (https://wildfireprepared.org/wp-content/uploads/WFPH-Standard.pdf)

Internal neighborhood sector. 45° azimuthal sector extending radially outward from the *neighborhood centroid* of the defined *neighborhood* to its perimeter and constructed using from the same radial lines used to construct the *external fuel sectors*.

LANDFIRE. Landscape Fire and Resource Management Planning Tools is a shared program between the wildland fire management programs of the U.S. Department of Agriculture Forest Service and U.S. Department of the Interior, providing landscape scale geo-spatial products to support cross-boundary planning, management, and operations. *LANDFIRE* began due to an increased concern about the number, severity, and size of wildland fires and the need for consistent national biological/ecological inventory data. *LANDFIRE* identifies areas across the nation potentially susceptible to wildland fire to support community and firefighter protection. *LANDFIRE* has evolved and expanded to include other applications such as habitat research and disturbance maps.

Neighborhood. For the purposes of the *IBHS Wildfire Prepared Neighborhood Standard*, a *neighborhood* is defined as a *cluster* or multiple *clusters* of residential *structures* enclosed by a continuous defined polygon boundary.

Neighborhood centroid. For the purposes of this standard, the position of the center of the defined *neighborhood* can be determined by summing the eastern and western-most longitudes along the perimeter of the *neighborhood* and dividing the result by two to calculate the x-coordinate and then summing the northern and southernmost latitudes along the perimeter of the defined *neighborhood* and dividing the result by two to obtain the y-coordinate.

Noncombustible or Noncombustible element. Made from material of which no part will ignite and burn when subjected to fire. Any material passing ASTM E136 shall be considered noncombustible.

Neighborhood flame zone (*NFz*). An area of the defined *neighborhood* which has a high likelihood of direct flame and radiant heat exposure from *external fuel* sources. This area is located inward from the perimeter of the defined *neighborhood*. The *neighborhood flame zone* is determined using *Equation 3.3* and through the process described in *Section 3.3*.

Parcel. A piece or unit of land, defined by a series of measured straight or curved lines that connect to form a polygon. There are some implications for land ownership. Commonly also called a tract.

Primary dwelling unit. The largest *structure* on a given *parcel* has at least one or more habitable rooms which are designed to be occupied by one family with facilities for living, sleeping, cooking, eating, and sanitation.

Roof assembly. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof covering, roof deck and may include a vapor retarder, thermal barrier, insulation, or similar substrate.

Roof covering. The material applied to the roof deck to provide weather resistance, achieve fire classification, or enhance appearance.

Roof system. A roof system consists of a roof covering and other interacting roofing components and may include vapor retarder, thermal barrier, insulation or other similar substrate. The system does not include the roof deck unless it is part of a single component serving as the roof covering and the roof deck.

Structure. Any non-commercial building fully enclosed on more than two sides, larger than 200 ft^2 or any *dwelling unit* on a *parcel*. Examples include but are not limited to single family homes, detached garages, recreational vehicle shelters (fully enclosed), *accessory dwelling units*, etc.

Structure separation distance (also referred to as structure separation or SSD). The shortest straight-line distance between a structure's footprint boundary and the footprint boundary of another *structure* that does not cross the following obstacles: any paved, maintained (city, town, county) road, any non-paved but gravel or bare soil roads, or natural barriers that are noncombustible such as creeks, rivers, lakes, ponds etc. with a minimum width of 20 feet.

Vegetative fuel element. A contiguous area bound by a polygon of vegetation consisting of a tree or group of trees, shrubs (bushes), grass/ground cover with a height or depth greater than 4 inches above ground, and/or any other vegetation taller than 4 inches. Trees with canopies less than 10 feet of spacing to the nearest tree canopy shall be considered a single *vegetative fuel element*.

Wildland-Urban Interface (WUI). Across scientific literature there are varying definitions of the *wildland-urban interface*. For the purposes of the *IBHS Wildfire Prepared Neighborhood Standard*, the definition from Johnston et al. (2011) and USDA (2001) is provided. The *WUI* is defined as the geographical area where human development, including structures and other infrastructure, meets or intermixes with undeveloped wildlands. Communities in such areas may be grouped into one of three categories: interface, intermix or occluded (where developed areas surround an area of wildlands that is typically smaller than 1,000 acres) depending on the density of development, coverage of wildland fuels, and population density (Davis 1989).

2.2 User guide

The *IBHS Wildfire Prepared Neighborhood Standard* features both a process to determine mitigation requirements and the requirements themselves that are necessary to address the core principles this standard was built on (see *Chapter 1*). It also has strict applicability requirements. *Chapter 3* provides the process details to determine the mitigation requirements for areas which may have: 1) extreme ember, flame and radiant heat exposure from *external fuels* (e.g., *neighborhood flame zone*), 2) areas which are likely to experience ember attack (e.g., *neighborhood ember zone*) and 3) the *connective fuels* across the *neighborhood*. For detailed information related to the scientific and engineering reasoning used to develop this standard and its processes, please see *Appendix B*.

2.2.1 Applicability

Construction Types: This standard applies to typical single-family, duplex, and townhome construction types.

Structure spacing: This standard can be applied to a defined *neighborhood* when 90% or more of the *structures* are separated by greater than 10 feet and less than 100 feet. The process for *structure separation* assessments is described in *Chapter 3*, *Section 3.1*.

2.2.2 Understanding *neighborhood* requirements

Roof Covering

All *structures* within the defined *neighborhood* must have a Class A roof covering. In addition, no wood roof covering products of any kind are allowed. *Chapter 4, Section 4.1*

The defined *neighborhood* is divided into two primary zones, each with specific mitigation requirements. The processes described in *Chapter 3* are best executed within a geographic information system (GIS) platform.

Neighborhood flame zone

The *neighborhood flame zone* is the area typically located from the boundary of the *neighborhood* inward for up to approximately 450 feet (distances are dependent on fuel characteristics) which has the highest likelihood of experiencing the most severe fire exposure resulting from *external fuels*.

The *neighborhood flame zone* is determined using the processes described in *Chapter 3*. It accounts for *external fuels* within 0.25 miles of the *neighborhood* boundary. For each sector, a "worst-case" distance into the *neighborhood i*s determined using the processes described in *Chapter 3*, *Sections 3.1* and *3.2*. The *structure* requirements for this zone are provided in *Chapter 4, Section 4.3*. It is possible that *external fuels* and/or *fuelbreak/firebreak* features can result in the *neighborhood flame zone* not being needed.

Connective fuel pathways in the *neighborhood flame zone*: For *structures* located inside the *neighborhood flame zone*, there can be no *connective fuel pathway* to any neighboring *structures*.

Neighborhood ember zone

The *neighborhood ember zone* is the area, typically the remainder of the *neighborhood* not within the *neighborhood flame zone* which has a high likelihood of experiencing ember attack from *external fuels* and/or *structures* within the *neighborhood* should fire enter. It is determined by the processes described in *Chapter 3*, *Section 3.4* and

considers *external fuels* within 4.25 miles of the defined *neighborhood*. It is possible the *neighborhood ember zone* will not cover the entire *neighborhood*; this is contingent on *neighborhood* size and fuel characteristics. The requirements for *structures* in this zone are provided in *Chapter 4*, *Section 4.4*.

***Connective fuels* in the *neighborhood ember zone* and remainder of the *neighborhood*:** *Connective fuels* are evaluated across *clusters* of *structures* as described in *Chapter 3*, *Section 3.5.1*. The *connective fuel* requirements for the full *neighborhood* are provided in *Chapter 4*, *Section 4.2*.

2.2.3 New *neighborhood* construction recommendations

The 100% application of *IBHS Wildfire Prepared Home Plus* construction across a new *neighborhood* development, provided the *structure separation* applicability criteria is met, will generally meet the requirements of this standard except in special cases related to *ADUs*, *auxiliary structures*, and *connective fuel pathways*.

For a decision-tree graphical depiction of the *IBHS Wildfire Prepared Neighborhood* processes and requirements, see *Appendix C*.

CHAPTER 3. Processes

3.1 *Structure separation* assessment

For any defined *neighborhood*, the distribution of the shortest separation distance from each *structure* to any neighboring *structures* shall be determined. To calculate the minimum *structure separation distance*, distribution datasets such as the Microsoft Building Footprint database or similar shall be considered sufficient for use. The *IBHS Wildfire Prepared Neighborhood* standard shall be considered applicable if 90% or more of the *structures* contained within the *neighborhood* boundary have a minimum *structure separation* distance greater than 10 feet and less than or equal to 100 feet.

To calculate the *neighborhood structure separation* statistics, count the number of *structures* for which the smallest *structure separation* measurement is equal to or less than 10 feet and divide that number by the total number of *structures* in the defined *neighborhood*.

The next step in the process is to calculate the full designated *neighborhood structure separation* statistics, count the number of *structures* that have a measurement equal to or less than 10 feet and divide this by the total number of *structures* in the defined *neighborhood*. The standard is considered applicable if this value is 10% or less as stated in *Chapter 1*. The *structure separation* procedure is also used within *Chapter 3*, *Section 3.5* for determining *clusters* and the *connective fuel* assessment.

3.2 *External fuel* assessment

External fuels surrounding a community drive the exposure risk for any community. To determine the *neighborhood flame zone* and *neighborhood ember zone* widths, *external fuels* and their associated *fire behavior fuel type models* surrounding the defined *neighborhoo*d are identified.

External fuels assessment shall include the area 4.25 miles (6.84 km) radially outward from the specified *neighborhood* exterior boundary in all directions around the assessed *neighborhood*. The *LANDFIRE* fuel type models described in Scott and Burgan (2005) shall be the minimum required dataset for the *external fuel* assessments. Other datasets can be used, provided their resolution is equivalent or finer in spatial resolution than the *LANDFIRE* 30 meter grid spacing and such that fuel types/classifications can be condensed into the 40 fuel models described by Scott and Burgan (2005). Those can be found in *Appendix A*, *Table A3.2*.

The *centroid* of the defined neighborhood will be determined to set external fuel assessment sectors. From the *neighborhood centroid*, eight 45° azimuthal fuel sectors will be determined. Fuels will be assessed for each using a 0.25-mile buffer extending outward in each sector from the *neighborhood* boundary for determining the *neighborhood flame zone* and a buffer of 4.25 miles outward in each sector will be used in assessing *external fuel* characteristics to determine the *neighborhood flame zone (Figure 3.1)* and *neighborhood ember zone (Figure 3.2, Figure 3.3)*.

Within each *external fuel sector* of the *flame fuel assessment zone*, the flame intensity shall be determined for any *fuel type model* classification that is present (Scott and Burgan 2005; *Appendix A*) as shown in *Figure 3.1*.

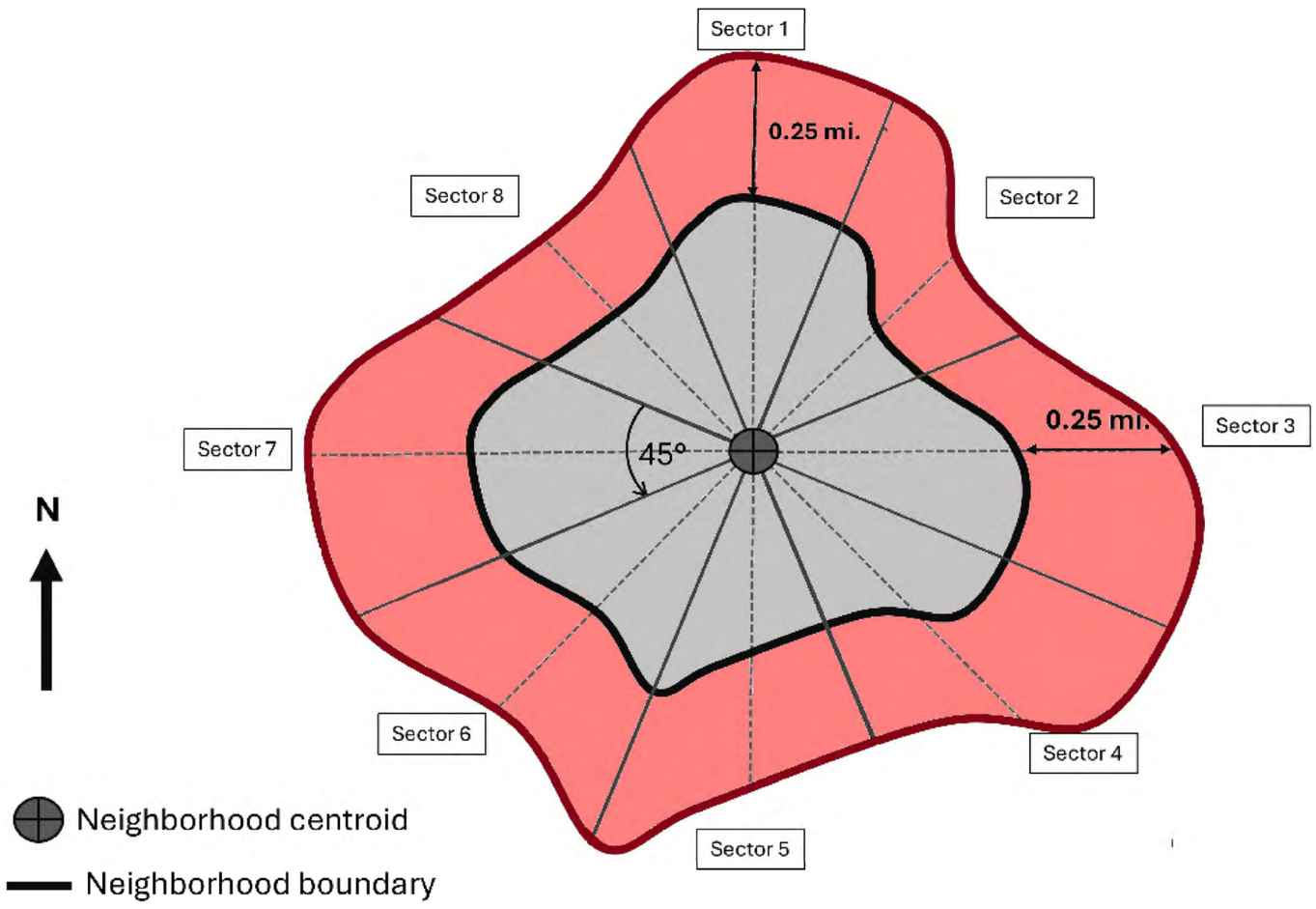


Figure 3.1. Idealized schematic illustrating how external fuel sectors are determined. The area shaded in gray represents the interior of the neighborhood. The red shaded areas represent the 0.25-mile buffer / flame fuel assessment zone that is used to determine the neighborhood flame zone (Equation 4-1). The neighborhood ember zone is not depicted but is shown in Figure 3.2 below. The schematic is not to scale and intended for illustrative purposes only.

Within each *external fuel sector,* the ember transport distance shall be determined for any *fuel type model* that represents 10% or greater of the fuel types present within the *external fuel sector* as shown in *Figure 3.2* and *Figure 3.3*.

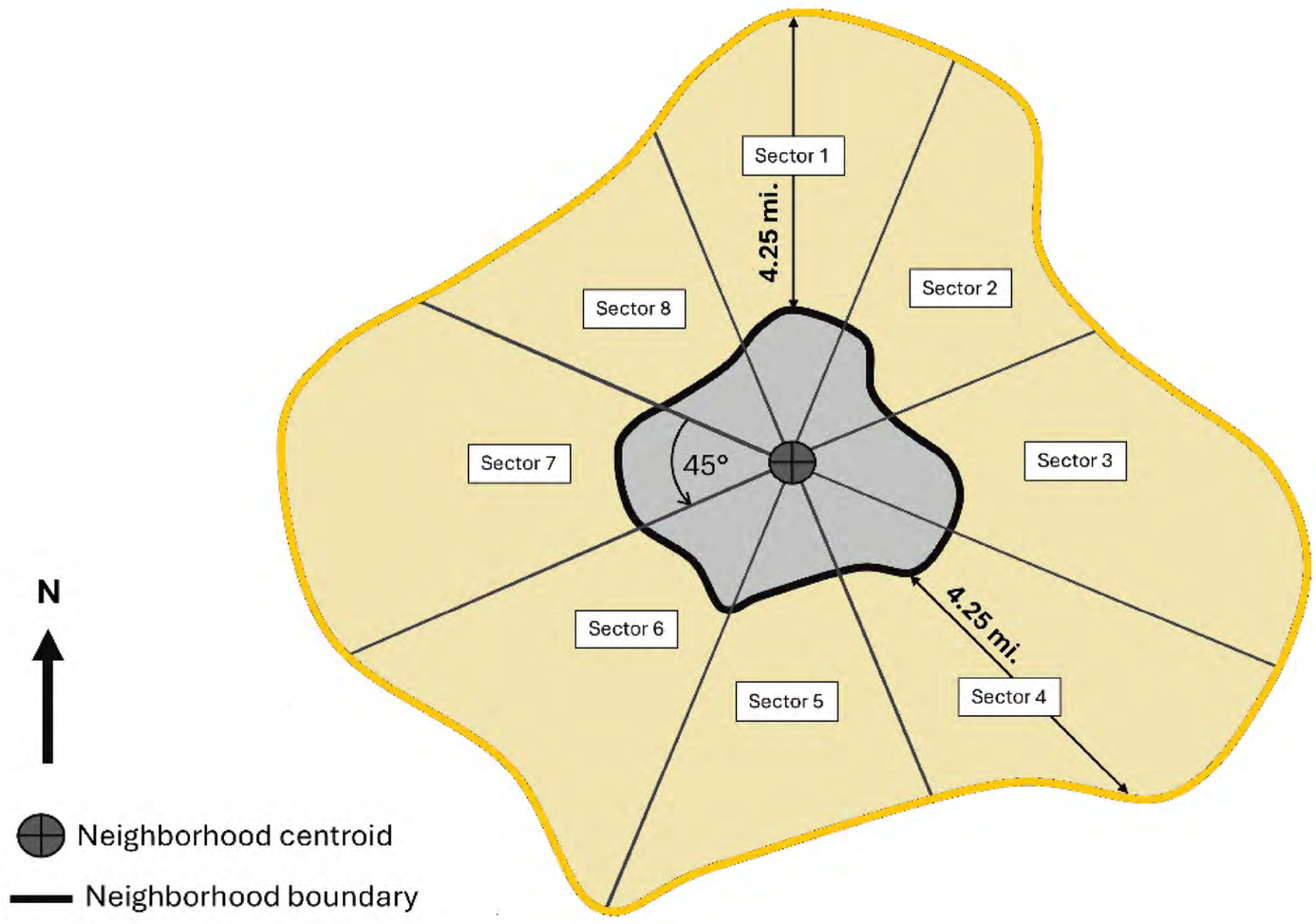


Figure 3.2. Idealized schematic illustrating how external fuel sectors are determined. The area shaded in gray represents the interior of the neighborhood. The beige shaded areas represent the 4.25-mile buffer region where external fuels will be evaluated for use in the neighborhood ember zone. The flame fuel assessment zone is not depicted but is shown in Figure 3.1 above. The schematic is not to scale and intended for illustrative purposes only.

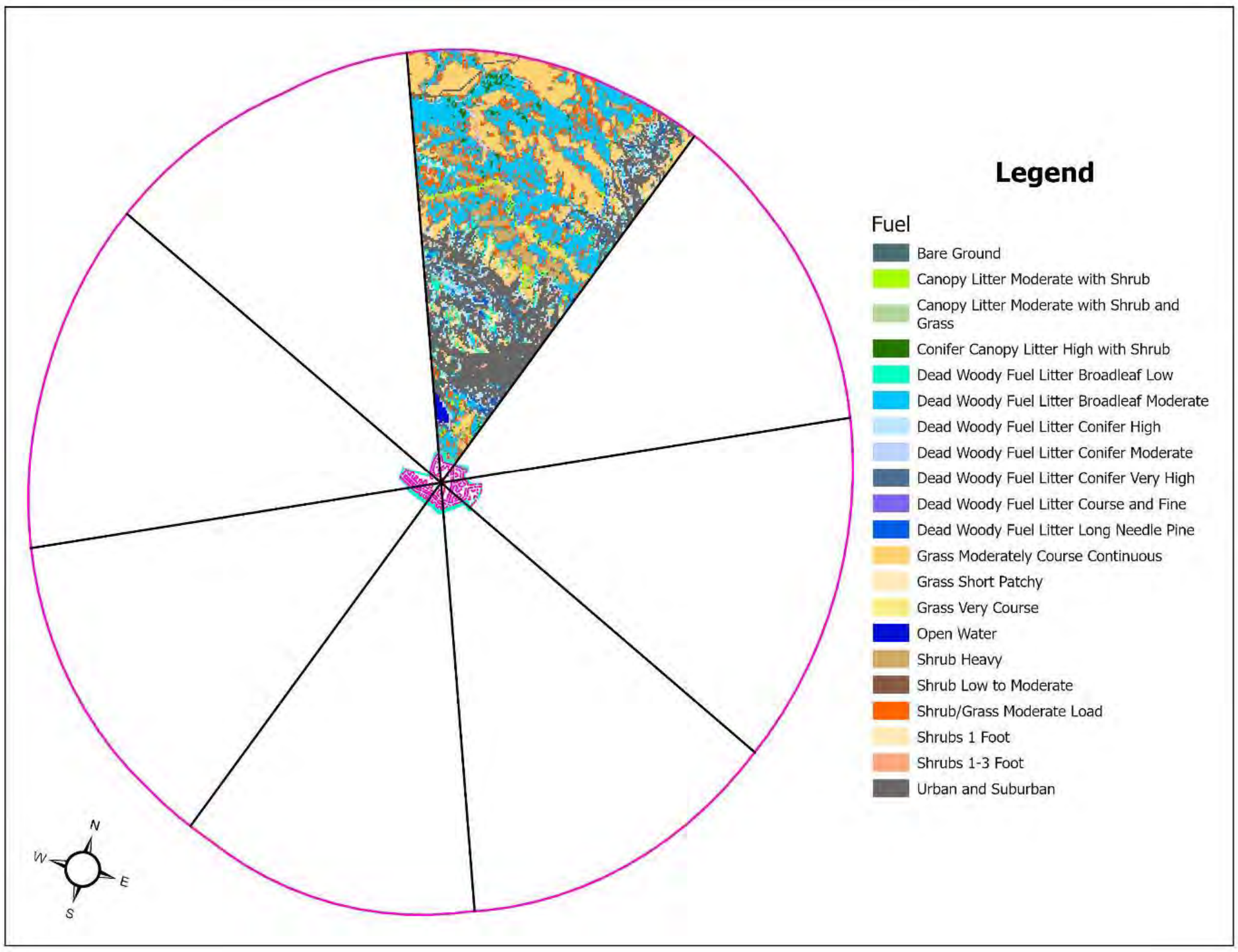


Figure 3.3. Example LANDFIRE fuel model type example for a specific external fuel sector.

3.3 Calculating the *neighborhood flame zone*

The *neighborhood flame zone* calculation method assesses the potential for direct flame contact and heat transfer from fuels adjacent to the defined *neighborhood* under common fire weather conditions observed during *conflagration* events. The calculation of the *neighborhood flame zone* is determined by:

1) Identify all *fuel model types* present in each of the eight *fuel assessment sectors* using the 0.25-mile buffer distance.
2) Determine for each sector the percentage tree coverage. If 10% or more is covered, then a canopy provision is applied in determining the *neighborhood flame zone*. This is to account for the potential for *crown fire* which could increase exposure.
3) Use *Table 3.2* and *Table 3.3* (for structural fuels) to determine the distance inward from the *neighborhood* boundary for each *fuel model type* present. The longest distance for any identified *fuel model type* shall be used to determine the boundary of the *neighborhood flame zone* for each sector (*FZ*, shown in *Equation 3-1*). If the canopy provision in step 2 is not met, then use *Column 2* of *Table 3.2* or *Table 3.3 (for structural fuels)*. If the canopy provision is met, then use *Column 4* of *Table 3.2* or *Table 3.3 to set FZ*.
4) Determine if a *fuelbreak* or *firebreak* is present and its width within the 0.25 mi *flame fuel assessment* buffer in each sector which will be applied to the final *neighborhood flame zone*

calculation (*Equation 3-1*). The *fuelbreak, firebreak* must be 20 feet or wider and span the width of the individual sector within the 0.25 mi buffer. If these conditions are met, the width of the *fuelbreak* or *firebreak* shall be accounted in the final *neighborhood flame zone* calculation for a given sector by:

$$Neighborhood\ flame\ zone\ width\ (NFz) = FZ - fuel/fire\ break\ width \qquad \textit{Equation 3-1}$$

If the *neighborhood flame zone* width is less than or equal to zero for all sectors, there is no *neighborhood flame zone* for the sector.

The final *neighborhood flame zone* shall be determined by the following procedure: use the same radial lines emanating from the *neighborhood* sector developed in the external fuel process to create 8 interior neighborhood sectors. Each sector is bound by two consecutive radial lines and the section of the neighborhood perimeter connecting those lines. Each of these *interior sectors* corresponds to the one of the 8 *exterior fuel sectors* (*Figure 3.4*). For a given *interior sector*, identify the corresponding *NFz* width and create a buffer around the perimeter portion of its bounds equal to that width. Then determine the intersection of that buffer and the corresponding interior sector, effectively clipping the buffer by the *interior sector's* bounds. Repeat this with each of the eight *interior sectors*, creating the appropriate *NFz* for each sector.

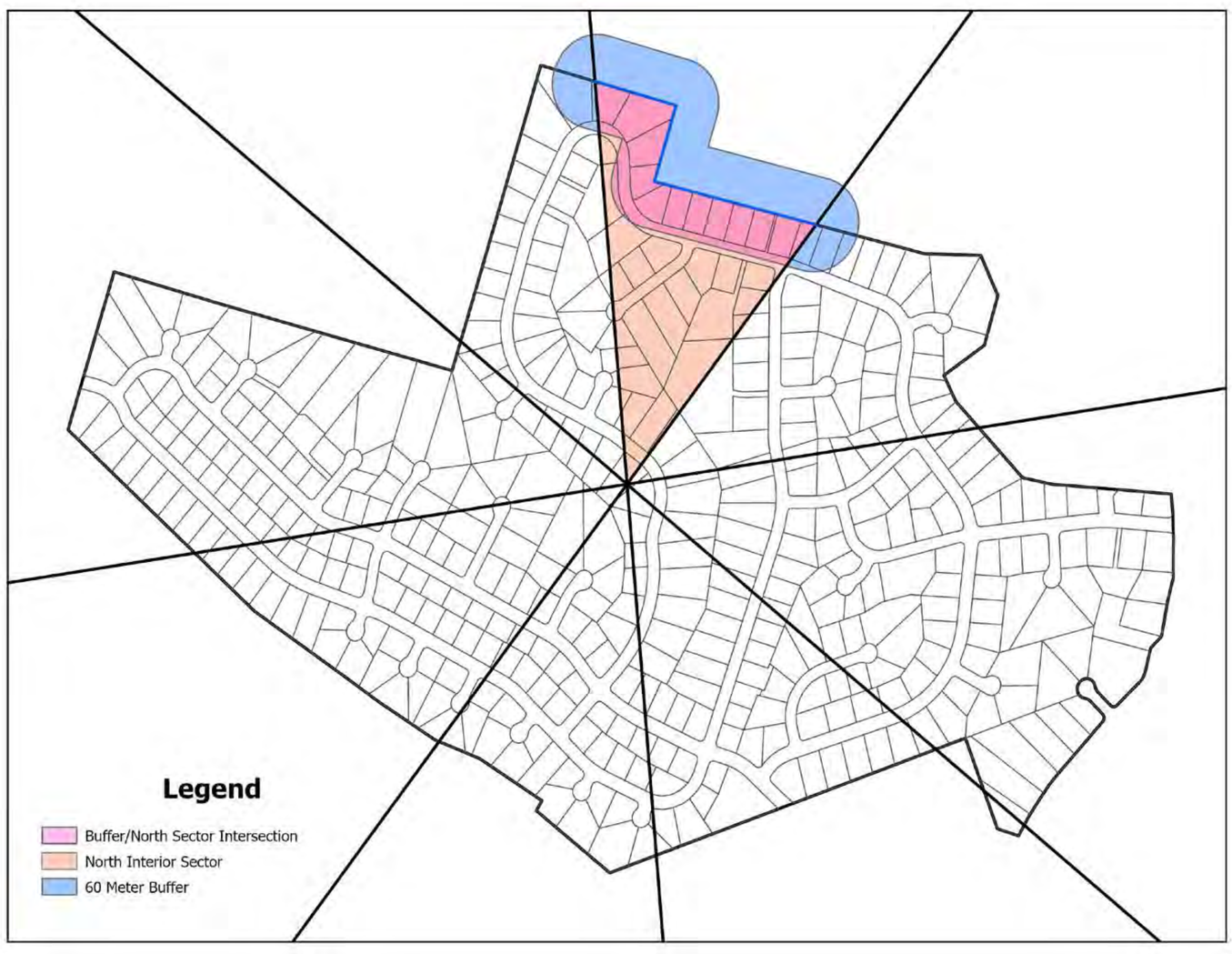


Figure 3.4. In this idealized example, the northern sector has an NFz of 60 m (197 ft) and so a buffer of 60 m is drawn around that portion of the neighborhood perimeter that binds the northern sector. This buffer is then clipped by the bounds of the northern sector. In this example, the final determined NFz boundary for the northern sector is shown in pink. Any parcel that falls on or within this boundary is considered part of the neighborhood flame zone.

Table 3.1. Neighborhood flame zone distances by fuel model type and if the canopy fuel threshold was met. Distances are provided in units of both meters and feet.

***Fire behavior fuel model* type identifier**	**Column 1** (m)	**Column 2** (ft)	**Column 3** Column 1 + Canopy fuel provision (m)	**Column 4** Column 2 + Canopy fuel provision (ft)
GR1	3	10	73	240
GR2	6	20	76	249
GR3	8	26	78	256
GR4	12	39	82	269
GR5	23	75	93	305
GR6	37	121	107	351
GR7	45	148	115	377
GR8	55	180	125	410
GR9	68	223	138	453
GS1	8	26	78	256
GS2	13	43	83	272
GS3	22	72	92	302
GS4	60	197	130	427
SB1	15	49	85	279
SB2	31	102	101	331
SB3	44	144	114	374
SB4	46	151	116	381
SH1	8	26	78	256
SH2	33	108	103	338
SH3	10	33	80	262
SH4	19	62	89	292
SH5	32	105	102	335
SH6	30	98	100	328
SH7	44	144	114	374
SH8	47	154	117	384
SH9	67	220	137	449
TL1	3	10	73	240
TL2	5	16	75	246
TL3	5	16	75	246
TL4	6	20	76	249
TL5	9	30	79	259
TL6	13	43	83	272
TL7	9	30	79	259
TL8	19	62	89	292
TL9	29	95	99	325
TU1	9	30	79	259
TU2	11	36	81	266

***Fire behavior fuel model* type identifier**	**Column 1** (m)	**Column 2** (ft)	**Column 3** Column 1 + Canopy fuel provision (m)	**Column 4** Column 2 + Canopy fuel provision (ft)
TU3	22	72	92	302
TU4	39	128	109	358
TU5	51	167	121	397

Table 3.2. Neighborhood flame zone distance for any structural fuels identified in the flame fuel assessment zone with 10% or more coverage in each sector. Distances are provided in units of both meters and feet.

***Fire behavior fuel model* type identifier**	**Column 1** (m)	**Column 2** (ft)	**Column 3** Column 1 (m)+ Canopy fuel provision (m)	**Column 4** Column 2 + Canopy fuel provision (ft)
NB1	21.7	71	91.7	301

Once the *neighborhood flame zone* is determined, the minimum structure separation distance for structures in this zone is determined for use in the *neighborhood ember zone* calculation using the same procedure as described for the full *neighborhood structure separation* assessment.

3.4 Calculating *neighborhood ember zone*

3.4.1 Ember loft

For the *IBHS Wildfire Prepared Neighborhood*, the Himoto and Iwami (2021) model for firebrand (ember) transport is used for its simplicity and because it provides conservative estimates for maximum ember transport distances.

For each *external fuel* sector, fuel model types with 10% or greater spatial coverage (i.e., 10% or more *LANDFIRE* grid boxes) in each sector are evaluated for ember transport considering the variables shown in *Figure 3.5*. The *fuel model types* obtained from the external fuel assessment (*Section 3.2.1*) are condensed into the three categories shown in *Table 3.4*. The Himoto and Iwami (2021) model uses a log-normal distribution to represent the statistical distribution of ember transport. A cumulative density function is obtained by integrating the log-normal probability density function. For the *IBHS Wildfire Prepared Neighborhood Standard*, the 80th percentile transport distance for a 10 meter open terrain exposure, peak 3-second gust wind speed of 70 miles per hour is used to calculate transport distances.

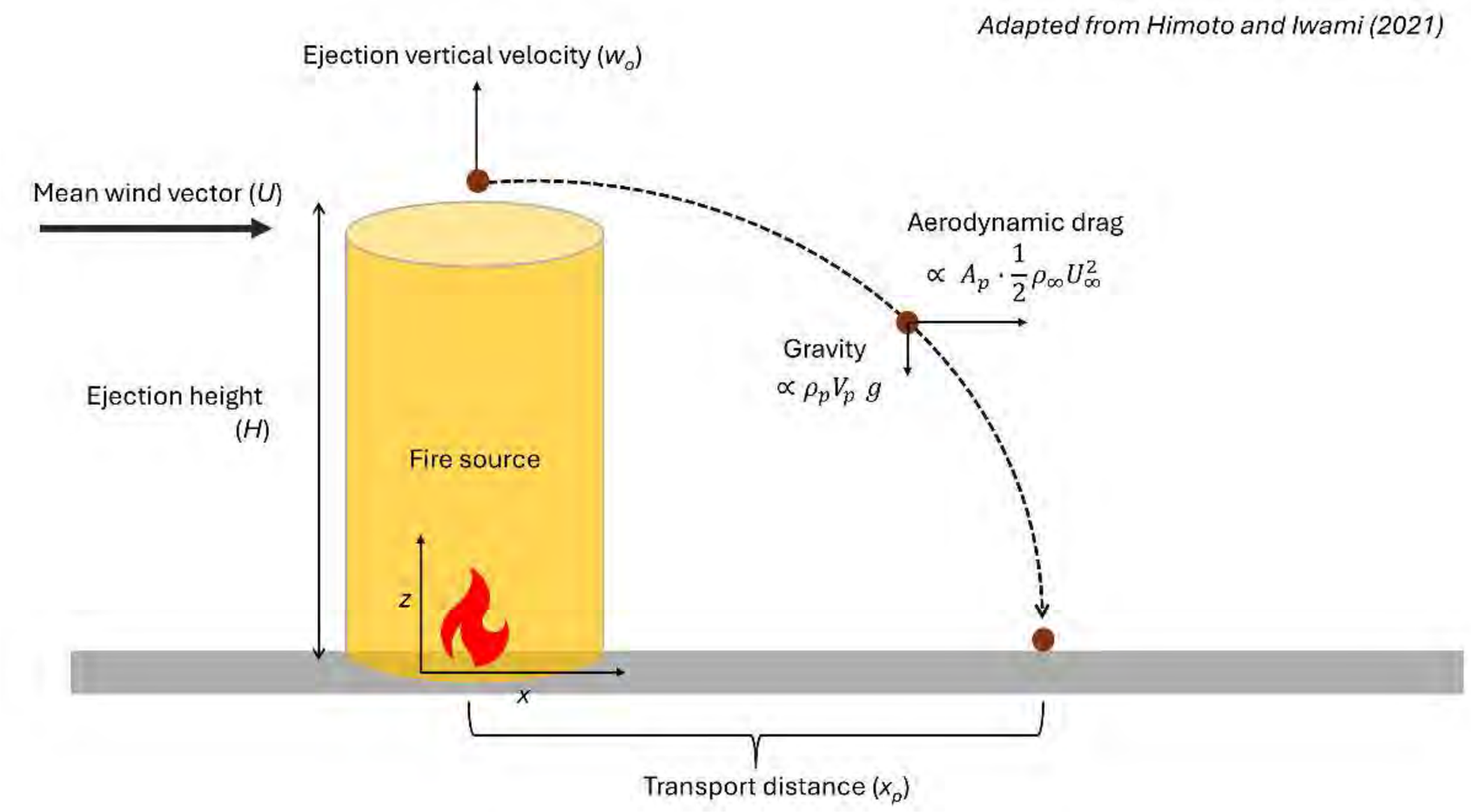


Figure 3.5 Conceptual diagram of the inputs to the Himoto and Iwami (2021) ember transport model (adapted from Himoto and Iwami 2021).

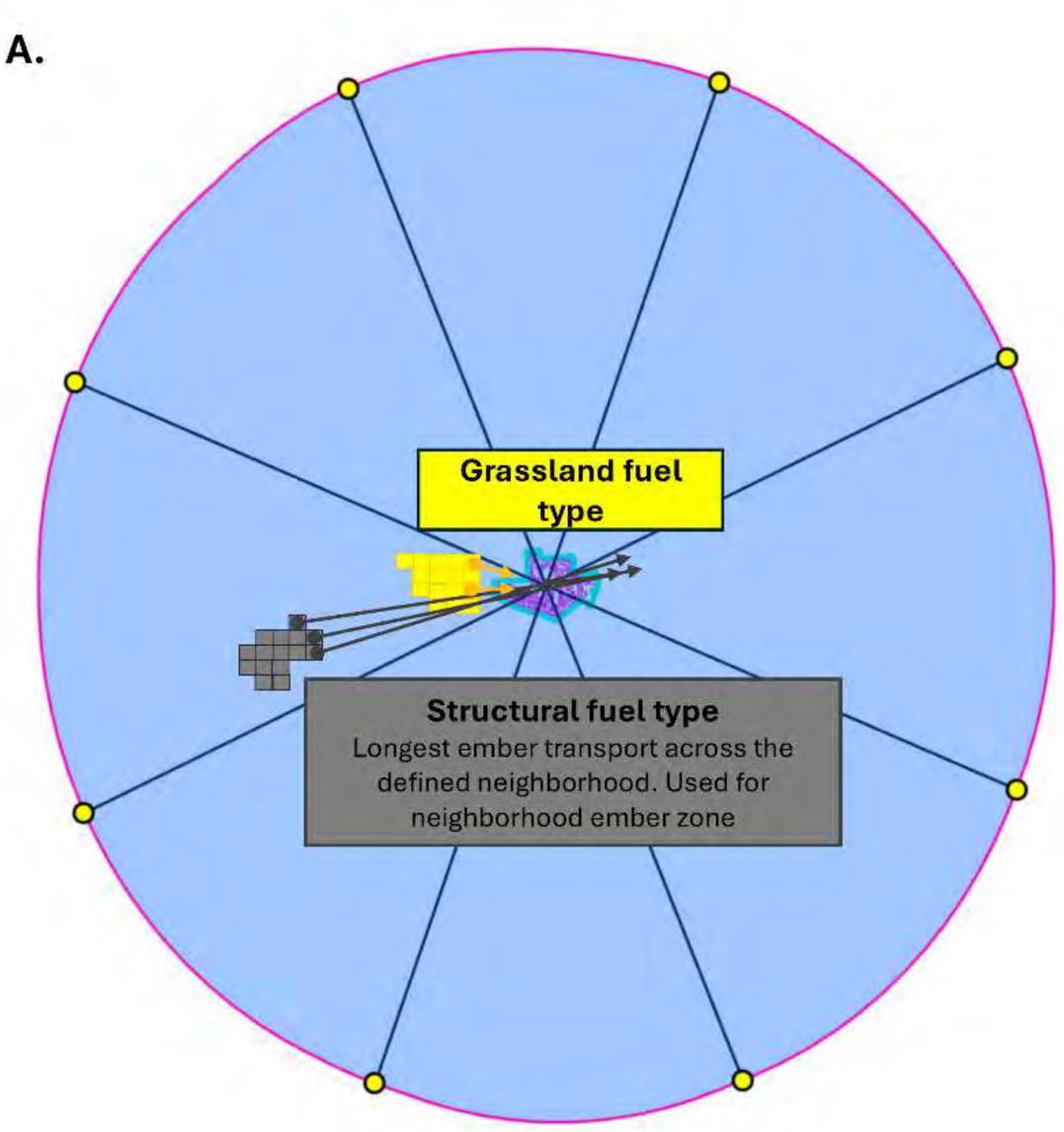
Table 3.4 Ember transport distances using the Himoto and Iwami (2021) model. For determining the neighborhood ember zone, the distances for a 70-mph wind shall be used and are provided in this table. See Appendix A, Table A3.2 for the full list of fuel model types.

Fuel type	***Column 1*** *Transport distance at 70 mph winds*	***Column 2*** *Total vector length if neighborhood flame zone structure separation conditions are present that require additional ember transport distance.*
Grassland/Fine Fuels LANDFIRE fuel model types: ***GR1-GR9 GS1-GS4***	3783 ft (0.72 mi)	25791 ft (4.88 mi)
Trees and Shrubs LANDFIRE fuel model types: ***SH1-SH9 TU1-TU5 TL1-TL9 SB1-SB4***	15158 ft (2.8 mi)	37166 ft (7.03 mi)
Structural fuels LANDFIRE fuel model types ***NB1***	22,008 ft (4.2 mi)	44,016 ft (8.4 mi)

3.4.2 Ember transport vectors and determining the *neighborhood ember zone*

Within each sector ember, transport vectors are directed toward the *neighborhood centroid* from the grid point for any *fuel model type* with 10% or more coverage in each sector. The vector length for each *fuel model type* is determined by using *Column 1* or *Column 2* of *Table 3.4*. *Column 1* is used for all sectors to determine ember transport vector lengths if 90% or more *structures* inside the *neighborhood flame zone* are separated by 30 feet or more. If not, *Column 2* is used for ember transport vector lengths. An example is shown in *Figure 3.6A*.

If any ember transport vector crosses more than one of the defined boundaries of the *neighborhood* and the length of that vector within the *neighborhood* boundary is greater than the width of the *neighborhood flame zone* in that sector, the entire *neighborhood*, excluding the *neighborhood flame zone* when present, shall be considered in the *neighborhood ember zone*. If all vectors do not meet this condition, then the *neighborhood ember zone* shall be drawn as a polygon connecting the endpoints of the eight ember transport vectors that extend the furthest inward from the defined *neighborhood* boundary. If this boundary falls across a specific *parcel* boundary, that *parcel* shall be considered part of the *neighborhood ember zone*. An example is provided in *Figure 3.6B*.



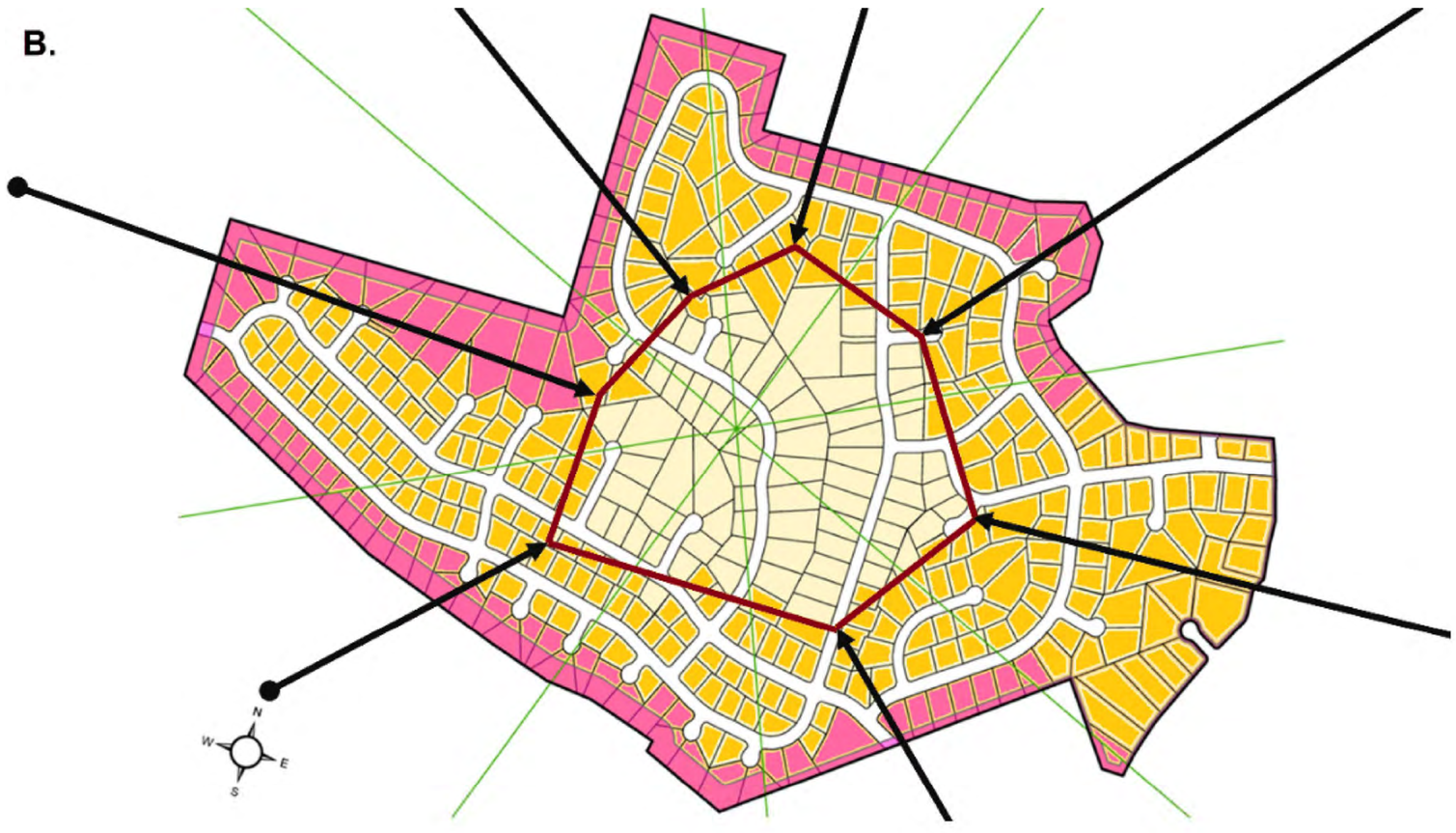


Figure 3.6. An idealized diagram of (A) ember transport vectors which cross the defined neighborhood and (B) where no vector crosses the neighborhood. In (A), the structural fuel ember transport vector produces the longest vector across the neighborhood despite being further away than the grassland fuels. Since the structural fuel transport distance is the worst-case scenario, it is used for the NE$_z$ determination. For (B) the neighborhood ember zone is defined by the area between the neighborhood flame zone (if present) or the defined neighborhood boundary (if no neighborhood flame zone is present) and the vector end points (black arrows). In the example shown in (B), the parcels included in the NFz are shaded orange, while the physical boundary is determined by the ember transport vector end points denoted by the red line. Parcels which fall into the neighborhood flame zone are shaded pink.

3.5 *Connective fuels*

The *connective fuel* characteristics of a defined *neighborhood* are determined by evaluating potential fire pathways through *clusters* of *structures*. The *clusters* are defined using break points which would alter the path of fire and where each *structure's* ignition potential would not be immediately influenced by other nearby *structures*. It is in these areas where *connective fuels* create the pathways for fire to easily move through direct flame contact and/or radiant heat exposure. For details on the *connective fuels* philosophy employed in this standard, see *Appendix B*, *section B4.2*.

Connective fuel pathways are evaluated within the defined *neighborhood* using the following process:

3.5.1 Cluster identification process

A *cluster* is one or more *structures* within a *neighborhood* separated in all directions from other *structures* within the *neighborhood* by one or more obstacles to structure-to-structure fire transmission.

1) any paved, maintained (city, town, county) road, any un-paved gravel or bare soil road, natural barriers that are noncombustible such as creeks, rivers, lakes, ponds etc. with a minimum width of 20 feet, or
2) 100 feet (approximately 30 m) or more from all other structures inside the defined neighborhood boundary.

The following process is best executed within a geographic information systems (GIS) platform and accompanying aerial imagery.

Identifying *clusters* for the *connective fuel node* evaluation: identify collections of *structures* that are completely bound by the barriers described in 1 and 2 above. Determining the extent of a given *cluster* is an iterative process that follows:

A) Start with a single *structure* and identify all other *structures* for which a measurement of 100 feet or less can be made without crossing one of the obstacles identified above and group them with the initial *structure*.

B) For each of the additional *structures* identified in step A, identify any other *structures* for which a measurement of 100 feet or less can be made without crossing one of the obstacles identified above and add these to the *cluster*. Continue expanding this process outward until no other additional *structures* can be added to the group of structures without crossing one of the obstacles cited above. The group of *structures* defined to its maximum extent shall be considered a unique *cluster* of *structures*. Each identified *cluster* shall be given a unique integer identifier. It is recommended for data schema purposes (see *Appendix A*), those *structures* within each *cluster* should be assigned to their specific *cluster* identifier.

The first *cluster* may or may not include all the *structures* within the defined *neighborhood*. If it does not include all the *structures* in the *neighborhood*, select another *structure* within the *neighborhood* not yet assigned to a *cluster* and repeat this process. Continue until every *structure* in the *neighborhood* has been assigned to a *cluster*. Note that it is possible for *structures* to be completely separated from all other *structures* in a *neighborhood* by one or more of the obstacles cited above, which means *neighborhoods* may contain *clusters* as small as one unit or *structure*. *Figure 3.7* provides an example of identified *clusters* for a test *neighborhood*.

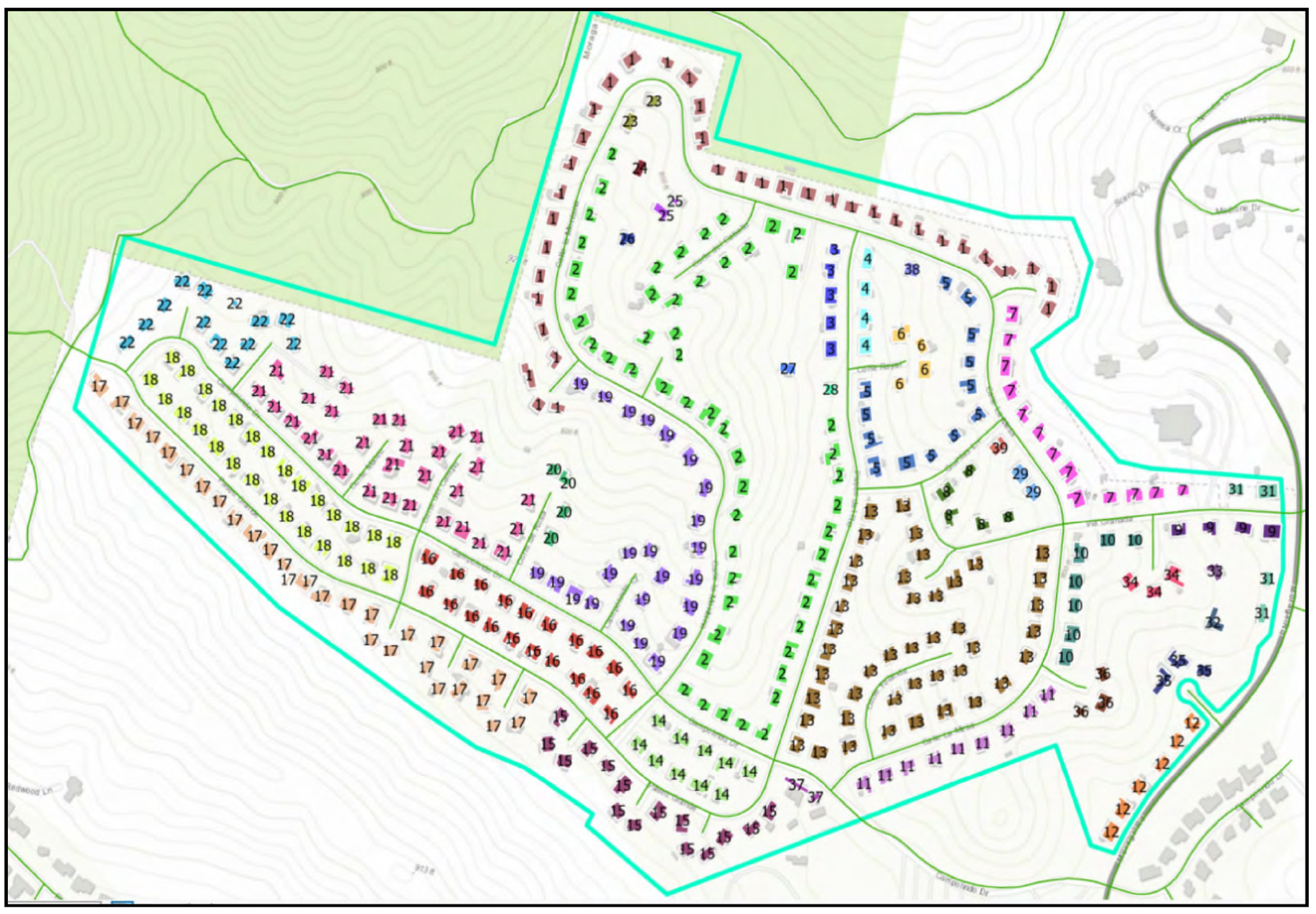


Figure 3.7. Example of a completed cluster analysis. Each identified cluster is indicated by an integer identifier and specific color.

3.5.2 *Connective fuel pathway* identification and evaluation

To determine whether an identified *cluster* of *structures* is compliant or flagged for *connective fuel pathways,* each individual *structure* within an identified *cluster* will be evaluated for *connective fuel pathways* to neighboring *structures*. *Connective fuel pathways* are identified through spatial analysis of *fuel elements* and whether adequate spacing is present such that the *connective fuel pathway* is broken.

All *fuel elements* will be identified across the defined *neighborhood*. *Fuel elements* shall be bound by a polygon that represents their surface area coverage.

For tree *fuel elements* with a trunk of 4 inches in diameter or greater when measured at a height of 4.5 feet above the ground the tree, per requirements stated in the *IBHS Wildfire Prepared Home Standard*. Other vegetative *fuel elements* including bushes, shrubs, and other vegetation shall also be treated by the definitions and requirements stated in the *IBHS Wildfire Prepared Home Standard*.

For *built environment fuels* that are not considered *structures* their surface area shall be used in the connective fuel assessment.

For fences or other *built-environment fuels* which extend vertically and the vertical surface area of which is two times or larger than their surface footprint, the *connective fuel pathway* shall be considered a straight line along the fence or other feature. This type of *fuel pathway* is considered broken by a compliant *0–5 Foot Noncombustible Zone* and/or ensuring that any fencing or similar *fuel element* that is parallel to a structure and within 5 feet is noncombustible. Combustible fences shall be considered a complete *connective fuel pathway* regardless of the overlap or proximity of other *fuel elements*. However, the use of a *0–5 Foot Noncombustible Zone* which includes the use of *noncombustible* fence materials in the 5-foot area extending outward from any *structure* results in a break of the *connective fuel pathway* associated with just the fence. In this case, the fence shall not be *considered a connective fuel pathway*.

Connected fuel pathways shall be evaluated for individual *structures* within each denoted *cluster*. The identified *fuel elements are* used to determine if a *connective fuel pathway* exists to each elevation (i.e., front, rear, right, left) of a *structure* to a neighboring *structure*. The *connective fuel pathway* is considered connected to the *structure* if a series of *fuel elements or a single element* connects the evaluated *structure* to one or more neighboring *structures* with no identified breaks greater than two times the height of the *fuel element* (excluding fences, see fence provisions below) along the fuel pathway. *Fuelbreaks and firebreaks*, as defined, shall be considered to have broken a *connective fuel pathway.* If along the *connected fuel pathway*, a break in *fuel elements* greater than two times the height of the *fuel element/s* is present, the pathway is also considered broken. For each *structure* the number of *connected fuel pathways* is found and used in the analysis of *connective fuels* for the *neighborhood flame zone* and the identified *clusters*. For each *cluster*, a *connective fuel flag* is assigned if more than 10% of *structures* have more than one *connective fuel pathway*.

After all *clusters* have been evaluated, the total number of *structures* within those *clusters* that have been assigned a *connective fuel flag* shall be calculated. If the total number of *structures* within flagged *clusters* represents 10% or less of the total *structures* within the entire defined *neighborhood* then the *neighborhood* shall be considered compliant with the *IBHS Wildfire Prepared Neighborhood Standard* for *connective fuels*. If the total number of *structures* within

clusters with *connective fuel flags* is greater than 10% of the total *structures,* the *neighborhood* shall be considered non-compliant for *connective fuels*.

CHAPTER 4. Neighborhood mitigation requirements

4.1 Roof covering

Within the defined *neighborhood*, regardless of *external fuel* characteristics or *structure separation* distributions, all *structures* shall have a Class A rated *roof covering* (see *Appendix B, Section B2* for additional scientific reasoning). Wood shakes and shingles or fire-retardant-treated, fire-resistant pressure-treated or any other wood *roof covering* within any *roof assembly* or *roof system* are prohibited regardless of *roof covering* fire classification.

4.2 *Connective fuels*

The defined *neighborhood* shall be segmented into *clusters* using the process described in *Chapter 3 Section 3.5.1*. Each *cluster* shall be given a numeric integer identifier.

4.2.1 *Connective fuels* in the *neighborhood flame zone*. All *structures* within the boundaries of the *neighborhood flame zone* shall have no *connective fuel pathways* to any neighboring *structures*.

4.2.2 *Connective fuels* across the defined *neighborhood*. If 10% or more of *structures* within each determined *cluster* have more than one side/elevation with a *connected fuel pathway* to any neighboring *structure*, the *cluster* is assigned a *connective fuel "flag"* for exceeding the *connective fuel pathway* tolerance. If the number of flagged *clusters* produces a total of greater than 10% of the total *structures* in the defined *neighborhood*, the *neighborhood* must remediate the *connective fuels*. The *IBHS Wildfire Prepared Neighborhood Standard* does not provide prescriptive *connective fuels* remediation requirements or guidance. Remediation shall meet the *neighborhood* requirement through any means determined by the defined *neighborhood*.

If the number of *connective fuels flagged clusters* is zero and all *structures* within the *neighborhood flame zone* have zero *connective fuel pathways*, then no *connective fuels* remediation is required, and the defined *neighborhood* shall be considered compliant.

If the total number of *structures* located in *connective fuel flagged clusters* is 10% or less than the total number of *structures* in the defined *neighborhood,* and all *structures* within the *neighborhood flame zone* have zero *connective fuel pathways*, no *connective fuels* remediation is required, and the defined *neighborhood* shall be considered compliant.

The *neighborhood ember zone* dimensions shall be determined using the processes described in *Chapter 3, Section 3.4* and *Equation 3-1*.

4.3 *Neighborhood flame zone structures*

The *neighborhood flame zone* width (in feet) shall be calculated to determine *structures* at risk from direct flame/radiant heat contact from surrounding *external fuels* for each *external fuel sector* considering the presence of *fuelbreaks and firebreaks* that are within the 0.25-mile *flame fuel assessment* buffer and meet the conditions described in *Chapter 3, Section 3.3*.

The *neighborhood flame zone* shall be determined using the processes defined in *Chapter 3, Section 3.3* and by applying *Equation 4-1*. If the *neighborhood flame zone* (NFz) is present in any sector, any *structures* and/or *parcels* within the defined *neighborhood* boundary and the determined *neighborhood flame zone*

shall meet the minimum mitigation requirements prescribed within the latest available *IBHS Wildfire Prepared Home Standard* for a "Plus" level of mitigation (henceforth referred to as *IBHS WFPH Plus*). These minimum requirements provide ignition protection from high radiant heat, direct flame contact, and ember exposure. If any part of a *parcel* falls within the *neighborhood flame zone*, any *structure* on that *parcel* shall be considered part of the *neighborhood flame zone* and must meet the specific requirements for this zone.

If there is no designated *neighborhood flame zone* for a specific sector, mitigation requirements move to ember protection and the *neighborhood ember zone* requirements.

Table 4.3 Neighborhood flame zone (NFz) construction requirements correspond to those requirements specified by the 2025 IBHS WFPH Plus requirements. Other select codes and standards provisions are provided for reference.

Structural component	Construction requirements	2025 *IBHS* WFPH Plus[1]	2024 IWUIC IR1[2]	2022 CBC[3]	2018 NFPA 1140[4]
Roof	Class A roof covering	✓	X	~	~
Gutters, Gutter Protection, and Downspouts	Noncombustible gutters, gutter protection, and downspouts	✓	✓	~	✓
Protection of Eaves	1. Noncombustible materials, or 2. 1-hour fire-resistance-rated construction, or 3. 2-inch nominal dimension lumber	✓	✓	✓	✓
Vents	1. Corrosion-resistant vents conforming with ASTM E2886 (flame- and ember-resistant), or 2. Noncombustible corrosion-resistant mesh with openings not to exceed 1/8-inch in diameter (ember-resistant)	✓	✓	✓	✓
Exterior Wall Covering	Noncombustible building material	✓	~	~	~
6-inch Noncombustible Vertical Clearance	Applied vertically on the exterior base of the wall measured from the grade and the nearest horizontal surface (e.g., decks and patios)	✓	✓	~	✓
Exterior Glass	1. Multipaned glass with at least two tempered panes, or 2. 20-minute fire-resistance rating when tested in accordance with NFPA 257, or 3. Glass blocks (windows only), and 4. Operable skylights protected by a noncombustible 1/8-inch mesh screen	✓	✓	✓	✓
Exterior Doors	The exterior doors shall be constructed with a noncombustible threshold and 1. Noncombustible construction, or 2. Solid-core wood not less than 1 ¾-inches thick, or 3. 20-minute fire-resistance rating when tested according to NFPA 252, or 4. Doors made of combustible material are permissible provided a noncombustible exterior storm door is installed as the outermost door	✓	✓	~	✓
Underfloor Area Construction	Fully enclosed to the ground with noncombustible corrosion-resistant mesh with openings not to exceed 1/8-inch in diameter.	✓	~	~	~

Structural component	Construction requirements	2025 *IBHS* WFPH Plus[1]	2024 IWUIC IR1[2]	2022 CBC[3]	2018 NFPA 1140[4]
	Exception: Complete enclosure shall not be required where underfloor areas are elevated more than 4 feet above the ground. In such a case, a minimum of 6-inches of noncombustible material or metal flashing shall be extended vertically from grade on the exterior of columns and supporting walls.				
Appendages and Projections (Decks)	Noncombustible building material	✓	~	~	~
Fences and Retaining Walls	Noncombustible fence and retaining walls within 5 feet of primary dwelling unit and attachments. No combustible parallel fences.	✓	X	X	X
Detached *Accessory Structures* and *ADUs*	*All detached ADUs and accessory structures* with a footprint greater than or equal to 15 square feet shall be located a minimum of 30 feet away from the *primary dwelling unit* and attachments	✓	~	~	~

1. *IBHS Wildfire Prepared Home Standard*, Plus level [https://wildfireprepared.org/wp-content/uploads/WFPH-Standard.pdf]
2. 2024 International Wildland-Urban Interface Code, Ignition Resistant Construction Class 1
3. 2022 California Building Code, Title 24, Part 2 (Volumes 1 & 2) with July 2024 Supplement updated
4. 2018 NFPA 1144, Standard for Reducing Structure Ignition Hazard from Wildland Fire

Green (✓) – Construction requirements referenced as one of the acceptable methods in this standard or by another code
Gray (~) – Construction requirements partially addressed by the code
Orange (X) – Construction requirements not referenced by the code

4.4 *Neighborhood ember zone structures*

The *neighborhood ember zone* width (in feet) shall be calculated to determine *structures* at risk from ember exposure from surrounding *external fuels* for each *external fuel* sector as well as possible ignitions in other areas of the defined *neighborhood*. The *neighborhood ember zone* dimensions shall be determined using the processes described in *Chapter 3, Section 3.4 (see process step 4)*.

Any *structures* and/or *parcels* within the defined neighborhood boundary or, when present inside the *neighborhood flame zone* boundary, and the determined *neighborhood ember zone* shall meet the minimum mitigation requirements prescribed within the latest available *IBHS Wildfire Prepared Home Standard* "Base" level (hereafter referred to as *IBHS WFPH Base*). These minimum requirements provide ignition protection from ember attack exposure. If any part of a *parcel* falls within the *neighborhood ember zone*, any *structure* on the *parcel* shall be considered part of the *neighborhood ember zone* and is required to meet the specified requirements for this zone.

If *structures* are present within the defined boundaries of the defined *neighborhood* and are not included in the *flame and/or neighborhood ember zones*, there are no additional mitigation requirements except for meeting roof cover material requirements and *connective fuel pathway* requirements.

Table 4.4. Neighborhood ember zone construction requirements correspond to those requirements specified by the 2025 IBHS WFPH Base. Other current codes and standards and how their provisions relate are provided for reference.

Structural component	Construction requirements	2025 *IBHS* WFPH Base[1]	2024 IWUIC IR3[2]	2022 CBC[3]	2018 NFPA 1140[4]
Roof	Class A roof covering	✓	X	~	~
Gutters and Downspouts	Noncombustible gutters and downspouts	✓	✓	~	✓
Vents	1. Corrosion-resistant vents conforming with ASTM E2886, or 2. Noncombustible corrosion-resistant mesh with openings not to exceed 1/8-inch in diameter	✓	X	✓	✓
6-inch Noncombustible Vertical Clearance	Applied vertically on the exterior base of the wall measured from the grade and the nearest horizontal surface (e.g., decks)	✓	X	~	✓
Underfloor Area Construction	Fully enclosed to the ground with noncombustible corrosion-resistant mesh with openings not to exceed 1/8-inch in diameter. **Exception:** Complete enclosure shall not be required where underfloor areas are elevated more than 4 feet above the ground. In such a case, a minimum of 6-inches of noncombustible material or metal flashing shall be extended vertically from grade on the exterior of columns and supporting walls.	✓	X	~	~
Fences and Retaining Walls	Noncombustible fence and retaining walls within 5 feet of *primary dwelling unit* and attachments.	✓	X	X	X
Detached Accessory Structures and ADUs	Shall have no more than 3 detached *accessory structures* and *ADUs* with a footprint greater than or equal to 15 square feet located between 10-30 feet of the *primary dwelling unit* and attachments.	✓	~	~	~

1. *IBHS Wildfire Prepared Home Standard*, Base level [https://wildfireprepared.org/wp-content/uploads/WFPH-Standard.pdf]
2. 2024 International Wildland-Urban Interface Code, Ignition Resistant Construction Class 3
3. 2022 California Building Code, Title 24, Part 2 (Volumes 1 & 2) with July 2024 Supplement updated
4. 2018 NFPA 1144, Standard for Reducing Structure Ignition Hazard from Wildland Fire

Green (✓) – Construction requirements referenced as one of the acceptable methods in this standard or by another code
Gray (~) – Construction requirements partially addressed by the code
Orange (X) – Construction requirements not referenced by the code

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APPENDIX A
Minimum data requirements, additional data and recommendations, data schema

The following appendix includes the minimum data requirements to determine compliance with the *IBHS Wildfire Prepared Neighborhood Standard* as well as recommendations for both additional data and data schema.

A1 Formats

A1.1 Date

The date shall be entered as a string using the form YYYY-MM-DD.

A2 *Neighborhood* applicability and governance

A2.1 *Neighborhood* design and applicability requirements

Table A2.1 provides the minimum required data fields and variables for determining the applicability of the IBHS Wildfire Prepared Neighborhood Standard. Within the data schema, roof compliance with the Class A requirement is considered part of the neighborhood compliance variables.

Variable	Variable name	Type	Description	Options
Roof	Neighborhood_roof_compliance	string	Are 100% of roofs Class A across the entire defined *neighborhood*?	Binary 0=True/Yes/Complaint 1=No/Noncompliant
Construction type	Construction_type	string	Are all *structure* types within the defined *neighborhood* boundary compliant by those listed in Chapter 1?	Binary 0=True/Yes/Compliant 1=No/Noncompliant
Structures	Total_structures	integer	Total number of *structures* identified in the defined *neighborhood*	integer
Parcels	Total_parcels	integer	Total number of *parcels* in the defined *neighborhood*	integer
Structure separation	Structure_separation	string	Are 90% or more of *structures* separated by a minimum distance greater than 10 feet to the closest neighboring *structure*?	Binary 0=True/Yes/Compliant 1=No/Noncompliant
Mean structure separation	Structure_separation_mean	float	Mean *structure* separation for the defined *neighborhood*	Float
Median structure separation	Structure_separation_median	float	Median *structure separation* distance for the defined *neighborhood*	Float
Standard deviation of *structure separation*	Structure_separation_stdev	float	Standard deviation of the distribution of *structure separation* distances for the defined *neighborhood*	Float

A2.1 Covenants, Conditions & Restrictions (CC&R)

Any *Covenants, Conditions and Restrictions* documents that are active and enforced are recommended to be submitted as a .pdf document if provided.

A2.2 FIREWISE

Neighborhoods, communities, etc. which hold an NFPA *FIREWISE USA* recognition are encouraged to provide proof of their recognition to accompany any *neighborhood* specific data in instances when the standard is being applied towards mitigation assessments or any designation program.

A3 Fuel assessment data requirements

A3.1 External fuels

Fuels surrounding the defined neighborhood govern the mitigation requirements for the *neighborhood flame zone* and the *neighborhood ember zone*. The *external fuel* type models listed in *Table A3.2* (Scott and Burgan 2005) are used in fuel models to identify fire and ember behavior and are derived from those included in the *LANDFIRE* dataset. *External fuel* type models/classifications which have 10% or greater coverage by surface area in each *external fuel* assessment sector shall be identified using the variable structure defined in *Table A3.1*. Additional supplemental data can be used to identify fuels and/or to augment the time lag between *LANDFIRE* updates where land-use surrounding the defined *neighborhood* may have changes if the spatial resolution is finer than that used by *LANDFIRE* (30 m by 30 m grid) and can be integrated under the 40 different fuel model types from Scott and Burgan (2005). *Tables A3.2, A3.3* provide the data structure for the identified fuel type models for each sector that are used within *Chapter 3*, to determine the *neighborhood flame zone* and *neighborhood ember zone* distances for each sector. See *Figures 3.1* and *3.2* for sector identification provisions.

Table A3.1. The following table provides the data variable structure for external fuel model types for all detected (depicted as the N-number of fuel types) fuels with 10% or more *coverage in each 45° north-relative external fuel assessment sector for 4.25 miles radially outward from the defined neighborhood boundary.*

Variable	Variable name	Type	Description	Options
Sector 1	Fuel_type_[1…N]_sector1	string	Fuel type present in sector 1	See fuel type options below in Table A3.3
Sector 2	Fuel_type_[1…N]_sector2	string	Fuel type present in sector 2	See fuel type options below in Table A3.3
Sector 3	Fuel_type_[1…N]_sector3	string	Fuel type present in sector 3	See fuel type options below in Table A3.3
Sector 4	Fuel_type_[1…N]_sector4	string	Fuel type present in sector 4	See fuel type options below in Table A3.3
Sector 5	Fuel_type_[1…N]_sector5	string	Fuel type present in sector 5	See fuel type options below in Table A3.3
Sector 6	Fuel_type_[1…N]_sector6	string	Fuel type present in sector 6	See fuel type options below in Table A3.3

Variable	Variable name	Type	Description	Options
Sector 7	Fuel_type_[1…N]_sector7	string	Fuel type present in sector 7	See fuel type options below in Table A3.3
Sector 8	Fuel_type_[1…N]_sector8	string	Fuel type present in sector 8	See fuel type options below in Table A3.3

Table A3.2. This table provides the data variable structure for the flame model types which represent the worst-case flame intensity and ember transport distances and are used in calculating the neighborhood flame zone and neighborhood ember zone (Chapter 3, Sections 3.3 and 3.4).

Variable	Variable name	Type	Description	Options
Neighborhood flame zone				
Neighborhood flame zone fuel model type sector 1	FRz_fueltype_sector1	string	Worst case fuel type for *neighborhood flame zone* in sector 1	See fuel model types in Table A3.3
Neighborhood flame zone fuel model type for sector 2	FRz_fueltype_sector2	string	Worst case fuel type for *neighborhood flame zone* in sector 2	See fuel model types in Table A3.3
Neighborhood flame zone fuel model type for sector 3	FRz_fueltype_sector3	string	Worst case fuel type for *neighborhood flame zone* in sector 3	See fuel model types in Table A3.3
Neighborhood flame zone fuel model type for sector 4	FRz_fueltype_sector4	string	Worst case fuel type for *neighborhood flame zone* in sector 4	See fuel model types in Table A3.3
Neighborhood flame zone fuel model type for sector 5	FRz_fueltype_sector5	string	Worst case fuel type for *neighborhood flame zone* in sector 5	See fuel model types in Table A3.3
Neighborhood flame zone fuel model type for sector 6	FRz_fueltype_sector6	string	Worst case fuel type for *neighborhood flame zone* in sector 6	See fuel model types in Table A3.3
Neighborhood flame zone fuel model type for sector 7	FRz_fueltype_sector7	string	Worst case fuel type for *neighborhood flame zone* in sector 7	See fuel model types in Table A3.3

Variable	Variable name	Type	Description	Options
Neighborhood flame zone fuel model type for sector 8	FRz_fueltype_sector8	string	Worst case fuel type for *neighborhood flame zone* in sector 8	See fuel model types in Table A3.3
Neighborhood ember zone				
Neighborhood ember zone fuel model type for sector 1	ERz_fueltype_sector1	string	Worst case fuel type for *neighborhood ember zone* in sector 1	See fuel model types in Table A3.3
Neighborhood ember zone fuel model type for sector 2	ERz_fueltype_sector2	string	Worst case fuel type for *neighborhood ember zone* in sector 2	See fuel model types in Table A3.3
Neighborhood ember zone fuel model type for sector 3	ERz_fueltype_sector3	string	Worst case fuel type for *neighborhood ember zone* in sector 3	See fuel model types in Table A3.3
Neighborhood ember zone fuel model type for sector 4	ERz_fueltype_sector4	string	Worst case fuel type for *neighborhood ember zone* in sector 4	See fuel model types in Table A3.3
Neighborhood ember zone fuel model type for sector 5	ERz_fueltype_sector5	string	Worst case fuel type for *neighborhood ember zone* in sector 5	See fuel model types in Table A3.3
Neighborhood ember zone fuel model type for sector 6	ERz_fueltype_sector6	string	Worst case fuel type for *neighborhood ember zone* in sector 6	See fuel model types in Table A3.3
Neighborhood ember zone fuel model type for sector 7	ERz_fueltype_sector7	string	Worst case fuel type for *neighborhood ember zone* in sector 7	See fuel model types in Table A3.3
Neighborhood ember zone fuel model type for sector 8	ERz_fueltype_sector8	string	Worst case fuel type for *neighborhood ember zone* in sector 8	See fuel model types in Table A3.3

Table A3.3. This table provides the LANDFIRE fuel type models used in Chapters 3 and 4 in determining neighborhood flame zone and neighborhood ember zone and for use in the variables described in Table A3.1. Adapted from Scott and Burgan (2005). Rows shaded in light brown represent fuels in arid to semiarid climates with rainfall deficient summer months and extinction moisture content of 15%. Those rows shaded in light green represent subhumid to humid climates with extinction moisture contents of 30%–40%.

Class	Type ID	Description
1. Grass		
	GR1	Short or patchy or heavily grazed grass
	GR2	Moderately coarse continuous grass with average height 1 feet
	GR3	Very coarse grass with average height 2 feet
	GR4	Moderately coarse continuous grass with average height 2 feet
	GR5	Dense, coarse grass with mean height 1-2 feet
	GR6	Dryland grass with average height 1-2 feet
	GR7	Moderately coarse continuous grass with average height 3 feet
	GR8	Heavy, coarse continuous grass with average height 3-5 feet
	GR9	Very heavy, coarse, continuous grass with average height 5-8 feet
2. Grass & Shrub Mix (Up to 50% shrub coverage)		
	GS1	Shrubs height about 1-foot, low grass load
	GS2	Shrubs height about 1 to 3 feet, moderate grass load
	GS3	Moderate grass/shrub load, average grass/shrub height less than 2 feet
	GS4	Heavy grass/shrub load, average height greater than 2 feet
3. Shrubs coverage 50% or greater; grass sparse or less		
	SH1	Low shrub fuel load, fuelbed depth about 1-foot; some grass may be present
	SH2	Moderate fuel load (higher than SH1), average height about 1-foot, no grass fuel present
	SH3	Moderate shrub load, possibly with pine overstory or herbaceous fuel, fuel bed depth 2 to 3 feet
	SH4	Low to moderate shrub and litter load, possibly with pine overstory, fuel bed depth about 3 feet
	SH5	Heavy shrub load, average height 4 - 6 feet
	SH6	Dense shrubs, little or no herb fuel, average height about 2 feet
	SH7	Very heavy shrub load, average height 4 - 6 feet
	SH8	Dense shrubs, little or no herb fuel, average height about 3 feet
	SH9	Dense, finely branched shrubs with significant fine dead fuel, average height about 4 - 6 feet; some herbaceous fuel may be present

Class	Type ID	Description
4. Grass or shrubs mixed with litter from forest canopy		
	TU1	Fuelbed is low load of grass and/or shrub with litter
	TU2	Fuelbed is moderate litter load with shrub component
	TU3	Fuelbed is moderate litter load with grass and shrub components
	TU4	Fuelbed is short conifer trees with grass or moss understory
	TU5	Fuelbed is high load conifer litter with shrub understory
5. Dead & down woody fuel beneath forest canopy		
		Recently burned but able to carry wildland fire
	TL1	Light to moderate load, fuels 1 to 2 inches deep
		Fuelbed not recently burned
	TL2	Broadleaf, hardwood litter, low load and compact
	TL3	Moderate load conifer litter and does not include coarse fuels
	TL4	Moderate load, includes small diameter downed logs. Includes both fine and coarse fuels
	TL5	High load conifer litter; light slash or mortality fuel. Does not include coarse fuels
	TL6	Moderate load, less compact broadleaf, hardwood litter
	TL7	Heavy load includes larger diameter downed logs includes both fine and coarse fuels. Not composed of broadleaf or long-needle pine litter
	TL8	Moderate load of long-needle pine litter. Compactness may include small amount of herbaceous load
	TL9	Very high load, fluffy composed of broadleaf, hardwood litter
6. Activity fuel or debris from wind damage		
		Fuelbed is activity fuel
	SB1	Fine fuel load is 10 - 20 tons/acre, weighted toward fuels 1 - 3 inches diameter class, depth is less than 1-foot
	SB2	Fine fuel load is 7 - 12 tons/acre, evenly distributed across 0 - 0.25, 0.25 - 1, and 1 - 3 inches diameter classes, depth is about 1 foot
	SB3	Fine fuel load is 7 to 12 tons/acre, weighted toward 0 - 0.25-inch diameter class, depth is more than 1-foot
		Fuelbed is blowdown
	SB2	Blowdown is scattered, with many trees still standing
	SB3	Blowdown is moderate, trees compacted to near the ground
	SB4	Blowdown is total, fuelbed not compacted, foliage still attached
7. Built environment or fire resistant agricultural (maintained)		*Note: The "NB" LANDFIRE fuel classes are considered unable to carry wildland fire. However, built environment fuels (NB1) are considered and used in both ember transport and flame intensity processes. They are considered combustible and are treated as such.*

Class	Type ID	Description
	NB1	Urban or suburban development
	NB2	Snow/ice
	NB3	Maintained agricultural field
	NB8	Open water
	NB9	Bare ground/soil

A3.3 *Flame & neighborhood ember zones* required data fields

Table A3.4 provides the minimum required data fields/variables for the *neighborhood flame* zone and *neighborhood ember zone* distances for each *external fuel sector*.

Table A3.4. Variable structure for the final flame resistance and neighborhood ember zone distances for each sector. The values for each variable listed in this table shall be calculated using the processes described in Chapter 3, Section 3.3 (neighborhood flame zone), Equation 4-1 (for FRz), and Section 3.4 (neighborhood ember zone). Values can be rounded to the nearest foot.

Variable	Variable name	Type	Description	Options
Neighborhood flame zone				
Neighborhood flame zone distance sector 1	Fz_distance_sector1	integer	*neighborhood flame zone* distance for sector 1	Value in feet. 0 if there is no *neighborhood flame zone*
Neighborhood flame zone distance for sector 2	Fz_distance_sector2	integer	*neighborhood flame zone* distance for sector 2	Value in feet. 0 if there is no *neighborhood flame zone*
Neighborhood flame zone distance for sector 3	Fz_distance_sector3	integer	*neighborhood flame zone* distance for sector 3	Value in feet. 0 if there is no *neighborhood flame zone*
Neighborhood flame zone distance for sector 4	Fz_distance_sector4	integer	*neighborhood flame zone* distance for sector 4	Value in feet. 0 if there is no *neighborhood flame zone*
Neighborhood flame zone distance for sector 5	Fz_distance_sector5	integer	*neighborhood flame zone* distance for sector 5	Value in feet. 0 if there is no *neighborhood flame zone*
Neighborhood flame zone distance for sector 6	Fz_distance_sector6	integer	*neighborhood flame zone* distance for sector 6	Value in feet. 0 if there is no *neighborhood flame zone*
Neighborhood flame zone distance for sector 7	Fz_distance_sector7	integer	*neighborhood flame zone* distance for sector 7	Value in feet. 0 if there is no *neighborhood flame zone*

Variable	Variable name	Type	Description	Options
Neighborhood flame zone distance for sector 8	Fz_distance_sector8	integer	*neighborhood flame zone* distance for sector 8	Value in feet. 0 if there is no *neighborhood flame zone*
Neighborhood flame zone structure separation	Fz_structure_separation	string	Are 10% or more structures in the *neighborhood flame zone* separated by less than 30 feet?	Binary 0 = Yes/True/Additional ember transport distance added to *Ez* 1= No/False
Neighborhood ember zone				
Neighborhood ember zone distance for sector 1	Ez_distance_sector1	integer	*neighborhood ember zone* distance for sector 1	Value in feet
Neighborhood ember zone distance for sector 2	Ez_distance_sector2	integer	*neighborhood ember zone* distance for sector 2	Value in feet
Neighborhood ember zone distance for sector 3	Ez_distance_sector3	integer	*neighborhood ember zone* distance for sector 3	Value in feet
Neighborhood ember zone distance for sector 4	Ez_distance_sector4	integer	*neighborhood ember zone* distance for sector 4	Value in feet
Neighborhood ember zone distance for sector 5	Ez_distance_sector5	integer	*neighborhood ember zone* distance for sector 5	Value in feet
Neighborhood ember zone distance for sector 6	Ez_distance_sector6	integer	*neighborhood ember zone* distance for sector 6	Value in feet
Neighborhood ember zone distance for sector 7	Ez_distance_sector7	integer	*neighborhood ember zone* distance for sector 7	Value in feet
Neighborhood ember zone distance for sector 8	Ez_distance_sector8	integer	*neighborhood ember zone* distance for sector 8	Value in feet

A3.4 Additional data fields

A3.2.1 Fuel Treatment activities

The following do not require data fields but are available for entry and logging should the user of the *IBHS Wildfire Prepared Neighborhood Standard* wish to include these data. These focus on treatments within three miles of the defined *neighborhood* boundary within the previous three years.

Table A3.5. The following shall be completed for any fuel treatment data entry.

Name	Type	Description	Options
Treatment_ID	String or integer	A unique integer identifier for the treatment within a project (for that organization), usually a number or an alpha-numeric code, rather than a full name. Preferred that it does not include text that identifies which organization, in case that must be kept private	
Treatment_name	string	Project or fuel treatment name	
County	string	County name where treatment was completed	
Neighborhood	string	Neighborhood name/identifier	
Neighborhood_ID		Account identifier	Identifier if applying for, or have an active *IBHS* designation
Primary_objective	string	The primary goal of the treatment (see options).	Ex: Broadcast Burn, Fuel Reduction, Fuelbreak, Roadway Clearance
Secondary_objective	string	The secondary goal of the treatment (see options). **Optional field**.	Ex: Broadcast Burn, Fuel Reduction, Fuelbreak, Roadway Clearance
Tertiary_objective	string	The tertiary goal of the treatment (see options). **Optional field.**	Ex: Broadcast Burn, Fuel Reduction, Fuelbreak, Roadway Clearance
Retreatment_date	date	Approximate estimated date at which the treatment will need to be performed again	
Treatment_status	string	Treatment status	Ex: Planned, Active, Complete
Treatment_start_date	date	Date the treatment started, usually the date of the first activity	
Treatment_end_date	date	Date all treatment activities were completed.	
Treatment_area	integer	Area of treatment in acres (nearest integer)	
Ownership_group	string	Agency or organization	Federal, State, Local, Private, Other, HOA, Firewise, etc.
Activity_description	string	The practice used to achieve management objectives.	
Broad_vegetation_type	string	Identify the primary broad vegetation type for the activity area	Forest, Woodland, Shrubland, Grass, etc.

Table A3.6 Objective descriptions

Objective	Objective definition
Biomass utilization	Work conducted in an area where the secondary or tertiary objective is to utilize woody biomass for wood products, and/or generate energy through combustion or gasification, and/or utilize woody biomass to help develop markets for beneficial uses of the material
Burned area restoration	Work conducted in a recently burned area intended to promote recovery and ecological stability
Carbon storage	Work conducted to improve carbon storage or carbon stability in forests, shrubs and grasslands
Climate adaptation	Work conducted to increase the ability of an ecosystem to be resilient to or resist climate change. Resilience is the ability to recover from a climate change-related event, while resistance is the ability to withstand that event unchanged

Objective	Objective definition
Cultural burn	Application of fire to the environment predominantly to achieve cultural objectives
Ecological restoration	Work conducted to re-establish the composition, structure, pattern, integrity, and ecological processes necessary to facilitate terrestrial and Wildfire & Landscape Resilience Interagency Tracking System – August 2023 9 aquatic ecosystem sustainability, resilience, and health under current and future conditions
Fire prevention	Activities were conducted to help educate the public about Fire Prevention. Includes CWPP, public education events, placement of prevention signs, and community meetings related to fire prevention
Forest pest control	Work conducted to control the spread of active forest pest and diseases, typically used during active infestations such as Sudden Oak Death and Gold Spotted Oak Borer outbreaks
Forestland stewardship	Work conducted to encourage private and public investments in forestlands and resources within the state to ensure adequate future high quality timber supplies, related employment, and other economic benefits, and to protect, maintain, and enhance the forest resource for the benefit of present and future generations
Fuelbreak	Work conducted to modify flammable vegetation to create defensible space to reduce fire spread to structures and/or natural resources, and to provide a safer location to fight the fire. Fuelbreaks are strategically placed along a ridge, valley bottom, access road, or around a subdivision
Habitat restoration	Work conducted to improve or protect wildlife habitat
Land protection	Protection of natural and working lands against conversion to other land cover types, such as developed or cropland, that would result in the loss of natural vegetation. Often through the establishment of easements, acquisitions, fee title, or other activities
Mountain meadow restoration	Work conducted to restore mountain meadow lands
Non-timber products	Work conducted to collect, propagate, or preserve non-timber products, including food, medicinal, cultural, spiritual, or other materials from an ecosystem
Other forest management	Precommercial forest management treatment activities. Or work conducted in an area to improve stand structure or composition
Other fuels reduction	Work conducted in an area where the primary objective is to reduce fuel loads. While this can be accomplished through Fuel Break and Broadcast Burn objectives, this should be used when Fuel Break and Broadcast Burning objectives are not being utilized
Prescribed fire	Work conducted in an area where the primary objective is reducing fuel loads through broadcast burning and pile burning
Recreation	Work conducted to improve or maintain recreation opportunities
Reforestation	Work conducted to promote the reforestation of non- or understocked forestland and areas burned by wildfire, drought, pests, or other natural disturbances to increase carbon sequestration and rebuild natural habitats and ecosystems. Tree planting associated with timber harvest operations is not tracked because these activities are legally required to meet minimum stocking standards following timber operations
Riparian restoration	Work conducted to improve riparian habitat or stream channel function
Roadway clearance	Work conducted along the right of way of fire roads, county roads, or highways for purposes of improved ingress and egress. This includes the removal of dead trees resulting from insects or drought. Right of Way Clearance is not done with the intent of stopping a fire at the location of work but instead focuses on ingress and egress enhancement
Site Preparation for Planting, Seeding, or Natural Regeneration	Manipulation of a site to enhance the success of regeneration, including through the completion of activities such as broadcast burning, mastication, mowing, dozer, or herbicide application
Timber harvest	Work conducted in an area where the primary objective is to harvest timber to produce wood products
Utility right of way clearance	Work conducted along the right of way of Electric Utility lines. This includes the removal of dead trees resulting from insects or drought. Right of Way Clearance is not done with the intent of stopping a fire at the location of work but instead focuses on keeping trees from hitting powerlines and/or high fuel loads from forming under powerlines

Objective	Objective definition
Watershed restoration	Work conducted in uplands and/or riparian areas to restore watershed function, including improvements in water quantity, water quality, habitat, and other ecological characteristics
Wetland restoration	Work conducted on land that is covered or saturated by water for all or portions of a year (excluding mountain meadows and riparian areas), to improve ecosystem function, including water quality, habitat, and other ecological characteristics

A4 *Parcel* Level Variables

A4.1 Required *parcel* level variables

The following variables represent the minimum requirements that shall be collected and submitted for each *parcel* and subsequent *structures* within the *neighborhood* being evaluated. Tables are broken down into parcel-level subsystems. The following are the sub-systems used in the data dictionary and minimum requirements as developed by *IBHS* in support of the *IBHS Wildfire Prepared Home Standard*. The *parcel*-level data fields can be obtained through any means such as ground-based inspections, *aerial imagery* etc. but must meet the minimum data requirements specified here.

Table A4.1. Home inspection details subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
address	address	string		Physical address	Home Inspection Details	
latitude	lat	float		Latitude in decimal degrees	Home Inspection Details	
longitude	lon	float		Longitude in decimal degrees	Home Inspection Details	
Single family home	single_family_home_present	string	Single Family Home Present?	Is the home a single-family home (no townhomes / condos) with three stories or less? Binary True/False	Home Inspection Details	0=True /compliant 1=False
Stories	number_of_stories	integer	Number of stories	How many stories does the home have (not including a walk-out basement)?	Home Inspection Details	
Neighborhood flame zone	flame_resistance_zone	string	Neighborhood flame zone	Is the parcel/home a part of the *neighborhood flame zone*	Home Inspection Details	0=True/Yes 1=False/No
Neighborhood ember zone	ember_resistance_zone	string	Neighborhood ember zone	If the parcel/home is not part of the neighborhood flame zone, is it part of the *neighborhood ember zone*	Home Inspection Details	0=True/Yes 1=False/No

Table A4.2 General parcel subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Accessory structure/s	accessory_structures_properly_distanced_from_home	string	*Accessory structure* spacing	Are all additional *structures* larger than 15 square feet. more than 30 feet from the house or not present? Note: If	General	0=True/Compliant 1=False

				not present, select yes. (Structure examples sheds, hot tubs, propane tanks, pergolas, ADUs, playsets) Binary Yes/No		
Accessory structure/s inside 30 feet	accessory_structures_present	string	*Accessory structures* inside 30 feet from the house	If the property has additional *structures* larger than 15 ft^2 within 30 feet of home, are there three or fewer structures? **Additional data requirements:** Photo of each *accessory structure* present showing distance from home for reference.	General	0=True/Compliant 1=False

Table A4.3 Accessory structure compliance subsystem (for 3 accessory structures, not required if not present).

Variable	**Data name**	**Variable type**	**Title**	**Description**	**Subsystem**	**Value**
Accessory structure compliance 1	accessory_structure_compliance_1	String	*Accessory structure* 1 compliance	For the *accessory structure* 1, does it meet all of the same requirements as the home? Binary Yes/No **Additional data requirements:** Photos of the 5 feet buffer zone all the way around the structure.	Accessory structure compliance	0=True/Yes/ Compliant 1=False
Accessory structure compliance 2	accessory_structure_compliance_2	String	*Accessory structure* 2 compliance	For the *accessory structure* 2, does it meet all of parcel requirements? Binary Yes/No **Additional data requirements:** Photos of the 5 feet buffer zone all the way around the *structure*.	Accessory structure compliance	0=True/Yes/ Compliant 1=False
Accessory structure compliance 3	accessory_structure_compliance_3	String	*Accessory structure* 32 compliance	For the *accessory structure* 3, does it meet all of the parcel requirements? Binary Yes/No **Additional data requirements:** Photos of the 5 feet buffer zone all the way around the structure.	Accessory structure compliance	0=True/Yes/ Compliant 1=False

Table A4.4. External propane tank (not required if not present).

Variable	**Data name**	**Variable type**	**Title**	**Description**	**Subsystem**	**Value**
External propane tank compliance	propane_tank_compliance	string	External fixed propane tank	If a stationary propane tank is present, is it at least 10 feet from with house with the additional clearance requirements or placed 30 feet away from the home? **Additional data requirements:** Photos of the	Propane tank	0=True/Compliant 1=False

				5 feet buffer zone all the way around the propane tank.		

Table A4.5. Hot Tub/Spa (not required if not present).

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Hot tub/spa compliance	hot_tub_compliance	string	Hot tub/spa	If applicable, is the hot tub placed at least 10 feet from the home, on a noncombustible surface (no wood decks) and not under a covered porch or pergola? Binary Yes/No **Additional data requirements:** Photos of the 5 feet buffer zone all the way around the hot tub.	Hot tub	0=True/Compliant 1=False

Table A4.6. General roof condition subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Roof debris	roof_clear_of_debris	string	Roof debris	Is the roof clear of debris Binary True/False. **Additional data requirements:** Presence of debris shall be documented with photo/s	Home Inspection Details	0=True/Compliant 1=False

Table A4.7. Dominant roof cover subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Dominant roof cover percentage	dominant_roof_cover_percentage	integer	Dominant Roof Cover Percentage	Percentage of coverage for the dominant roof cover material	Dominant roof cover	Range: 50%-100%
*Dominant roof cover material type	dominant_roof_cover_material	string		What is the dominant roof covering material? **Additional data requirements**: Photo requirement: 6 photos showing all roof faces.	Dominant roof cover	See sub-table for minimum required roof cover types

Table A4.8. Secondary roof cover subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Secondary roof cover percentage	secondary_roof_cover_percentage	integer	Dominant Roof Cover Percentage	Percentage of coverage for the dominant roof cover material	Dominant roof cover	Range: <50%
*Secondary roof cover material type	secondary_roof_cover_material	string		What is the secondary roof covering material? **Additional data requirements:**	Dominant roof cover	See sub-list for minimum required roof cover types

				Photo requirement: 6 photos showing all roof faces.		

**The following provides the minimum required roof cover types to be evaluated and listed in required parcel-level data for both dominant and secondary roof cover materials:*
Asphalt shingle
Standing seam metal
Metal with exposed fasteners
Discontinuous metal
Clay tile with bird stops
Clay tile without bird stops
Concrete tile with bird stops
Concrete tile without bird stops
Slate
Composite shingle/Plastic Panel
Wood shake shingle
Low slope/flat membrane
Low slope/flat built-up/TPO
Low slope/flat modified bitumen
Low slope/flat ballasted
Unknown steep slope
Unknown low slope/flat

Table A4.9. Gutters, downspouts subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Metal gutters downspouts	metal_gutter_downspouts_present	string	Metal gutters and downspouts	Are the gutters and downspouts made of metal Binary True/False **Additional data requirements:** Photos required of gutters and downspouts	Gutters & downspouts	0=True/Compliant 1=False
Gutter debris	gutters_downspouts_clear_of_debris	string	Debris in gutters	Are the gutters and downspouts clear of debris. **Additional data requirements:** Photos required of inside gutter condition	Gutters & downspouts	0=True/Compliant 1=False
Gutter guards	metal_gutter_guard_present	String	Presence of gutter guards	Are gutter guards present and completely made of metal? **Additional data requirements:** If true a photograph is required	Gutters & downspouts	0=True 1=False

Table A4.10. Vents subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Roof vent compliance	roof_vents_compliance	string	Roof vent compliance	Are all roof vents (except plumbing vents) flame- and ember-resistant or covered with 1/8" metal mesh or finer? Binary True/False	Vents	0=True/Compliant 1=False

Variable	Data name	Variable type	Title	Description	Subsystem	Value
				Additional data requirements: Close-up photo of every vent with mesh in view (to observe size).		
Under eave vents	vents_under_eaves_compliance	string	Vents_under_eaves_compliance	If present: Are the open eave vents flame- and ember-resistant or covered with 1/8" metal mesh or finer? Binary True/False **Additional data requirements:** Photos require close-up of every vent with mesh in view (to observe size).	Vents	0=True/Compliant 1=False
Roof vent type	roof_vents_type	string	Roof vent types	Identify and list all vents visible that are present on the roof. **Additional data requirements:** Provide photographs of each	Vents	*See sub-list below for minimum vent type requirements
Eave attic vents	eave_attic_vents_compliance	string	Eave attic vents	If present: Are under eave vents that enter directly into the attic space flame- and ember-resistant or covered with 1/8th inch metal mesh or finer? Binary True/False	Vents	0=True/Compliant 1=False
Gable end vents	gable_end_vents_compliance	string	Gable end vents	If present: Are the gable end vents flame- and ember-resistant or covered with 1/8" metal mesh or finer? Binary True/False **Additional data requirements:** Photos must be provided of each visible vent with close-up of mesh	Vents	0=True/Compliant 1=False
Crawl space vents	crawl_space_vents_compliance	string	Crawl space vent compliance	If present: Are the crawl space vents flame- and ember-resistant or covered with 1/8" metal mesh or finer? **Additional data requirements:** A close-up photo of every vent with mesh in view (to observe size).	Vents	0=True/Compliant 1=False
Forced air vent louver flap	dryer_vent_louver_flap_present	string	Forced air vent louver flap present	Do forced air vents have a louver or flap? Binary True/False **Additional data requirements:** A close-up photo of the vent.	Vents	0=True/Compliant 1=False
Forced air vent and flap material	metal_dryer_vent_present	string	Forced air vent louver flap material	Is the dryer vent assembly made of metal? **Additional data requirements:** A close-up photo of the vent/s.	Vents	0=True/Compliant 1=False

**The following provides the minimum required roof vent types to be listed in required parcel-level single-family home data*.
Ridge-cap vent
Off-ridge vent
Turbine vent

Table A4.11. Eave/Soffit subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Eave/soffit materials	eave_soffits_materials_compliance	string	Eave soffit materials	Are the eaves enclosed on the underside with soffits made of noncombustible material, have at least a 1-hour fire-resistance-rating, material, or 2-inch dimension lumber (no plywood or vinyl)? Binary True/False **Additional data requirements:** A close-up photo/s of the eaves.	Dominant roof cover	0=True/Compliant 1=False

Table A4.12. General exterior walls subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Exterior walls material and 6- inch vertical clearance	exterior_walls_material_compliance	string	Exterior Walls Material(s) Compliance	Noncombustible 6-inch vertical clearance. Do all exterior walls have a minimum of 6 vertical inches (measured from the ground up and from any attached horizontal surface like a deck or patio) of noncombustible siding material around the home such as fiber-cement, brick, stone, stucco, or exposed concrete foundation?	General exterior walls	0=True/Compliant 1=False

Table A4.13. Dominant wall subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Dominant wall cover material	dominant_wall_cover_material	string	Dominant wall cover material	*Please select the dominant wall cover material(s). **Additional data requirements:** A close-up	Dominant walls	*see list below for minimum wall material types

				photo/s of materials used on all wall coverings.		
Dominant wall cover material coverage	dominant_wall_cover_cover_percentage	integer	Dominant wall cover material coverage percentage	What is the dominant wall cover percentage of coverage on the structure	Dominant walls	>50%

Table A4.14. Secondary wall subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Secondary wall cover material	secondary_wall_cover_material	string	Secondary wall cover material	*Please select the secondary wall cover material(s). **Additional data requirements:** A close-up photo/s of materials used on all wall coverings.	Secondary walls	*See list below for minimum wall material types
Secondary wall cover material coverage	secondary_wall_cover_cover_percentage	integer	Secondary wall cover material coverage percentage	What is the secondary wall cover percentage of coverage on the structure?	Secondary walls	<50%

**The following provides the minimum required wall material types to be listed in required parcel-level single-family home data.*

Stucco
Vinyl siding
Fiber cement siding
Wood panel/wood-based composite siding
Wood shake
Plastic composite siding
Brick or brick veneer
Stone or stone veneer
Concrete
Other
Unknown

Table A4.15. Foundation subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
				Photos required	Foundation	

Table A4.16. Shutters subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Functional shutters	functional_shutters_present	string	Presence of functional shutters	Are functional noncombustible shutters present on all windows? Binary True/False	Shutters	0=True/Yes 1=False

Variable	Data name	Variable type	Title	Description	Subsystem	Value
				Additional data requirements: Close-up photos showing the shutters/shutter system.		
Decorative shutters	secondary_wall_cover_cover_percentage	string	Presence of decorative shutters	If present, are decorative shutters made of noncombustible material? Binary True/False **Additional data requirements:** Close-up photo/s of the materials used.	Shutters	0=True/Yes 1=False

Table A4.17. Exterior glass and doors.

Variable	Data name	Variable type	Title	Description	Subsystem	Value
Exterior glazing	windows_skylights_glazed_glass	string	Windows / Skylights / Glazed Glass	Do all windows, skylights, and glazed openings within doors meet ONE of the following requirements: Multipaned glass with at least two tempered panes (etched), have a 20-minute fire-resistance rating, or glass blocks (windows only)? **Additional data requirements:** Photos of the tempered glass etched label (bug), located on the inside of each tempered pane in one of the four corners, meeting AMMA labeling requirements.	Exterior glazing, doors, bay windows	0=True/Yes/ Compliant 1=False
Exterior doors	exterior_door_material_compliance	string	Exterior door materials compliance	Are all exterior doors solid, have a noncombustible threshold and ONE of the following: 1) Door surface/cladding made of noncombustible or ignition-resistant material (e.g., metal, solid hardwood, fiberglass), or 2) a noncombustible storm door as the outermost door? **Additional data requirements:** A photo of every exterior door.	Exterior glazing, doors, bay windows	0=True/Yes/ Compliant 1=False
Skylight type	skylight_type	string	Skylight glass type	If skylights are present, are they made of flat glass (rather	Exterior glazing,	0=True/Yes/ Compliant

Variable	Data name	Variable type	Title	Description	Subsystem	Value
				than domed plastic)? Binary Yes/No	doors, bay windows	1=False
Skylight mesh	Skylight_mesh	string	Skylight mesh protection	If skylights are operable, is the opening protected by a noncombustible mesh screen where the dimensions of the mesh shall not exceed 1/8-inch in diameter? Binary Yes/No	Exterior glazing, doors, bay windows	0=True/Yes/ Compliant 1=False

Table A4.18. Primary deck/covered porch subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Values
Area around deck	deck_area_noncombustible_space_present	string	Deck area noncombustibles	Does the area around the footprint of all decks / covered porches, including under stairs, have at least 5 feet of noncombustible space? Binary Yes/No	Primary deck/covered porch	0=True/Yes/Compliant 1=False
Decks and porches condition	decks_covered_porches_clear_of_debris	string	Decks covered porches clear of debris	Is the top surface of all decks / covered porches clear of yard debris? Binary Yes/No **Additional data requirements:** Photo/s of the deck / porch deck surface.	Primary deck/covered porch	0=True/Yes/Compliant 1=False
Deck or porch type description	deck_covered_porch_type	string	Type of porch/deck	What type of deck / covered porch is present? **Additional data requirements:** Photos of each side of the deck / porch and include the base of the structure (see subsystem photo requirements for additional details)	Primary deck/covered porch	*See sublist below for minimum porch/deck descriptors
Deck and porch vegetation condition	decks_covered_porches_clear_of_excessive_vegetation	string	Porch/deck vegetation condition	Is the top surface of all decks / covered porches completely free from trees and shrubs, with no more than 10 potted plants / flowers in noncombustible planters? Binary Yes/No	Primary deck/covered porch	0=True/Yes/Compliant 1=False
Underneath deck area condition assessment	underneath_decks_covered_porches_clear_of_vegetation	string	Under deck condition assessment	Is underneath all decks / covered porches including stairs free from any vegetation (including wood piles, plants, grass, weeds,	Primary deck/covered porch	0=True/Yes/Compliant 1=False

Variable	Data name	Variable type	Title	Description	Subsystem	Values
				etc.)? Binary Yes/No Noncombustible materials like concrete, rock, or dirt are permitted. **Additional data requirements:** Photo/s of underneath the deck / porch of the ground and substructure (including any mesh or lattice used to enclose it.)		
Decks/porches under 4 feet elevation	decks_porches_less_than_4ft_to_ground_properly_enclosed	string	Deck/porches below 4 feet elevation	Decks / porches 4 feet or less from walking surface to ground: Is it fully enclosed underneath with 1/8-inch or finer metal mesh with no combustible material such as lattice installed over the mesh? Binary Yes/No **Additional data requirements:** Photo/s of the covering.	Primary deck/covered porch	0=True/Yes/Compliant 1=False
Auxiliary deck structures	decks_w_additional_structure_compliance	string	Decks with additional structure/s attached	Attached decks with an additional structure (like a pergola or gazebo): Is it made of metal, with no solid roof cover, free from all vegetation, and without curtains / drapes / screens? **Additional data requirements: Photo**/s of the structure.	Primary deck/covered porch	0=True/Yes/Compliant 1=False
Deck stairs materials	decks_stairs_construction_materials_compliance	string	Deck stair materials	Are all decks, including stairs, entirely constructed with noncombustible materials such as metal / lightweight concrete OR retrofitted with noncombustible materials for no-gap walking surfaces and railing within 5 feet of home? Binary Yes/No. **Additional data requirements:** minimum of 2 photos of underdeck structure materials and a close-up of the walking surface.	Primary deck/covered porch	0=True/Yes 1=False

Table A4.19. Secondary deck/covered porch subsystem – provides data requirements for additional decks and porches.

Variable	Data name	Variable type	Title	Description	Subsystem	Values
Area around deck	secondary_Deck_area_noncombustible_space_present	string	Deck area noncombustible	Does the area around the footprint of all decks / covered porches, including under stairs, have at least 5 feet of noncombustible space? Binary Yes/No	Secondary deck/covered porch	0=True/Yes/Compliant 1=False
Decks and porches condition	secondary_decks_covered_porches_clear_of_debris	string	Decks covered porches clear of debris	Is the top surface of all decks / covered porches clear of yard debris? Binary Yes/No **Additional data requirements:** Photo/s of the deck / porch deck surface.	Secondary deck/covered porch	0=True/Yes/Compliant 1=False
Deck or porch type description	secondary_deck_covered_porch_type	string	Type of porch/deck	What type of deck / covered porch is present? **Additional data requirements:** Photos of each side of the deck / porch and include the base of the structure (see subsystem photo requirements for additional details)	Secondary deck/covered porch	*See sublist below for minimum porch/deck descriptors
Deck and porch vegetation condition	secondary_decks_covered_porches_clear_of_excessive_vegetation	string	Porch/deck vegetation condition	Is the top surface of all decks / covered porches completely free from trees and shrubs, with no more than 10 potted plants / flowers in noncombustible planters? Binary Yes/No	Secondary deck/covered porch	0=True/Yes/Compliant 1=False
Underneath deck area condition assessment	secondary_underneath_decks_covered_porches_clear_of_vegetation	string	Under deck condition assessment	Is underneath all decks / covered porches including stairs free from any vegetation (including wood piles, plants, grass, weeds, etc.)? Binary Yes/No Noncombustible materials like concrete, rock, or dirt are permitted. **Additional data requirements:** Photo/s of underneath the deck / porch of the ground and substructure (including any mesh or lattice used to enclose it.)	Secondary deck/covered porch	0=True/Yes/Compliant 1=False

Variable	Data name	Variable type	Title	Description	Subsystem	Values
Decks/porches under 4 feet elevation	secondary_decks_porches_less_than_4ft_to_ground_properly_enclosed	string	Deck/porches below 4 feet elevation	Decks / porches 4 feet or less from walking surface to ground: Is it fully enclosed underneath with 1/8-inch or finer metal mesh with no combustible material such as lattice installed over the mesh? Binary Yes/No **Additional data requirements:** Photo/s of the covering.	Secondary deck/covered porch	0=True/Yes/Compliant 1=False
Auxiliary deck structures	secondary_decks_w_additional_structure_compliance	string	Decks with additional structure/s attached	Attached decks with an additional structure (like a pergola or gazebo): Is it made of metal, with no solid roof cover, free from all vegetation, and without curtains / drapes / screens? **Additional data requirements: Photo**/s of the structure.	Secondary deck/covered porch	0=True/Yes/Compliant 1=False
Deck stairs materials	secondary_decks_stairs_construction_materials_compliance	string	Deck stair materials	Are all decks, including stairs, entirely constructed with noncombustible materials such as metal / lightweight concrete OR retrofitted with noncombustible materials for no-gap walking surfaces and railing within 5 feet of home? Binary Yes/No. **Additional data requirements: minimum** of 2 photos of underdeck structure materials and a close-up of the walking surface.	Secondary deck/covered porch	0=True/Yes 1=False

Table A4.20. 0–5 Foot Noncombustible Zone: 0–5 foot subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Values
0-5 Foot Noncombustible Zone ground cover assessment	hiz_ground_cover_noncombustible	string	Ground cover assessment	Is the ground cover in the 0-5-Foot Noncombustible Zone hardscaped with bare dirt, gravel, pavers, river rocks, DG base, steppingstones, or concrete and free from debris? No combustible	*0-5 Foot Noncombustible Zone*	0=True/Yes/Compliant 1=False

Variable	Data name	Variable type	Title	Description	Subsystem	Values
				ground covers such as wood or rubber mulch are allowed. Binary Yes/No		
0-5 Foot Noncombustible Zone vegetation assessment	hiz_clear_of_vegetation	string	Vegetation assessment	Is the 0-5-Foot Noncombustible Zone free from all vegetation? This means no bushes, grass/artificial turf, flowers, trees, succulents, including no overhanging tree branches? Binary Yes/No	*0-5 Foot Noncombustible Zone*	0=True/Yes/Compliant 1=False
0-5 Foot Noncombustible Zone combustible items	hiz_clear_of_combustible_items	string	Combustible items assessment	Is the 0-5-foot noncombustible buffer free from all combustible items such as furniture, firewood, sheds, storage units, hot tubs, etc.? Binary Yes/No	*0-5 Foot Noncombustible Zone*	0=True/Yes/Compliant 1=False
0-5 Foot Noncombustible Zone Vehicles	hiz_clear_of_vehicles	string	Vehicles	Is the 0-5-foot noncombustible buffer free of stored boats, RVs, trailers, or ATVs? Binary Yes/No	*0-5 Foot Noncombustible Zone*	0=True/Yes/Compliant 1=False
Yard vegetation debris	hiz_clear_of_debris_accumulation	string	Yard vegetation debris	Is the entire yard free of accumulated fallen pine needles, leaves, and other debris? Binary Yes/No	*0-5 Foot Noncombustible Zone*	0=True/Yes/Compliant 1=False
Tree spacing canopy	trees_spaced_pruned	String	Tree spacing/canopy spacing	Are all trees with trunks 4+ inches spaced apart / pruned to a canopy-to-canopy distance of at least 10 feet and limbs pruned to a minimum of 6 feet off the ground? Binary Yes/No	*0-5 Foot Noncombustible Zone*	0=True/Yes/Compliant 1=False
Tree to shrubs/bush spacing	trees_vegetation_properly_spaced	string	Tree to shrub-bush spacing	Are the trees with trunks 4+ inches properly spaced? (Spacing between the tree canopy and the next closest shrub / bush / tree must be at least twice the height of the shrub / bush / tree or 10 feet.) Binary Yes/No	*0-5 Foot Noncombustible Zone*	0=True/Yes/Compliant 1=False
Shrubs and bushes spacing	shrubs_bushes_trees_spaced_properly	string	Shrub/bushes spacing	Do all the shrubs / bushes / trees with trunks less than 4 inches have proper spacing between them? Spacing distance must be at least twice the height of the tallest	*0-5 Foot Noncombustible Zone*	0=True/Yes/Compliant 1=False

Variable	Data name	Variable type	Title	Description	Subsystem	Values
				bush / shrub present and privacy bushes or rows of shrubs are not allowed. (Example: 3 feet bush + 4 feet bush (tallest) = spaced 8 feet apart.) Binary Yes/No		
Dead vegetation	dead_vegetation_removed	string	Dead vegetation maintenance	Has all dead vegetation been removed? Binary Yes/No	*0-5 Foot Noncombustible Zone*	0=True/Yes/Compliant 1=False

Table A4.21. 5–30-foot subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Values
Trees properly pruned	thirty_feet_hiz_trees_pruned	string	Trees pruned	Do all trees within 30 feet, have branches removed from the ground up to 6 feet and upper branches trimmed to ensure 10 feet of space from neighboring trees? Binary Yes/No	HIZ 5-30	0=True/Yes/Compliant 1=False
Tree spacing canopy	thirty_feet_hiz_vegetation_spaced	string	Tree spacing 5-30 feet	Trees with trunk 4 inches or larger: Have spacing between the tree canopy and the next closest shrub/bush/tree with a trunk diameter of less than 4 inches at least twice the height of the bush/shrub/tree (or 10 feet, whichever is less)? Binary Yes/No	HIZ 5-30	0=True/Yes/Compliant 1=False
Shrub/bushes spacing	thirty_feet_hiz_shrubs_spaced	string	Spacing of shrubs and bushes	Are all shrubs within 30 feet, removed from under trees, have space between grouping of a 10-foot area of 10 feet apart, AND all privacy hedges and rows of bushes have been removed? Binary Yes/No	HIZ 5-30	0=True/Yes/Compliant 1=False
Yard debris Zone 1	thirty_feet_hiz_vegetation	string	Yard debris 5-30 foot area	Within 30 feet of the home, is the yard free of accumulated fallen pine needles, leaves, and other debris? Binary Yes/No	HIZ 5-30	0=True/Yes/Compliant 1=False
Dead vegetation and firewood stacks	thirty_feet_hiz_vegetation_firewood	string	Dead vegetation and	Has all dead vegetation and firewood stacks been	HIZ 5-30	0=True/Yes/Compliant 1=False

Variable	Data name	Variable type	Title	Description	Subsystem	Values
			firewood 5–30-foot area	removed or placed at least 30 feet away from the home?		

Table A4.22. Fences subsystem.

Variable	Data name	Variable type	Title	Description	Subsystem	Values
Back-to-back fencing	back_to_back_fencing_compliance	string	Back-to-back fence sections	If fences are back-to-back within 30 feet, is there at least 5 feet between them? Binary Yes/No **Additional data requirements:** Photos of any fencing within 30 feet.	Fences	0=True/Yes/Compliant 1=False
Home fencing	fencing_distance	string	Fencing near or within the HIZ	Is fencing within 5 feet of the home, including any part that attaches to the home? Binary Yes/No **Additional data requirements:** Photos of any fencing near or within 5 feet/HIZ of the home.	Fences	0=True/Yes/Compliant 1=False
0-5 Foot Noncombustible Zone fencing	fence_material_noncombustible	string	0-5 Foot Noncombustible Zone fencing	If fencing, posts or gates are present within 5 feet of the home, are they made of *noncombustible* materials, such as metal (aluminum, chain link, or iron) or concrete blocks? No vinyl or wood fences allowed. Binary Yes/No	Fences	0=True/Yes/Compliant 1=False

A4.2 *Parcel* level additional data requirements

The following represent the minimum subsystem photograph requirements that shall be collected for each *parcel/single family structure* and subsystem variable if the variable feature is present. See *Section A6* for photograph/image format requirements, metadata requirements and recommendations.

Table A4.23 Parcel level additional data requirements.

Subsystem	Variable	Data name	Photograph minimum requirements
Home Inspection Details	Address numbers	address_numbers_photo	1 photo of the address numbers on the home / mailbox.
Home Inspection Details	Left elevation photographs	left_yard_photos	2 photographs of the yard area in its entirety

Subsystem	Variable	Data name	Photograph minimum requirements
Home Inspection Details	Back/rear of house photographs	back_of_the_house_photos	3 photos of the back of the property in landscape mode/orientation.
Home Inspection Details	Front elevation of the property photographs	front_of_the_house_photos	3 photos of the front of the property in landscape mode/orientation.
Home Inspection Details	Front yard photographs	front_yard_photos	2 photos of the yard in its entirety.
Home Inspection Details	Left Side of the House Photos	left_side_of_the_house_photos	3 photos of the left side of the property in landscape mode/orientation.
Home Inspection Details	Right Side of the House Photos	right_side_of_the_house_photos	3 photos of the right side of the property in landscape mode/orientation.
Home Inspection Details	Right Yard Photos	right_yard_photos	2 photos of the yard in its entirety.
General	*Accessory structures* within 30 feet	accessory_structures_present	Photo/s required of each *accessory structure* present showing distance from home for reference.
***Accessory structure* 1**	*Accessory structure* compliance 1	accessory_structure_compliance_1	Photos of the 5 feet buffer zone all the way around the *structure*
***Accessory structure* 2**	*Accessory structure* compliance 3	accessory_structure_compliance_2	Photos of the 5 feet buffer zone all the way around the *structure*
***Accessory structure* 3**	*Accessory structure* compliance 3	accessory_structure_compliance_3	Photos of the 5 feet buffer zone all the way around the *structure*
Hot Tub/Spa	Hot tub/spa	hot_tub_compliance	Photos of the 5 feet buffer zone all the way around the hot tub
Exterior Propane Tank	Exterior fixed propane tank	propane_tank_compliance	Photos of the10 feet buffer zone all the way around the propane tank.
Dominant Roof Covering	Dominant roof cover material	dominant_roof_covering_material	6 photos showing all roof faces
Secondary Roof Covering	Secondary roof cover materials	secondary_roof_covering_material	6 photos showing all roof faces
Roof	Roof clear of debris	roof_clear_of_debris	Photo/s of any areas of visible built-up debris on any roof face. Close-up photographs if possible
Gutters and Downspouts	Gutters and downspout materials	metal_gutter_downspouts_present	1 close-up photo of gutter, 1 close-up photo of downspout
Gutters and Downspouts	Gutters and downspout debris accumulation	gutters_downspouts_clear_of_debris	Photo/s of any areas of debris in gutter systems

Subsystem	Variable	Data name	Photograph minimum requirements
Gutters and Downspouts	Gutter guard	metal_gutter_guard_present	Close-up photo/s of gutter guard material (if present)
Vents	Roof vent compliance	roof_vents_compliance	Close-up photo of every vent with mesh in view (to observe size)
Vents	Roof vent types	roof_vents_type	Close-up wide-angle photo of every vent with mesh in view (to observe size)
Vents	Forced air vent assembly	dryer_vent_louver_flap_present	1 photo of the vent assembly including the louver flap (if present)
Vents	Dryer vent material	metal_dryer_vent_present	1 close-up photo of the vent
Vents	Eave attic vents	eave_attic_vents_compliance	A close-up photo/s of every vent with mesh in view (to observe size)
Vents	Gable-end attic vents	gable_end_vents_compliance	A close-up photo/s of every vent with mesh in view (to observe size)
Vents	Crawl space vents	crawl_space_vents_compliance	A close-up photo/s of every vent with mesh in view (to observe size)
Eaves & Soffits	Eave/soffit material compliance	eaves_soffits_materials_compliance	Close up photo of the eaves for all 4 elevations (4 total photos, minimum requirement)
Dominant Walls	Dominant wall cover material	dominant_wall_cover_material	Close up photo of material used on dominant percentage wall coverings
Secondary Walls	Secondary wall cover material/s	secondary_wall_cover_material	Close up photo/s of material/s used on any secondary wall coverings
Foundation	Foundation	foundation_photos	Photos of all sides of the foundation, including the deck (if present). Minimum of 4 photos total, 1 for each elevation clearly showing foundation ground/foundation interface.
Shutters	Functional shutters	functional_shutters_present	Close-up photo showing the shutters
Shutters	Decorative shutters	decorative_shutters_material_non_combustible	Close up photo/s of the decorative shutter material/s
Exterior glazing, windows, doors, bay windows	Windows, skylights compliance	windows_skylights_glazed_glass	Photo of the tempered glass etched labels for all accessible windows.
Exterior glazing, windows, doors, bay windows	Exterior Door Material(s) Compliance	exterior_door_material_compliance	Photo of every exterior door
Exterior glazing, windows, doors, bay windows	Bay window	bay_window_non_combustible_wall_present	Photo/s of any bay window and area underneath and surrounding the window feature.
Primary Deck / Covered Porch	Deck / Covered porches clear of debris	decks_covered_porches_clear_of_debris	Photo/s of the deck / porch deck surface
Primary Deck / Covered Porch	Deck / Covered porch type	deck_covered_porch_type	Photos (minimum 3) of each side of the deck / porch and include the base of the structure.

Subsystem	Variable	Data name	Photograph minimum requirements
Primary Deck / Covered Porch	Under deck/porch area	underneath_decks_covered_porches_clear_of_vegetation	Photo/s of underneath the deck / porch of the ground and substructure (including any mesh or lattice used to enclose it.)
Primary Deck / Covered Porch	Decks below 4 feet elevation	decks_porches_less_than_4ft_to_ground_properly_enclosed	Photo of the covering surrounding deck (less than 4 feet elevation)
Primary Deck / Covered Porch	Decks with additional structure/s	decks_w_additional_structure_compliance	Photo/s of the structure/s
Primary Deck / Covered Porch	Deck/stairs materials	decks_stairs_construction_materials_compliance	2 photos of underdeck structure materials and 1 close-up photograph of the walking surface
Secondary Deck / Covered Porch	Secondary deck/porch debris condition	secondary_decks_covered_porches_clear_of_debris	Photo of the deck / porch deck surface
Secondary Deck / Covered Porch	Secondary deck / Covered porch type	secondary_deck_covered_porch_type	Photos (minimum 3) of each side of the deck / porch and include the base of the structure.
Secondary Deck / Covered Porch	Secondary deck underneath area	secondary_underneath_decks_covered_porches_clear_of_vegetation	Photo of underneath the deck / porch of the ground and substructure (including any mesh or lattice or other materials used to enclose it.)
Secondary Deck / Covered Porch	Secondary decks below 4 feet elevation	secondary_decks_porches_less_than_4ft_to_ground_properly_enclosed	Photo of the covering surrounding deck (less than 4 feet elevation)
Secondary Deck / Covered Porch	Secondary decks with additional structure/s	secondary_decks_w_additional_structure_compliance	Photo/s of the structure/s
Secondary Deck / Covered Porch	Secondary decks/stairs materials	secondary_decks_stairs_construction_materials_compliance	2 photos of underdeck structure materials and a close-up of the walking surface
0-5 Foot Noncombustible Zone	0-5 Foot Noncombustible Zone Photos	hiz_photos	Please take photos showing the 0–5-Foot Noncombustible Zone surrounding the entire house. Photos must capture all four elevations, front, rear, left and right sides
5-30 Foot Defensible Space Zone	5-30 Foot Defensible Space Zone Photos	thirty_feet_hiz_photos	Please take photos showing the 5–30 Foot Defensible Space Zone surrounding the entire house for reference. Photos must capture all four elevations, front, rear, left and right sides
Fences	Fencing	back_to_back_fencing_compliance	Photos of any fencing within 30 feet
Fencing	0-5 Foot Noncombustible Zone Fencing	fencing_distance	Photos of any fencing near the home

A4.3 *Connective fuel parcel* level requirements

A4.3.1 Required data

Connective fuel assessment is required for all structures within the designated neighborhood/community and the following data fields are required. See *connective fuel node* definition.

Table A4.24. Connective fuel pathways.

Subsystem	Variable	Data name	Description	
Connective fuels	Cluster identifier	Cluster_id	Which cluster of *structures* does this parcel belong to	ID integer
Connective fuels	Front elevation connective fuel	front_elevation_connective_fuel	Does the front elevation have a connected fuel node pathway to a neighboring *structure*?	0= Yes 1= No
Connective fuels	Left elevation connective fuel	left_elevation_connective_fuel	Does the left elevation have a connected fuel node pathway to a neighboring *structure*?	0= Yes 1= No
Connective fuels	Back/rear elevation connective fuel	back_elevation_connective_fuel	Does the back/rear elevation have a connected fuel node pathway to a neighboring *structure*?	0= Yes 1= No
Connective fuels	Right elevation connective fuel	right_elevation_connective_fuel	Does the right elevation have a connected fuel node pathway to a neighboring *structure*?	0= Yes 1= No

A4.4 Additional data

Intentionally left blank for future standard revisions and the identification of additional relevant data sources

A4.5 Additional optional neighborhood to parcel data

A4.5.1 Neighborhood “as built” site and structure plan drawing sets

“As built” site and individual *structure* drawing sets can be submitted as a .pdf document.

A4.5.2 Local defensible space ordinance

A .pdf file of any local ordinance in place and enforced for *defensible space* requirements.

A5 *Structure cluster* and *neighborhood connective fuel* minimum data requirements

See *structure cluste*r definition and *Chapter 3* for *structure* identification and connective fuel processes and *Chapter 4* for defined *neighborhood* requirements.

Table A5.1. Contiguous cluster required variables and connective fuel flags.

Variable	Data name	type	Description	Value
Cluster identifier	cluster_id	integer	Integer number identifier for each contiguous *structure cluster* identified within the boundaries of the *neighborhood*	i.e. 1, 2, 3, … N block. Each block can reuse integer IDs
Total homes within the *cluster*	cluster_homes	integer	Number of homes/units within the identified contiguous *cluster*	Numeric integer values

Total homes pass connective fuels	cluster_homes_pass	integer	Total number of homes/units which passed *connective fuel node* criteria in *cluster*	Numeric integer values
Total homes flagged for connective fuels	cluster_homes_flagged	integer	Total number of homes/units which failed *connective fuel node* criteria in *cluster*	Numeric integer values
Cluster compliance	cluster_compliance	string	Was the cluster flagged for connective fuels?	0=No/Compliant 1=Yes/Flagged for connective fuels

Table A5.2. Neighborhood connective fuel compliance.

Variable	Data name	type	Description	Value
Neighborhood connective fuel compliance	neighborhood_connect_fuel	integer	Does the *neighborhood* meet all connective fuel requirements?	Binary 0=Yes/Compliant 1=No/False/Non-Compliant

A6 *Neighborhood flame zone* and *neighborhood ember zone* mitigation compliance

Table A6.1. Flame and neighborhood ember zones mitigation compliance.

Variable	Data name	type	Description	Value
Neighborhood flame zone compliance	flame_resistance_zone	string	Does the parcels within the *neighborhood flame zone* meet all mitigation requirements including connective fuel provisions	Binary 0=Yes/Compliant 1=No
Neighborhood flame zone percentage mitigated	flame_resistance_ zone_ percent	percentage	Percentage of mitigated *parcels* meeting *neighborhood flame zone* requirements	Percentage (if compliant, percentage = 100%)
Neighborhood ember zone compliance	ember_resistance_zone	string	Does the *parcels* within the *neighborhood ember zone* meet all mitigation requirements	Binary 0=Yes/Compliant 1=No
Neighborhood ember zone percentage mitigated	ember_resistance_ zone_percent	percentage	Percentage of mitigated *parcels* meeting *neighborhood ember zone* requirements	Percentage (if compliant, percentage = 100%)

A7 Imagery minimum requirements

A7.1 Ground-level imagery photograph requirements

The following provides requirements and recommendations for *ground level imagery* and photographs used to assess, verify, validate, and/or monitor any element required by the *IBHS Wildfire Prepared Neighborhood Standard*.

A7.1.1 Camera specifications

Resolution: Any submitted ground-based imagery shall use a minimum resolution of 12 megapixels.

Lens: It is recommended to use wide-angle lenses to capture more of the scene; a focal length of 24mm-35mm is recommended but not required.

A7.1.2 Image format
File Format: Images shall be saved and submitted in RAW format.
Color Depth: Images shall use a minimum 16-bit color depth setting.

A7.1.3 Geotagging and metadata
All submitted images shall contain the following minimum metadata:
Time, Latitude, Longitude, Camera settings (i.e., aperture and focal length settings)

A7.1.4 Temporal requirements
Ground-based imagery shall be collected within 60 days of any defined neighborhood evaluation, verification and/or monitoring.

A7.2 Ground level imagery recommendations
The following are recommendations and best-practices for ground-level imagery and are not considered to be requirements for ground-based imagery use for any element and/or requirement of the *IBHS Wildfire Prepared Neighborhood Standard*.

A7.2.1 Recommended imaging conditions
Time of Day: For the best image quality, photos should be taken during the “golden hours,” however it is understood that these times are not ideal for typical inspection activities.

A7.2.2 Weather conditions
Avoid rainy or completely overcast days, if possible, to minimize reflections, issues with water droplets, distortion from rain/moisture, and shadows that might not show details.

A7.2.3 Photographic techniques
Exposure: It is recommended to use HDR techniques to manage high-contrast scenes but not required
Focus: Ensure the entire scene is in focus.

A7.2.4 Coverage
360-Degree Views: Each required image location could also include a 360-degree series of photos. For 360-degree image processing, the process will require taking multiple photos in a circle around a central point. 360 imagery is not required (see imagery requirements).

A7.2.5 Panoramic shots
Use panoramic shots for open areas to get a wider perspective of the landscape and community layout, which can be useful for understanding potential fire spread.

A7.2.6 Overlapping fields of view
Each photo should overlap with the previous by approximately 30% to ensure complete coverage when stitching images together or when analyzing spatial relationships.

A7.2.7 Consistent height
Establish a consistent height at which photos are taken by using a tripod to standardize the angle of capture across different photographers and locations. While not required, the use of a tripod at a consistent height for all ground-based images is recommended.

A7.2.8 Distance from subject
Standardize the distance from which photos are taken to maintain consistency across different images and scenes.

A7.2.9 Positioning and reference points
Use reference points or markers in photos to help align shots taken from different angles or at different times. Mark specific spots for repeated photography. It's useful for monitoring changes over time.

A7.2.10 Macro and micro scales
Instruct photographers to take both wide-angle shots for overall views and closer, detailed shots of specific features like building materials, vegetation types, and ground cover for assessing fire risk.

A7.2.11 Angle grids
Create a grid system for larger areas, specifying the exact points and angles from which photos should be taken. This can guide photographers and ensure that all necessary perspectives are covered.

A7.3 *Aerial imagery* requirements

This section provides the minimum requirements for aerial imagery used for assessment, verification, validation, and/or monitoring of any requirement specified in the *IBHS Wildfire Prepared Neighborhood Standard*.

A7.3.1 General *aerial imagery* requirements. Aerial imagery collected from any fixed-wing aircraft, unmanned aerial vehicle, drone, quadcopter etc. for use in assessing roof cover type, connective fuels, defensible space, and fuelbreak characterization shall meet the following:

A7.3.1.1 Digital file format
Aerial imagery may be supplied using one of the following file formats: ECW, geoTiff, GeoJSON, TIFF, MrSID, MRF or HDF. Other file formats not listed here require additional approval for use.

A7.3.1.2 Spectral resolution
Photogrammetric digital camera providing 3-bands, red, green, blue, and panchromatic if available.

A7.3.1.3 Temporal resolution
Aerial imagery used to provide an evaluation and determination of mitigation requirements specified in *Chapter 4* using the processes described in *Chapter 3* shall have been collected within one calendar year. Imagery used for verification of mitigation actions and/or monitoring of mitigation actions described in *Chapters 3* and *4* shall be collected within 6 months of its use in verifying actions.

A7.3.1.3 Spatial resolution shall be 15 cm or finer.

A7.3.1.4 Image compression shall not exceed 15 times and should minimize image quality loss.

If imagery must be converted follow these recommendations for the specific data type (recommendations courtesy of ESRI).

Table A7.1

Data Type	Recommendations
8-bit or 16-bit, 1-,3-, or 4-band rasters where lossy compression is not suitable	Use MRF with LERC compression or TIF with LZW/Deflate compression. These formats include tiling with tiles of size 512, 256 or 128. Smaller tile sizes work best for scientific data where access to temporal profiles is more common.
8-bit, 3-band natural color imagery already preprocessed by orthorectification, color balanced, mosaicked, and cut into tiles	This imagery is generally used as background imagery and should be converted directly to a tile cache or stored as MRF or TIFF with JPEG YCbCr compression. Typically, a quality value of around 80 is used, which provides approximately 8-times compression. YCbCr-based JPEG compression internally converts the image to a different spectral domain, improving the compression.
16-bit or 32-bit, 1-band elevation data	Use MRF with LERC compression or TIFF, LZW/Deflate compression, tiled 128 or 256. For 16-bit elevation, be sure that JPEG is not used.
8- or 16-bit imagery where lossy compression is suitable	Use MRF or TIF with JPEG (YCbCr) compression. The quality should be checked by testing some sample imagery. In many cases, a quality factor of 90 is suitable. Note that ArcGIS supports a 12-bit version JPEG. Therefore, when compressing 16-bit pan imagery using JPEG, only the first 12 bits of the imagery will be used. Many modern sensors have a sensitivity in the range of 11 - 14 bits, and using 12-bit compression maintains much of the image content but excludes the last (often noisy) bits.
8-bit or 16-bit, 3-band, non-natural-color imagery when lossy compression is suitable	Examples of this kind of imagery include false color imagery or scanned maps. Use MRF or TIFF, with JPEG (RGB) compression. In RGB JPEG compression, each band is compressed separately.
8-bit or 16-bit, 4-band RGB-IR	This is the format often captured by modern digital sensors. If the data has been orthorectified and enhanced, then some of the original image information has been lost, potentially limiting its use for some forms of analysis. For such imagery, lossy compression may be suitable, but care should be taken to quantify the effects on any intended future analysis. It is then recommended to convert such imagery into a 3-band RGB and 1-band NIR image and use the above recommendations for compressing each. Splitting into a separate RGB image enables better compression, and most users will likely access the RGB component more than the NIR. In ArcGIS, one can virtually merge the two files to create an RGB-IR image suitable for displaying as false color or computing NDVI. Typically for such imagery, the compression quality is set higher, to 90 or 95, so that compression does not add significant artifacts to NDVI. When using JPEG compression, the recommended quality values to use can range from 80 to 95. It is best to try different factors on sample images and review the differences to determine an optimal value.

Data Type	Recommendations
8-bit or 16-bit, 5-band RGB-IR with a panchromatic band	Many sensors include 4-band multispectral imagery and 1-band higher-resolution panchromatic imagery. If you are maintaining the IR band, it is recommended to not pre-pansharpen such imagery. The pan-image changes the multispectral properties of the bands, and the pan-sharpening process will significantly increase the file sizes, reducing the suitability of the imagery for analysis. Instead, maintain the 4-band multispectral and 1-band panchromatic as separate rasters, and use the capability of ArcGIS to pan-sharpen on the fly, which is performed very fast and ensures that the integrity of the spectral bands is not lost. If you need to compress the imagery to reduce size, the panchromatic band should use JPEG compression, as the panchromatic band is typically much larger than the multispectral image and is not used for spectral analysis. Limited JPEG compression (for example, Q90) has minimal effect on visual interpretation or computation of tie points or DSM generation. When using JPEG compression, the recommended quality values to use can range from 80 to 95. It is best to try different factors on sample images and review the differences to determine an optimal value. Another option that can be used is to pansharpen and store the 3band RGB image with lossy JPEG compression. This image can be used for visual interpretation. Then store the lower resolution multispectral red and IR bands separately for use in analysis.

A7.3.2 *Aerial imagery* requirements for connective fuel assessment.
For *aerial imagery* to be used in *connective fuel* assessments it must be orthorectified for use in Geographic Information Systems (GIS) platforms.

It is important to collect ortho-rectified imagery so ground features/connective fuel elements can be measured, and other data layers can be created from the data source which has a strong relationship to ground control. The data required for ortho-rectification include orientation parameters for the source image(s) and a digital elevation model (DEM) of the geographic area to be covered by the imagery. Ortho-rectification corrects for tip and tilt of the aircraft and displacement in the photograph caused by changes in the ground elevation. Generally, the development of ortho-rectified imagery requires the acquisition of overlapping photography of the same geography and some combination of surveyed ground control and airborne (Global Positioning System) GPS collection at the time of photography. A photogrammetrist performs image correlation techniques and aero-triangulation on the resulting block of photographs to establish the orientation parameters of the individual image. Using the most recent DEM source or new LiDAR DEM provides the base for which the new imagery is rectified. Orth-rectified imagery allows for detailed connective fuel features to be accurately mapped and measured. The requirements specified here provide a consistent structure for data providers and users to ensure compatibility of datasets within the same framework layer. The requirements integrate with existing standards such as the American Society for Photogrammetry and Remote Sensing (ASPRS) standards.

A8 Definitions specific to this appendix

Accuracy, horizontal. A measure of the horizontal distance on a photograph within defined tolerances.

Accuracy, vertical. Vertical (elevation) accuracy of a rectified image and associated digital elevation models. Vertical measurements are usually expressed as contour lines or spot heights.

Aerial imagery. Any image taken from an airborne craft.

Band. A range of wavelengths of electromagnetic radiation.

Covenants, Conditions, and Restrictions (also referred to as CC&R). A recorded document that contains a legal description of the development and a statement that it is a community apartment project, condominium project, planned development, or stock cooperative. The declaration must additionally set forth the name of the association and the restrictions on the use or enjoyment of property. Unlike bylaws, which address the governance of an association, CC&Rs describe property rights and obligations of the membership, such as 1) restrictions on the use of property, 2) member and association maintenance duties, 3) enforcement powers, 4) lender protection provisions, 5) assessments obligations and lien/collection rights, 6) duty to insure, and 7) dispute resolution and attorneys' fees provisions.

Datum. The description of the shape of the earth as defined by the National Geodetic Survey; usually referred to as NAD27 or NAD83 for the horizontal datums and NAVD29 or NAVD88 for the vertical datums. NAD27 uses surface reference points, whereas NAD83 uses the center of the earth as the reference point.

Digital elevation model (DEM). A Digital Elevation Model (DEM) is a representation of the bare ground (bare earth) topographic surface of the Earth excluding trees, buildings, and any other surface objects.

Forward lap or End lap. The extent to which sequential exposures in a flight line overlap, typical end lap for stereo photography is 60%.

Ground sample distance (GSD). The area of ground represented in each pixel in x and y components.

Ground-based imagery. Any imagery taken or collected from the ground.

Side Lap. The extent to which the exposures of adjacent flight lines overlap, typical side lap for a block of stereo photography is 30%.

Pixel. The smallest cell size with a uniform value of an image. This digital image cell is produced in varying sizes, usually referred to in ground units such as 6 inches, 1 foot, 3 meters, etc. Pixels are created during the scanning of the aerial imagery and are key to establishing the resolution of the orthophotograph.

Map or Cartographic scale. The relationship between a given distance on the ground and the corresponding distance on a photograph or image. Scale is expressed in at least two different ways. Both are ratios. In the first, commonly used measuring systems are compared; for example, 1" = 100' (1 inch on the map equals 100 feet on the earth). In the second, the map unit is arbitrary; for example, 1:100 means that one of anything (an inch, a foot, a centimeter, etc.) on the map equals 100 of that same unit on the earth. (1"=100' is the same scale as 1:1200). Scale is presented in several ways: as a bar at the bottom of the map, as a ratio (1:100), or as an equation (1"=100').

Orthorectified. The process of geometrically correcting an image to remove relief distortions, sensor artifacts, earth curvature and other perspective distortions, and align the image with coordinates on the

ground, restoring geometric integrity. Ground control points, tie points, and elevation data are used to correct perspective and terrain distortion in aerial, drone, and satellite imagery.

Projection. Methods of presenting the earth (a three-dimensional object) on a plane, (a two-dimensional object) with as little distortion as possible.

Root-mean-square error (RMSE). Square root of average squared error.

Scanning. The process of converting analog photographs or hard copy maps into a digital form.

Spatial accuracy. Distance from true ground location.

Spatial resolution. Pixel.

APPENDIX B
Commentary

IBHS Wildfire Prepared Neighborhood
Technical Standard
Version 2025

B1 Administrative commentary

The *IBHS Wildfire Prepared Neighborhood Standard* was developed to provide a means for community-scale wildfire mitigation through a system of requirements that could build upon the growing body of science. The goals of this standard are to provide a system of mitigation requirements that account for varying external fuel exposures, structure spacing, and connective fuel conditions to address the following core principles:

- Reduce the probability of *structure* ignition from flames, radiant heat, and ember exposures that are closest to or in direct contact with the specific external fuels that surround the defined neighborhood.
- Holistically reduce the probabilities of ember-driven ignitions across the defined neighborhood.
- Slow or halt structure-to-structure fire spread within the defined neighborhood should ignitions occur.

By addressing each of these elements, the probability of a *conflagration* occurring can be reduced and allow the neighborhood to function more as a *fuelbreak* rather than a fuel source.

The *IBHS Wildfire Prepared Neighborhood Standard*, like any building code, ordinance, or standard, has its limitations which are governed by practical application and limits to scientific and engineering understanding. It is designed to provide a system of mitigation elements that are generally more stringent than those administered under current *WUI* building code provisions. The *IBHS Wildfire Prepared Neighborhood Standard* is intended to be applied as a voluntary standard that enables a neighborhood and/or community to increase its resilience to wildfires and reduce the probabilities that a built-environment *conflagration* occurs. It is meant to defend against fire entering the defined neighborhood from all directions.

The current state of wildfire science does not provide the practical ability to reduce *structure* ignition probabilities to zero, even in a neighborhood which meets the provisions of this standard. The scientific reasoning behind the provisions included in this standard are targeted to contain *structure* ignitions to 10% or less within a compliant neighborhood. This is accomplished through bulk *parcel* level requirements, management of *connective fuels*, and evaluating the presences of *fuelbreaks* and *firebreaks*. Like all codes, ordinances, and standards, the maintenance of the required provisions is critical to ensuring the effectiveness of the mitigation system.

It is well understood that wildland fire behavior is governed by fuel, weather, and topography. The *IBHS Wildfire Prepared Neighborhood Standard* seeks to affect fuels and account for typical weather conditions that occur during built-environment conflagrations. Topography, however, is not included as a critical variable. While different slope configurations can be diagnosed, the small-scale changes in topography present practical challenges for designing and implementing a technical mitigation standard such as this. The focus on *connective fuels* and the *parcel*-level mitigation elements specified in this standard should also account for fuels across topographic features which could influence fire spread toward *structures*. The *IBHS Wildfire Prepared Neighborhood Standard* uses a 10 m, 70 mph 3-second gust wind for open terrain conditions as its wind-design level. Using the extreme value analysis of wind return intervals used in the ASCE 7-22 standard, this value generally represents an annual exceedance probability of 0.25% – 1% across much of the Western United States. It is noted that this design wind speed is higher than the 90th percentile of peak gusts observed in downsloping wind events across the Pacific Coast states of California, Oregon, and Washington (56 mph; Garner and Kovacik 2022). However, it is below extremes that have been observed, such as the peak gust observed in Arvada, Colorado of 115 mph during the Marshall Fire (2021) and those estimated to have occurred within meso- and micro-scale features such as the tornado-like vortex seen during the Carr Fire (2018) (Lareau et al. 2018).

B1.1 Applicability

The applicability of the standard and the areas in which it can be applied was determined through synthesizing the body of research regarding w*ildland-urban interface* fires, beginning with Cohen's (2008) conceptual model of *wildland-urban interface* fire spread through Maranghides et al.' s framework for mitigation. It also leverages improved understanding, through experimental testing, of how fire spreads between structures. The *IBHS Wildfire Prepared Neighborhood Standard* was designed to serve typical communities near or within the *WUI*. Its system of actions is generally designed for and applicable to WUI types 1-5 developed by Maranghides et al. (2022) and shown in *Table B1*. The standard also follows a similar approach to Maranghides et al. (2022) of segregating perimeter areas from areas interior to the defined *neighborhood*. It is noted that the *IBHS Wildfire Prepared Neighborhood Standard* is more conservative with *structure separation* in types 1 and 2 (see *Table B1.1*) due to recent experimental testing results described in *Section B2*. The *IBHS Wildfire Prepared Neighborhood Standard* only can apply if at least 90% of the *structures* within the defined *neighborhood* have more than 10 feet and less than 100 feet of *structure separation* distance.

Table B1.1. WUI types classified by structure separation and typical parcel/lot size as developed by Maranghides et al. (2022). The green shaded rows are the classes where the IBHS Wildfire Prepared Neighborhood Standard is generally applicable. It is noted that the IBHS Wildfire Prepared Neighborhood Standard applies 10 feet as the lower bound for structure separation distance whereas Maranghides et al. (2022) uses 6 feet, applying a 3 feet setback distance.

Type	WUI Type Name	Structure separation (feet)	Typical parcel/lot size (acres)	Typical housing density (structures per acre)
*1	High density intermix – perimeter	6-30 feet	< 0.5	2 – 8+
*2	High density intermix - interior	6-30 feet	< 0.5	2 - 8+
*3	Medium density intermix – perimeter	30-100 feet	0.5 – 1+	< 2
*4	Medium density – intermix – interior	30-100 feet	0.5 – 1+	< 2
*5	Medium density intermix	30-100 feet	0.5 – 1+	< 2
6	Low density interface	> 100 feet	> 1	< 1
7	Low density intermix	> 100 feet	> 1	< 1

**WUI types in which the IBHS Wildfire Prepared Neighborhood Standard is generally applicable are shaded green. For types 1 and 2, the classification assumes a 3 feet setback. For type 2, the interior of the community is defined as located more than 0.25 miles from wildland fuel sources.*

B1.2 Mitigation approach and framework

To develop the mitigation approach at a neighborhood-scale used in this standard, *IBHS* synthesized the body of scientific literature including post-event analyses, experimental testing, and dynamical modeling. The *IBHS Wildfire Prepared Neighborhood Standard* was developed as a system of protection which accounts for different characteristics of external fuels, how different parts of a *neighborhood* could experience different exposure from flames, radiant heat, and embers, as well as how the *neighborhood* is designed and the fuel characteristics across it.

Across the history of conflagrations in the built environment from urban fires, to fires following earthquakes, to wildfire-driven conflagrations five commonalities have emerged:

- Presence of drought conditions, at any time scales

- Presence of strong winds, typically above 20-30 mph
- Ignition mechanism, typically human-caused
- Dense construction with materials that have little to no fire resistance
- Dense combustible elements surrounding and between *structures*

The details behind the characteristics of wildfire-driven conflagrations are well summarized within Giammanco et al. (2023). The *IBHS Wildfire Prepared Neighborhood Standard* seeks to address the last two critical factors related to hardening of *structures* with more fire resistance characteristics and materials and helping remove pathways for fire to spread between and to neighboring *structures*. The controllable factors within a community are parcel level mitigation, distribution of density of ladder and connective fuels, building codes/ordinances/HOA *CC&Rs*, vegetative fuel types, presence of *fuelbreaks* and existing or in-place preparedness programs. The standard presented here is configured as a system to slow fire spread and reduce the probability of conflagration. To develop the system of requirements shown here, the following questions had to be addressed in some manner to identify a practical system for a *neighborhood* spatial scale:

1) What degree of parcel level mitigation/hardening could slow fire spread to a rate where conflagration was not a certainty?
2) How much *connective fuel* mitigation was needed with no parcel level hardening? With some hardening measures? With maximum protection that wildfire science could practically offer?

B1.2.1 Experimental simulations

To begin to address these questions to understand what mitigation approach should be taken and how to understand the influence of mitigation actions in larger scales, *IBHS* partnered with the University of Buffalo to conduct a series of idealized dynamical model simulations and two "hind-cast" simulations (Marshall Fire and Camp Fire) to understand what degree of mitigation through parcel level actions and connective fuel remediation is needed to slow fire spread and meaningfully lower the probability of a built-environment conflagration. Given the lack of post-fire observations of the impact of community-scale mitigation, dynamical modeling has helped fill the gap in designing the framework of this standard. The simulations were designed to bring together the known understanding of built-environment conflagrations, experimental test results and post-fire investigations.

The dynamical modeling study used the SWUIFT model (Streamlined Wildland-Urban Interface Fire Tracing) to conduct the hindcast and idealized neighborhood experiments using various levels of hardening, connective fuel conditions, and different wind speed exposures (Masoudvaziri et al. 2021). Inputs to the SWUIFT model were *LANDFIRE* for landcover, Microsoft building footprints, WRF-LES model for wind conditions, and WRF-Fire for wildland fire spread. The structure hardening conditions were designed to mimic the reduction in ember and direct flame/radiant heat ignition probabilities and designed to serve as proxies for the *IBHS Wildfire Prepared Home* (WFPH) requirements. The hindcast of the Marshall Fire (2021) using 70% of *structures* within the fire boundary hardened to a level that is considered a proxy for the *IBHS WFPH Plus* level of mitigation was shown to reduce fire spread within the built environment. However, at this same level of mitigation, it did not make a detectable difference in fire spread rates and destroyed structures for the Camp Fire (2018) hindcast. The *connective fuels*, in this case mostly vegetative, were too densely connected and enabled fire to continue to propagate despite the simulated mitigation efforts. The result suggested that a combination of both structure hardening, *parcel* level fuel management and overall *connective fuel* management is crucial to ensure the mitigation system can accomplish the goals set forth in this standard.

To test the framework of the system employed in this standard, two idealized communities were defined as a high and a medium density interface community (see *Table B1*) covering approximately 0.75 mi^2 with two different *structure spacing* distances (4 meters and 20 meter), 33 feet (10 meter) wide streets and different *connective fuel* and *parcel* level mitigation levels. Five different wind environments were also tested from winds of 5 to 25 ms^{-1} (11–56 mph). This yielded 110 independent dynamical simulations. Conflagration was defined as greater than 10% structure loss in a 12-hour time window. In both communities, with *connective fuels* connecting all four sides of each *structure* and in any wind conditions conflagration occurred easily as no mitigation elements were present. In the most densely spaced community, even with 0% connected fuel coverage, once fire entered the modeled community conflagration occurred. Simulations at low wind speeds showed that by reducing *connective fuels* to only two *connective fuel paths* per *structure* reduced the number of *structures* burned and slowed fire spread but still met the conflagration criteria (> 10% *structures* ignited). When combining *parcel* level mitigation on 70% of *structures* (a proxy for *IBHS WFPH Plus* construction) and reducing connective fuel pathways to just one side of each *structure*, conflagration was avoided, and fire spread rates were greatly reduced.

The results were in general agreement with the wildfire mitigation framework within these types of communities discussed in Maranghides et al. (2022) and provided support for a framework which accounted for parcel level actions (both *structure* hardening and fuel management) and overall management of *connective fuels* into and within the defined *neighborhood*. The *IBHS Wildfire Prepared Neighborhood Standard* applies a modified hardening approach to utilize maximum protection elements in areas which may see a greater likelihood of direct flame and radiant heat exposure and fill the remaining ember protection gaps using those measures described in the base level of protection of the *IBHS Wildfire Prepared Home Standard*. This allows for greater flexibility in structure spacing applicability and in *connective fuel pathways*. It is noted that in each case, a *0–5 Foot Noncombustible Zone* remains a cornerstone of mitigation actions. It is also noted that the 30% *connective fuel* coverage configuration on each parcel used in the dynamical simulations was nearly identical to the *connective fuel node* and *pathway* requirements stated in *Chapter 4*. The *IBHS Wildfire Prepared Neighborhood Standard* also uses a more stringent wind design environment (70 mph 3-second gust wind speed at 10 m (33 feet) height for open terrain exposure conditions) compared to the highest wind conditions used in the idealized *neighborhood* simulations (56 mph). In this Appendix, *sections B2 through B6* provide additional details to support the scientific and engineering decision made regarding structure separation applicability requirements, roof cover requirements, *connective fuels*, and the requirements of the *flame* and *neighborhood ember zones*.

B2 Roof provisions

The *IBHS Wildfire Prepared Neighborhood Standard* requires that all roof covering materials in the defined neighborhood carry a Class A fire rating based on the ASTM E108 (ASTM 2020) testing standard regardless of whether the home falls outside the *flame* or *neighborhood ember zones*. The requirement is more stringent than what is currently specified in Chapter 7A of the California Building Code and the 2021 International Wildland Interface Code (IWUIC). The *IBHS Wildfire Prepared Neighborhood Standard* specifically requires a Class A roof covering material and does not permit Class A by assembly. Regardless of their fire classification, any wooden roof covering product including but not limited to fire-retardant treated and fire-retardant coated wood shakes and shingles are not permitted.

Wind patterns near buildings heavily influence ember distribution patterns and accumulation locations. Because roofs are a large, elevated surface with complex geometry and a range of slopes, they are prone to ember accumulation during ember storms. The regions on the rooftop where embers reach stability and rest are also a complex function of roof geometry, particularly roof valleys. Roof valleys are often covered with organic vegetative debris, which is particularly susceptible to ignition from embers (Nguyen and Kaye

2021). Standard test methods such as ASTM E108 and UL 790 (Underwriters Laboratories 2022; ASTM 2020) evaluate the fire performance of different roof covering materials.
The vulnerability of roofs to ember storms is well studied. Several retrospective studies have reported a statistical correlation between wood coverings and building losses due to ember exposure (Davis 1990; Foote et al. 2011). Moore (1981) reported that out of 1,850 homes, 50% of homes with wooden roof covering within 30 feet of burning vegetation ignited while only 24% of homes with fire-resistant roofs ignited in the 1961 Bel Air Fire in Southern California. Foote (1994) found the degree of flammability of the roof had a significant impact on home survival where homes with nonflammable roofs had a 70% survival rate compared to 19% for homes with flammable roofs. After the 1991 Oakland Hills Fire in California, it was estimated that each burning home with a non-fire-retardant-treated wood shake roof contributed to the ignition of ten other homes (Bryner 2000). Hedayati et al. (2024) also identified during the Lahaina Fire that roof performance was nearly binary. Non-Class A roofs had an ignition rate greater than 80% and the roof was a critical variable in ignition probabilities. However, for *structures* with a Class A roof covering, the roof was a far less critical variable in explaining ignition potential.

Wood shake and/or wood shingle roofs have been identified as one of the most susceptible roof covers to ember attack and ignition. These materials, when new or at a later point in their lifetime, are often treated with fire retardant material or ignition-resistant coatings, sprays, paints, etc. to allow the material to have some degree of ignition resistance. Quarles and Standohar-Alfano (2017) investigated the aged performance of several fire-retardant coatings, and their relative ignition resistance compared to untreated wood surfaces. Degradation for some began as soon as three months, and by a year of exposure to typical weather conditions the ignition performance was no different than an untreated specimen. When considering fire-retardant coatings, Koo et al. (2001) also found highly variable performance of different fire-retardant coatings on wood specimens even in newly applied conditions.

Östman and Tsantaridis (2016) explored how treated wood products performed over a 10-year window of natural weathering. While they found some products that could retain their treatment compounds could maintain performance over time, others after 10 years showed no performance benefit compared to untreated products. Zhou et al. (2018) specifically examined a fire-retardant treated cedar shake shingle and how its ignition performance degraded using three accelerated weathering tests. While the fire-retardant treated wood performed better than its untreated counterpart, it was observed that ignition times decreased with added artificial aging. The result was sufficient to indicate a decrease in fire resistance performance as the treated wood aged.

While new coatings, treatments, and formulations continue to be developed and are emerging into the marketplace that show promise, there remains little new literature on how their performance changes over time under natural aging/weathering conditions; nor are there any operational testing standards that evaluate changes over time in performance. The uncertainties surrounding adhesion, compatibility of materials, and long-term durability are well described in Albert and Liew (2023).

Given the potential service life uncertainties of both ignition resistant treatments and applied ignition-resistant coatings, the use of wood shake, wood shingle, or any wood roofing materials regardless of test rating as a new product in the *IBHS Wildfire Prepared Neighborhood Standard* is prohibited. This follows that stated in Chapter 7A of the California Building Code (Section 703A.5.3). While new coatings, treatments, and formulations continue to be developed that show promise, there remains little new literature on how the performance changes over time under natural aging/weathering conditions. Additionally, there are no operational testing standards and associated product approvals that account for changes over time in performance.

B3 Structure separation

Laboratory experiments and post-fire investigations show a direct link between thermal exposure and the structure hardening needed for fire resilience (Maranghides et al. 2022). Effective wildfire mitigation balances both factors. Embers are the primary ignition source, starting small fires that, under favorable conditions, spread to larger fuels like fences, sheds, and vehicles. This escalation, combined with strong winds, often leads to rapid, building-to-building fire spread. Spot fires rely on nearby fuels to reach *structures*, with these fuels radiating heat and accelerating fire growth. Denser *neighborhoods*, with more fences and vehicles, amplify this risk. Thus, greater structure spacing is crucial to reducing vulnerability and preventing catastrophic conflagrations in the built environment.

The built environment, specifically where high-density construction is built with little to no fire-resistance, has minimal resistance time against potential flame exposure. Once ignited, the fuel load of a typical single-family home is easily sufficient to produce a flame and radiant heat exposure on a nearby *structure* to ignite it, even with some degree of hardened or fire-resistant materials, especially in the presence of wind which helps stretch flame lengths.

IBHS is studying wind-driven fire spread from a source building to a target building which represents a typical *primary dwelling unit (30-feet by 40-feet in size, and 1.5 stories in height)*. *Figure B3.1* provides a photograph of an active test at the *IBHS* Research Center. In the first phase, the source building was a large burning shed, while the second phase uses a 625 ft^2 *accessory dwelling unit* as the source. Results from the first phase show that heat intensity on the target building depends on the source-target orientation, wind speed, and separation distance. When the target building absorbs thermal energy from the fire, energy is dissipated through the complex turbulent flow, some is reflected away from the *structure*, and the rest is absorbed, raising the temperature of the building envelope. The thermal response varies by component: annealed glass may shatter in place, tempered glass might fall out depending on its frame, combustible siding and open eave can ignite, and noncombustible siding may buckle. These illustrate the diverse damage modes under fire exposure. While some of these damages are not catastrophic, nearly all can compromise the building's envelope through large openings or ignitions, significantly increasing the likelihood of complete destruction in the absence of fire-service intervention.



Figure B3.1. Photograph of wind-driven flame spread testing at the IBHS Research Center in Richburg, South Carolina.

The first phase of the project was able to demonstrate that even under non-extreme wind conditions, the energy accumulated at a 10-foot separation is sufficient to ignite combustible siding and open eaves. Even with noncombustible siding or enclosed eaves, other vulnerable components of the building remain at risk at a 10-foot separation distance. In experimental tests, double-pane tempered windows with vinyl frames—a product with a 20% US market share and likely to remain popular due to its affordability—failed under similar energy accumulation rate. This suggests the fire intensity at 10 feet or closer is sufficient to overwhelm the resilience of many common building materials, even those compliant with modern WUI codes.

Therefore, based on the initial results from this experimental testing program, *the IBHS Wildfire Prepared Neighborhood Standard* uses the 10-foot minimum spacing benchmark as the smallest structure-to-structure spacing extent to which the standard is applicable.

B4 Connective fuels

The importance of fuels between and around structures has been a critical variable in built-environment *conflagrations* dating back to the first urban fires of the 1600s. Dense combustible fuels between *structures* create fire paths in which fire can easily spread through direct flame and radiant heat-driven ignition from structure-to-structure. In wildland fires, these types of fuels are commonly referred to as ladder fuels and are typically vegetative, which allow fire to spread both laterally and vertically. Within the context of a *WUI* fire or built environment *conflagration*, *connective fuels* are both *vegetative* and *built-environment fuels*. They play a critical role in whether a wildfire entering a *neighborhood* becomes a catastrophe. For example, wooden privacy fences served as a dominant fire pathway between *structures* during the Marshall Fire (2021) (FEMA 2023; Giammanco et al. 2023; Juliano et al. 2022).

B4.1 Fuel continuity

The arrangement and continuity of fuel can affect the fire's ability to spread, influencing the intensity of the flames. The arrangement and distribution of fuel, both vertically and horizontally, is referred to as fuel continuity. This continuity or connectivity describes the degree to which fuels are interconnected to provide a continuous path for fire to spread. Within the *IBHS Wildfire Prepared Neighborhood Standard*, these are referred to as *connective fuels* and *connective fuel pathways*. In terms of fire behavior, fuel continuity plays a significant role in determining the rate and intensity of fire spread. High fuel continuity, where fuels are densely distributed and interconnected, can promote the rapid spread of fire, as flames can easily propagate from one fuel source to another. In general, live vegetation exhibits gaps between needles, shrubs, or trees, and clumps of trees, arguing that understanding continuity of fuels is critical for fire suppression and fuel management (Hurley et al. 2015). Even at small scales, the separation between fuel particles has been shown to create critical conditions for fire spread on both natural and artificial fuel beds. (Vogel 1970; van Wagner 1970; Weber 1990; Di Christina et al. 2021; Bu et al. 2021). This concept of critical conditions or thresholds also applies to larger scales, where discontinuity occurs between plants rather than individual particles (Cheney et al 1998; Marden-Smedley et al. 2001; Weise et al. 2005). In either case, the fire spread threshold is determined by fuel characteristics and environmental factors such as wind, slope, and fuel moisture content.

Over the past few years, *IBHS* has collaborated with the United States Forest Service (USFS) to investigate and identify the critical physical processes that drive ignition, considering the spatial distribution of fuel and a range of environmental conditions. As a result of this collaborative effort, valuable insights have been gained, particularly regarding the threshold separation distance between pine needle fuel beds for continuous flame spread under various wind conditions. As can be seen in *Figure B4.1*, the findings have demonstrated the separation distance required for sustained flame spread varies depending on wind speed and moisture content conditions. Understanding this threshold separation distance is crucial for effectively predicting fire behavior and implementing appropriate fire management strategies such as the *connective fuel* provisions described in this standard in *Chapters 3* and *4*.

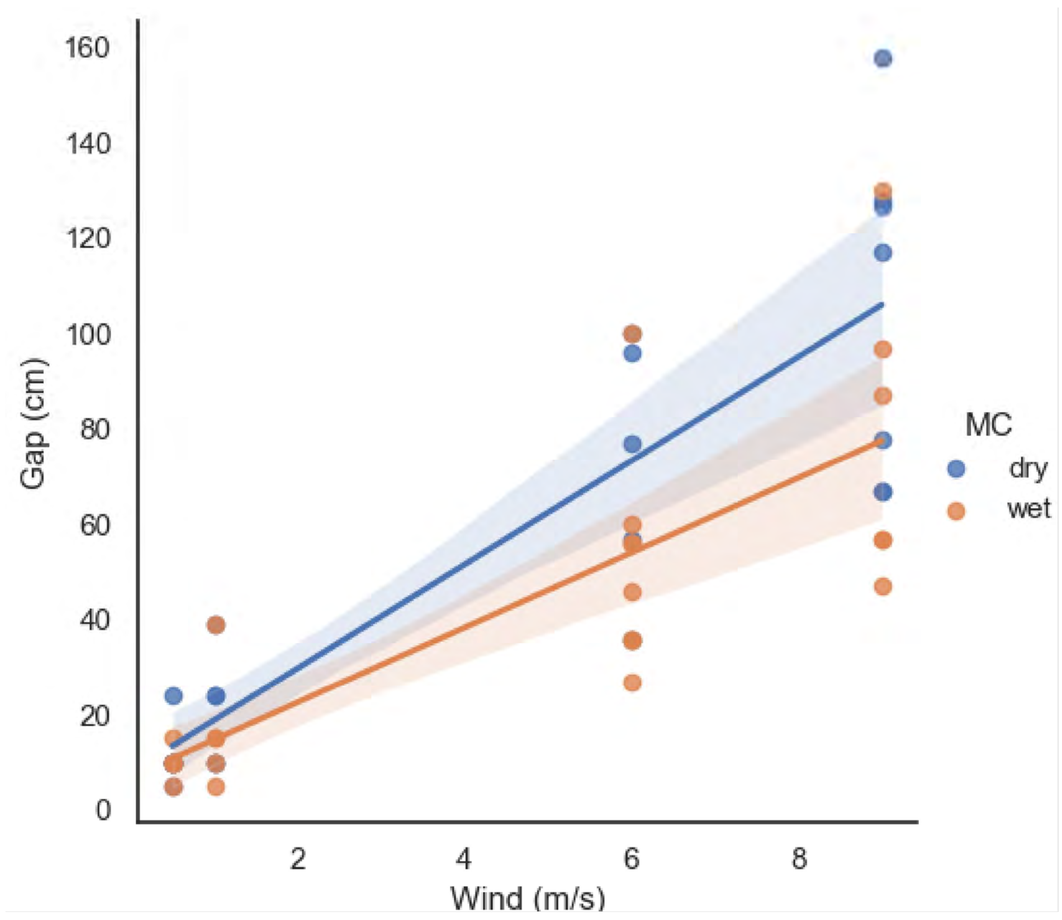


Figure B4.1. Maximum separation distance required for sustaining flame spread. Fuelbreak gap distances shown as a function of wind speed for fine fuels at two different moisture content levels at the IBHS Research Center.

The concept of fuel connectivity observed in vegetation fuels can also be extended to structural fuels such as fences, sheds, *accessory dwelling units*, and other similar objects. The underlying mechanism driving fire spread remains the same: when these structural fuels are closely spaced or connected, heat transfer between burned and unburned particles occurs at a high rate, leading to rapid fire spread (Shields 2008). Understanding the role of fuel connectivity in structural fuels is essential for assessing fire risk and implementing appropriate fire mitigation strategies. It emphasizes the importance of maintaining adequate spacing and reducing fuel continuity to minimize the potential for fire spread and mitigate the risks associated with structural fires

In the case of nonhomogeneous fuel, such as a mixture of different structural/*built environment and vegetative fuels*, details of the fire spread mechanisms are not yet well understood due to the interactions and complexities arising from the combination of different types of fuels. When low density fuels such as leaves meet larger fuels, such as building components, qualitative observations suggest a more rapid rate of fire growth. This fuel configuration can create a vertical fuel ladder that allows the fire to jump from the ground and engulf different building components in flames (Menning and Stephens 2007). According to post-fire investigations, discontinuities between trees, bushes and *structures* can reduce the threat of tall, high-intensity flames, which are strongly correlated with building damage. An analysis of Ramsay et al.'s (1970) post-Ash Wednesday bushfire damage in Australia found that damage to homes was affected by the amount and type of vegetation around them. Dense vegetation around houses aided in connecting the fire to other nearby homes, making it less likely they would survive. During the Witch Creek Fire (2007), when evaluating the vegetation within the first 30 feet of houses in San Diego County, California, Maranghides et al. (2013) found that 67% of homes with unmaintained vegetation were destroyed, whereas only 32% of homes with maintained defensible spaces were destroyed. The importance of fuel discontinuity was found to be even more important near buildings. Syphard et al. (2014), after analyzing more than 2,000 structures in San Diego County, concluded *structures* with defensible space that contained spaced vegetative fuels "immediately adjacent" survived more fires. Additionally, it was also found that reducing woody vegetation by up to 40% immediately adjacent to *structures* and preventing vegetation from overhanging or touching structures were the most effective measures (Syphard et al. 2014). A fence or deck attached to the house can also facilitate the spread of fire or radiate enough heat to ignite the building's cladding. *Figure B4.2* provides a photograph illustrating fire spread along a wooden fence following the Mountain Fire in Camarillo California in 2024. Both post-event investigations and laboratory experiments show that these components, especially if they are in the vicinity or in contact with vegetation, can ignite *structures*.



Figure B4.2. Photograph of a fence, following the 2024 Mountain Fire in Camarillo, CA, which had ignited adjacent to a home where fire spread to the wall of the structure. In this case fire service intervention and the presence of noncombustible wall cladding (stucco) helped avoid ignition of the structure. The window frame on the right side of the image was damaged, and there was evidence of sufficient radiant heat to damage the paint in the eaves of this home. Photograph by Evan Sluder.

B4.2 Connective fuel mitigation approach

The mitigation approach taken by the *IBHS Wildfire Prepared Neighborhood Standard* leans heavily on the defensible space provisions of the *IBHS Wildfire Prepared Home Standard* but takes a fire pathway approach toward evaluating the defined neighborhood and determining what conditions it must meet. *Connective fuels* are evaluated across contiguous *clusters* of *structures*, where fire can most easily spread from structure-to-structure via *connective fuels* and direct flame / radiant heat. This will manifest itself more readily across *clusters* of homes that do not have barriers that help break the chain of fire. Across those *clusters* the coverage of connective fuels is evaluated. Within the *neighborhood flame zone* where the most severe fire exposure from external fuels is most likely, *structures* cannot be connected by any fuel pathway. This area is the first step in minimizing initial ignitions in the area where fire is likely to enter the defined neighborhood through external fuels. Across the remainder of the defined *neighborhood* and the identified *clusters*, it is acceptable to have a single *connective fuel pathway*. Given the hardening provisions specified for *structures*, this flexibility would enable more practical landscape options while keeping the probability of *conflagration* low. It is noted in most cases, *structures* that comply with the *IBHS WFPH Plus*, will not have any connective fuel pathways. However, complications could arise with the use of accessory structures and the parcel configuration; where an *accessory structure* could act as a *connective fuel pathway* or complete a pathway to a neighboring *structure* while complying with the parcel-level provisions of the *IBHS Wildfire Prepared Home Standard*. If the defined *neighborhood* is large enough, or external fuels do not necessitate a *neighborhood ember zone,* the *connective fuel* provisions combined with the Class A compliant roof will still provide measures to defend against the lower probability of fire entering the area, representing a factor of safety.

B5 *Neighborhood flame zone*

The *neighborhood flame zone* encompasses the perimeter of the defined *neighborhood* where *structures* are near *external fuels* that could impart direct flame contact and radiant heat exposure on *structures* within the zone. It is in this area where protection from ember attack, direct flame contact and radiant heat is required to reduce the probability of ignitions should fire reach the defined *neighborhood* boundary.

The method can be broken down into three key steps, *external fuel* determination, fire intensity analysis, and heat transfer calculations. To complete each of these steps, described in detail in *Chapter 3,* requires key assumptions to be made. Undoubtedly, these assumptions impact those calculations used to determine mitigation provisions. The scientific assumptions used in the *IBHS Wildfire Prepared Neighborhood Standard* provide a conservative and objective process for determining necessary mitigation actions to achieve the four core principles of this standard listed in *Chapter 1*.

B5.1 External fuel determination

Fuel is a critical component in determining fire behavior, influencing how fires ignite, spread, and intensify. Fuel data is crucial for the decision-making process in the *IBHS Wildfire Prepared Neighborhood Standard*. Due to the availability of detailed vegetation maps and integration within the United States operational fire management practice, *LANDFIRE* is used as the baseline data source for the *external fuel* determination. A *LANDFIRE* landscape file is a multi-banded raster, with five bands required: elevation, slope, aspect, fuel model, and tree canopy cover (*LANDFIRE*). For the external fuel determination, the processes described in this standard specifically consider the fuel model band. *LANDFIRE* creates their fuel model maps by creating a rule set based on the existing vegetation type, existing vegetation cover, existing vegetation height, and the environmental site potential and assigns a *fire behavior fuel model type* to each rule set. These rules are reviewed by local experts to maximize accuracy and calibrate the rules and resulting maps (*LANDFIRE*).

Two Fire Behavior Fuel Models are available in *LANDFIRE*, 40 Scott and Burgan (2005) Fire Behavior Fuel Model (FBFM40), and the original 13 Anderson Fire Behavior Fuel Model (FBFM13). These two fuel models represent the same fuel types, although Scott and Burgan's model, chosen for use in this standard, offers more fuel models in every fuel type providing higher resolution for the fuel characterization processes.

LANDFIRE products were created and are maintained to support national, regional, and sub-regional fire management and analysis, with a spatial resolution of 30 meters (*LANDFIRE*). At this scale, considering the fire interface at the edge of a community requires assumptions and analysis that account for this resolution. Two methods are used to consider variations in fuel that may occur within the 30-meter resolution of *LANDFIRE* products.

The first method conservatively considers all fuels within a 0.25-mile buffer (*flame fuel assessment zone*) of the *neighborhood*, allowing for an analysis of 10 times the minimum spatial resolution of *LANDFIRE* products when considering what surface fuels drive fire intensity and the resulting exposure a *neighborhood* may experience. Considering all fuels present within the *flame fuel assessment zone* of the *neighborhood*, the worst-case fuel —determined by the total heat release rate per unit area—with 10% or greater coverage is used for the exposure analysis. For assessing potential flame exposure all fuels, regardless of coverage, are used to ensure that all fuels capable of generating the spreading line fire assumed in the *fire behavior fuel model* are considered.

The second method allows local, regional, or expert knowledge and data to supplement *LANDFIRE* in the determination of the appropriate *fire behavior fuel model* for this analysis. Fuel management and planning are encouraged to reduce the potential fire exposure. Fuel management practices within the *flame fuel assessment zone* outside the defined *neighborhood* boundary will affect the surface fire behavior and the appropriate *fire behavior fuel model*.

B5.2 Vegetative fuel fire intensity analysis

To determine potential surface fire intensity of the vegetative fuels identified in the *flame fuel assessment zone*, BehavePlus is used to calculate Reaction Intensity (or HRRPUA). The BehavePlus fire modeling system is a Windows®-based computer program that can be used for any fire management application that needs to calculate fire behavior Andrews (2003). It uses specified fuel and moisture conditions to simulate surface and crown fire rate of fire spread and intensity, probability of ignition, fire size, spotting distance, and tree mortality. The resulting HRRPUA is determined for each one of the 40 fuel models is shown in *Table B5.1*.

Table B5.1 Fire behavior fuel models and the resulting heat release rate per unit area (HRRPUA) for use in this standard.

Fire Behavior Fuel Model **Type Identifier**	**HRRPUA (kW/m²)**
GR1	88
GR2	233
GR3	301
GR4	454
GR5	852
GR6	1304
GR7	1598
GR8	1963
GR9	2993
GS1	309
GS2	503
GS3	819
GS4	3573
SB1	557
SB2	1127
SB3	1554
SB4	1637
SH1	313
SH2	1201
SH3	389
SH4	708
SH5	1163

Fire Behavior Fuel Model Type Identifier	HRRPUA (kW/m²)
SH6	1074
SH7	1547
SH8	1667
SH9	2678
TL1	106
TL2	156
TL3	178
TL4	222
TL5	354
TL6	509
TL7	357
TL8	727
TL9	1052
TU1	364
TU2	410
TU3	824
TU4	1397
TU5	1813

However, to consider potential *crown fire* intensity a different approach was followed since the crown Fire model in Behave requires canopy base height as input—information that is often unavailable—and does not provide the HRRPUA needed for FDS simulations. Therefore, a simplified yet conservative approach is used to assess the potential impact of crown fires. This approach utilizes the existing vegetation cover (EVC) from the LANDFIRE dataset or a supplemental dataset that meets the specifications outlined in this standard. If 10% or more of the sector's area is covered by trees, as identified from the EVC data, a 70-meter (230-foot) buffer is added to the *neighborhood flame zone* (*NFz*) distance derived from the fuel analysis. The buffer distance was determined based on exponent-based models for energy decay with distance in wildland fires. These models, derived from heat flux measurements of natural and prescribed wildland fires across Alaska to Florida between 2006 and 2010, identified four distinct regimes. Data from the most intense fires, typically associated with crown fires, yielded an incident heat flux equation, $q = 300/L^{0.75}$, where L is the distance from the fire (Butler et al. 2015). Using this equation, a radiative heat flux threshold of 13.1 kW/m^2—representing a realistic ignition potential for common structural fuels Cohen (2004)—corresponds to approximately 65 meters. To ensure a conservative margin, this distance was rounded up to 70 meters.

B5.2.1 Heat transfer calculations

Heat flux calculations were performed using FDS, considering a range of HRRPUA values (~80 kW/m^2 to 3600 kW/m^2) derived from BehavePlus for all fuel types. In all simulations, a fixed fire was positioned 5 meters from the boundary of the computational domain, with the fire's head assumed to be located at the *neighborhood's* edge or beyond any established *fuelbreaks* or *firebreaks*. A similar approach was previously employed by Parsons et al. (2014) to simulate potential burn injuries. In this case, the heat source is used to simulate potential structural

ignition, with the fire size assumed to match the resolution of the LANDFIRE data (30 m x 30 m). However, it is acknowledged that the fire size significantly influences the simulation results, and this effect will be analyzed in the following section.

Total heat fluxes were calculated at distances of 10, 20, 30, 40, and 80 meters downwind from the fire at a height of 1 meter above ground level assuming neutral stability and a logarithmic wind profile defined by the following equation:

$$u(z) = \frac{u_*}{k}\, ln\left(\frac{z}{z_o}\right) \qquad \textit{Equation B5-1}$$

where u is wind speed, u_* is the friction velocity (m/s), z is height (m), k is the von Karman constant (0.4), and z_o is the surface roughness length (0.03 m for open terrain exposure). After the corresponding sensitivity analysis, all simulations were computed using a computational domain of 70 m x 130 m x 30 m and a grid resolution of 1 meter. An optical-thin approach is used for the radiation model, with a prescribed radiation fraction of 0.371. For all the simulations, the leading edge of the fire is positioned 5 meters from the boundary of the computational domain while the fire's head is assumed to be located at the edge of the *neighborhood* or outside any established *fuelbreaks* or *firebreaks*. No obstructions, such as *structures*, are considered in the model (*Figure B5.1*).

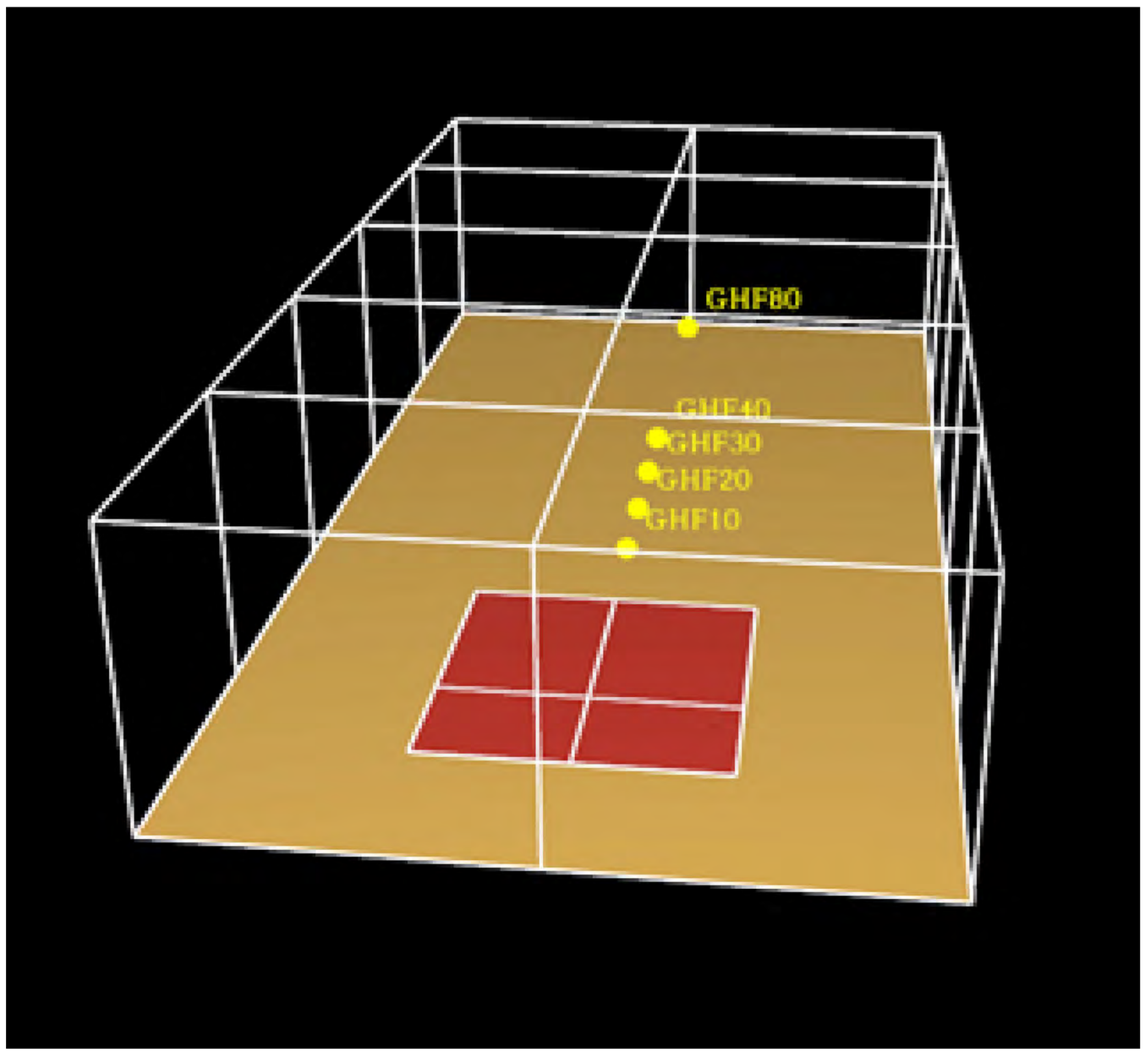


Figure B5.1. FDS simulation showing heat source and measurement locations

Mean heat fluxes, as a function of distance, are calculated during the quasi-steady state and used to determine a power-law or linear least-squares fit, depending on the HRRPUA range. An example for an HRRPUA of 1160 kW/m^2, corresponding to the FBFM SH5, is shown below in *Figure B5.2*.

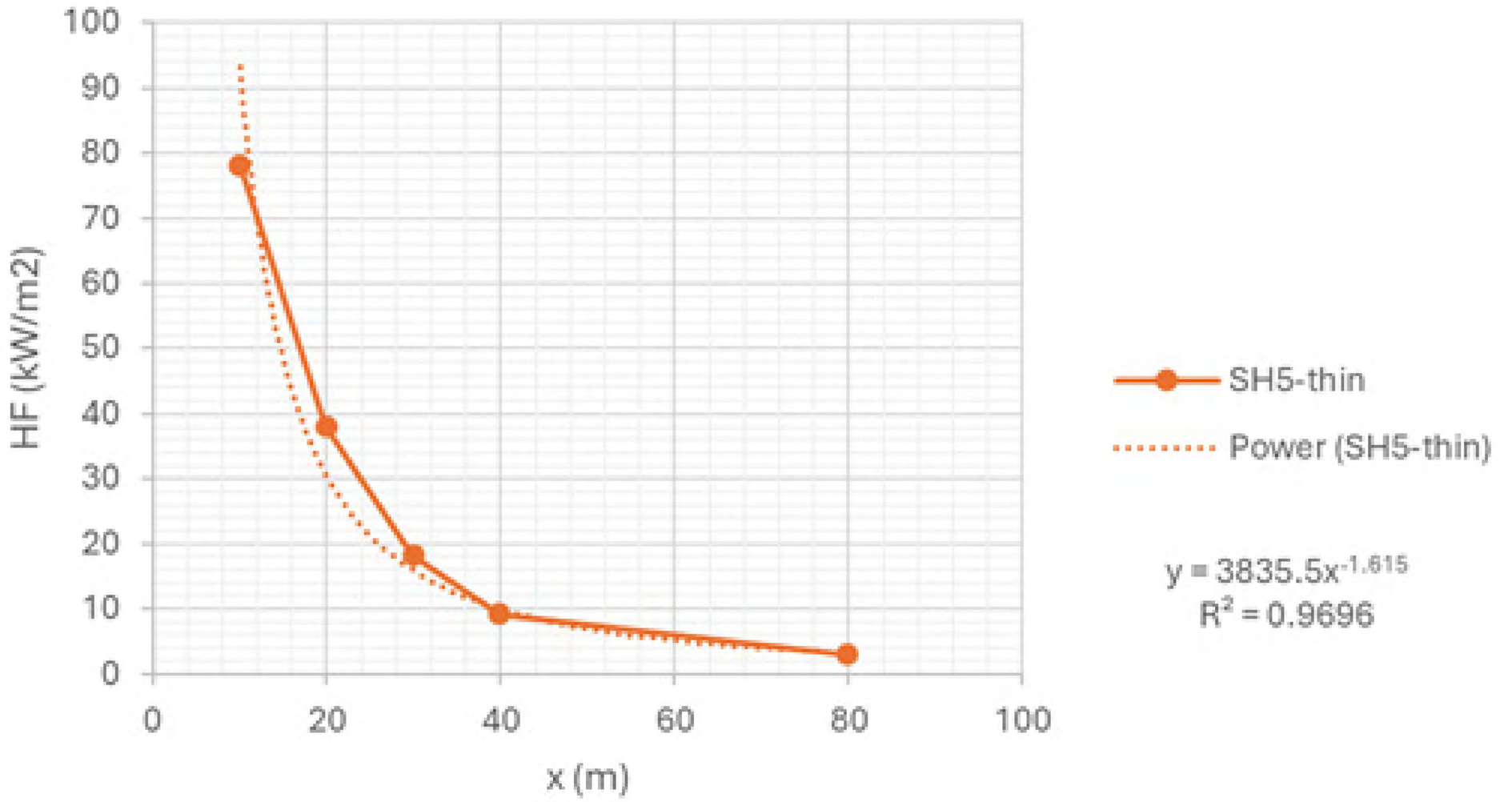


Figure B5.2. Power-law least squares fit for the mean heat flux (HF) as a function of the distance for a HRRPUA equivalent to the FBFM SH5.

These equations were derived for various HRRPUA values, ranging from 80 to 3600 kW/m^2, and solved with a radiative heat flux threshold of 13.1 kW/m^2, which is an appropriate threshold value to represent a realistic ignition potential for common structural fuels Cohen (2004). The solution identifies regions where this heat flux exposure threshold is met for different HRRPUA values, classifying them as part of the *neighborhood flame zone*. A second-degree polynomial fit with an R^2 value of 0.997 is then obtained to calculate the distances that meet this criterion as a function of HRRPUA, establishing the initial *neighborhood flame zone (NFz)* in meters, as given by *Equation 3-2*:

$$FZ\ (x)=1\times\ 10^{-6}\ x_2+0.0279x \qquad \textit{Equation B5-2}$$

where x is HRRUPUA determined by *Table 3.1* for the worst-case *fuel model type* in the *flame fuel assessment zone* in each sector. If the canopy fuel provision described above is met, then an additional 70-meter (230-foot) distance is added to obtain the value for FZ to use in *Equation 4-1* for vegetative fuels.

B5.2.1.1 Optically thin approach

An optically-thin limit is applied in the radiation model, a suitable approach for simulating outdoor fires (McGrattan et al. 2008). In this method, the fire radiates a user-specified radiative fraction of energy, which is transported to the domain boundaries without being reabsorbed by cooler gases. The radiative fraction (χ_R), is a common parameter in CFD models; however, it is not a universal constant and depends on factors such as fuel type and fire size

*Figure B5.*3 illustrates examples of radiative fraction measurements for various liquid fuels as a function of pool fire diameter. The data show that χ_R changes slightly with increasing size for smaller fires (less than 1 meter), but these variations become more pronounced for larger fires, generally resulting in lower χ_R values.

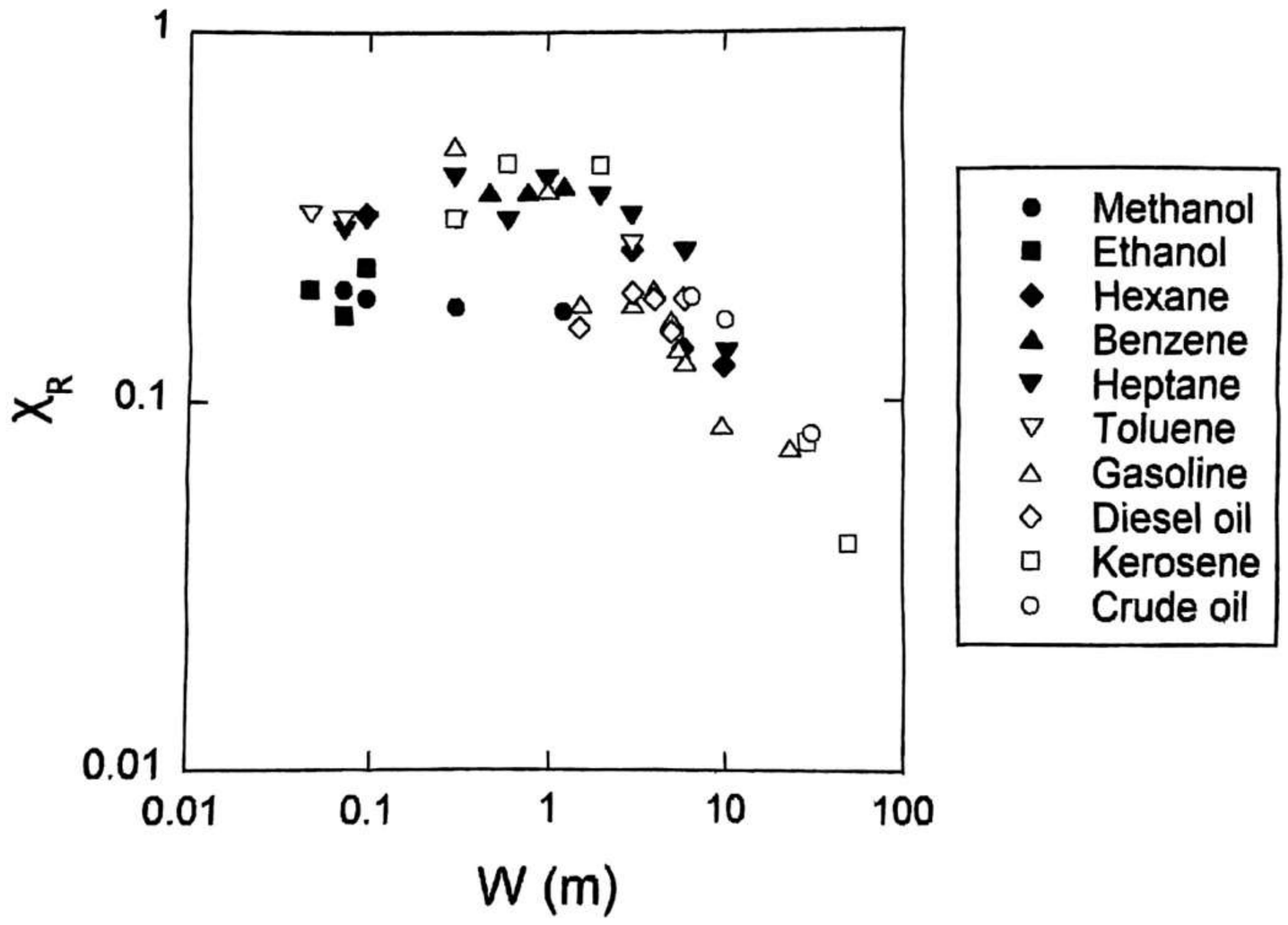


Figure B5.3 Radiative fraction as a function of pool fire diameter (Taken from Himoto, K. (2022). Large Outdoor Fire Dynamics. CRC Press.)

For biomass fires, several studies have measured the radiative fraction for different woody materials under various conditions. For example, Tihay et al. (2009) calculated the radiative fraction of laminar flames from vegetative fuels, finding values between 20% and 27%. Kremens et al. (2012) conducted experiments with preconditioned wildland fuels typical of mixed-oak forests, reporting an average radiative fraction of 17%. Morandini et al. (2013) studied the influence of fuel load on radiative fraction and other fire properties, using pine needle fuel beds (2 m x 1 meter) and found radiative fractions ranging from 17.4% to 22.4%. Further, Morandini et al. (2014) investigated the effect of slope on convective and radiative heat transfer. They observed slightly higher radiative fractions under sloped conditions, with values ranging from 25.1% to 38.9% for a slope of 20°, compared to flat surfaces.

In summary, χ_R that has not been measured or reliably predicted for all potential fuel types, and this parameter significantly influences the simulation results. For example, *Figure B5.4* illustrates mean heat fluxes at various distances for three different χ_R values, using a heat source of 20 meters x 20 meters. These data show higher heat flux values with increasing radiative fractions across all distances.

For this study, a conservative approach was adopted. Since most χ_R values reported in the literature for woody materials range from approximately 17% to 39%, we used a value of 0.37, which is the radiative fraction in FDS for "red oak." This value is close to the upper boundary of the reported range, ensuring higher heat flux predictions compared to smaller χ_R. Model results could be improved by inputting the appropriate χ_R values that better represent each specific type of vegetation.

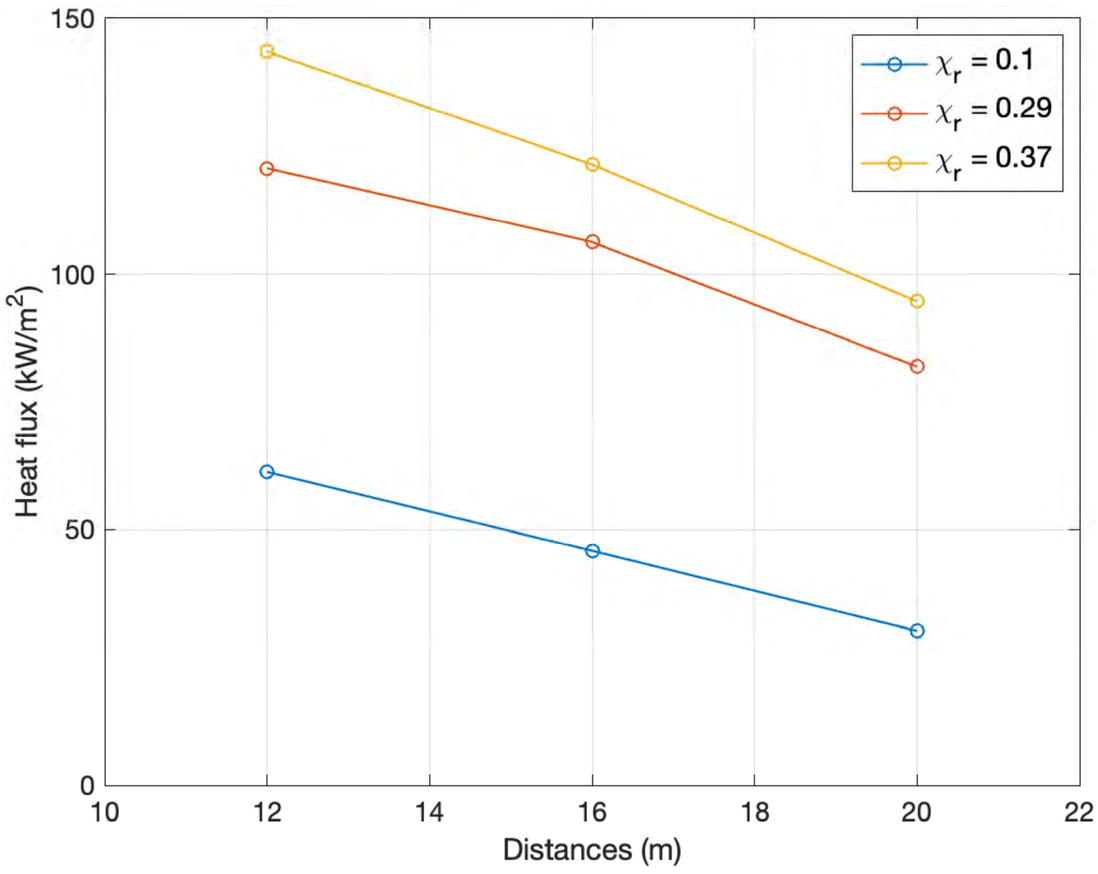


Figure B5.4. Simulation results for the mean heat flux values as a function of the distance for radiative fraction of 0.1, 0.29 and 0.37.

B5.2.1.2 Sensitivity analysis

Sensitivity analysis was done to evaluate the effect on the simulation results, specifically in the total heat fluxes as the grid size, the fire depth and fire width change. For this analysis, the larger fire provided by BehavePlus was used (HRRPUA = 3600 kW/m^2) to ensure there the domain is large enough to recreate the prescribed HRR.

To begin with the sensitivity analysis, the appropriate grid size was evaluated considering the smallest (5 x 5 meters) and largest (30 x 30 meters) heat source size evaluated in this work. For this, the criteria suggested by Mc Grattan et al. (2008) were followed as guidance, stating the ratio between length scales characterizing the diameter of the pool fire (z_c), and the grid cell size in the gas-phase (dx_g) has to range between 4 and 16. Considering,

$$z_c = \left(\frac{\dot{q}}{\rho_a c_p T_a \sqrt{g}}\right)^{2/5} \qquad \textit{Equation B5-2}$$

Where $\dot{q}$ is the HRR, ρ_a, c_p, T_a are respectively the density, specific heat and temperature of the ambient air and g is the standard gravity. *Table B5.5* presents the values of z_c, $z_c/4$, and $z_c/16$ for the smallest fire simulated (5m x 5m) and the largest one (30m x 30m). $\delta = 0.5$ meter, 1 meter and 1.5 meters were used to evaluate the effect of the grid resolution in the results. For these simulations a value of radiative fraction of 0.37 was used.

Table B5.2

	z_c (m)	$z_c/4$ (m)	$z_c/4$ (m)
5m x 5m heat source	5.8	1.4	0.4
30 m x 30 m heat source	24.3	6.1	1.5

To assess the impact of grid size on simulation results, fires measuring 5 x 5 meters and 30 x 30 meters were simulated using grid sizes of 0.5 meter, 1.0 meter, and 1.5 meter. The mean heat fluxes and their corresponding standard deviations from the simulations for each heat source size are presented in *Figure B5.5.* Due to significant fluctuations in heat fluxes near the heat source, no notable effect of grid resolution was observed at distances less than 30 m. However, at 40 meters and 80 meters, the effect became more apparent, particularly for the 1.5 meter grid size compared to the smaller grid sizes. Based on these findings, a grid cell size of 1.0 meter was selected for subsequent simulations.

Another important factor influencing the simulation results is the size of the fire. Since HRRPUA (Heat Release Rate Per Unit Area) is the primary input, larger fire sizes result in higher total HRR and consequently greater heat fluxes in front of the fire. To optimize computational resources, it is desirable to simulate the smallest possible fire size that still provides realistic results for the intended scenario.

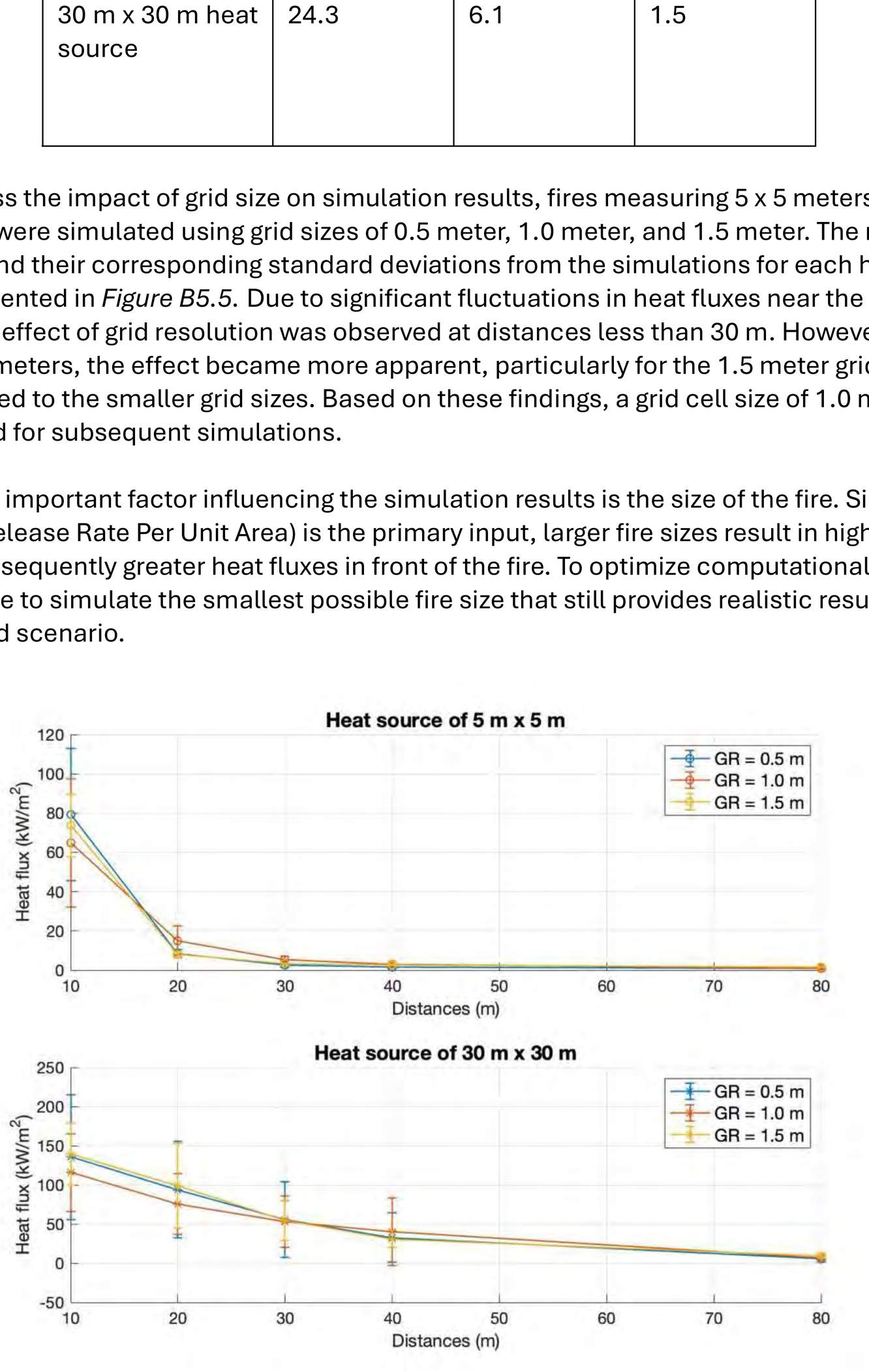


Figure B5.5. Mean heat flux results for varying grid cell sizes as a function of distance.

The effect of fire size was examined during the sensitivity analysis. *Figure B5.4a* shows the mean heat fluxes at various distances from the fire front as a function of FD with a fixed fire width (FW) of 10 meters. For locations closer to the fire front (less than 30 meters), no clear trend is observed, and the mean heat fluxes vary significantly as FD changes. However, this region is not the focus of this study, as structural ignition is assumed to occur in this zone due to proximity to the flame. The area of interest lies where heat flux values approach the ignition threshold of 13.1 kW/m^2. This region is highlighted in *Figure B5.6b*, where it can be observed that changes in HF have become less significant as FD increases. In fact, the difference in HF values calculated for FD = 30 meters and FD = 40 meters is less than 1%. A similar trend is observed when heat fluxes are evaluated as a function of fire width (FW) with a fixed FD. Based on these findings, a fire source measuring 30 x 30 meters is used in this study.

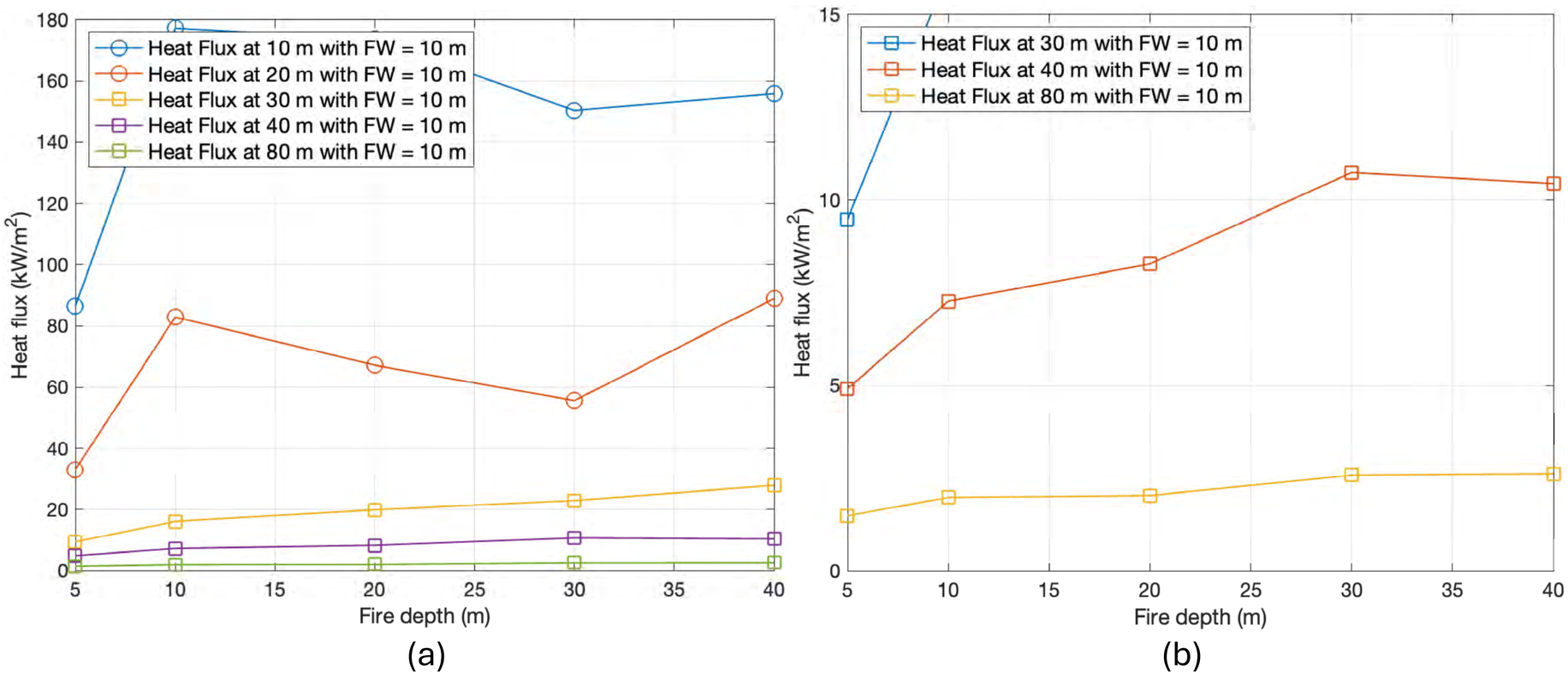


Figure B5.6. Mean heat fluxes at different distances from the fire front as a function of the fire depth (FD) considering a fire width of 10 m.

B5.3 Structural fuel fire intensity analysis

Structures are considered a non-burnable object in the *LANDFIRE* dataset, requiring an independent analysis from vegetative fuels. Burning structures can produce high radiant heat fluxes, large flames, and large embers capable of supporting extreme fire behavior and are an important exposure consideration for the defined *neighborhood*. However, there is a significant research gap in understanding the bounds of the potential exposures from burning structures in wind-driven fires, especially in extreme fire weather conditions. The variability of structure geometry and composition, complex fire dynamics, and scale of wind-driven structure fires are key challenges in the analysis of these potential exposures.

Research on building-to-building fire spread has predominantly relied on reduced-scale experiments (Narayanan et al. 2022) or on numerical, stochastic, and physics-based modeling approaches (Huang 2020; Masoudvaziri et al. 2021; Himoto and Tanaka 2008; Cheng 2011; Purnomo Dwi et al. 2024). Experimental investigations addressing fire spread between buildings, specifically considering flame radiation through openings during internal fires, are relatively scarce (Yuen et al. 2021; Lee et al. 2009; Maranghides and Johnsson 2008). In contrast, during wildfires, entire *structures* can become fully engulfed in flames and subjected to elevated wind speeds, resulting in significantly different fire dynamics

and exposure risks to adjacent buildings. Research focusing on fire spread from fully engulfed *structures* to nearby buildings, particularly under high wind conditions, remains limited.

To address this research gap and improve our understanding of wind-driven building-to-building fire spread and verify if small-scale experiments still hold up in a more realistic scenario, a series of fire exposure experiments were conducted between sheds and *structures* at *IBHS*. In the shed experiments, 15 UL 711 Class 1-A – 6-A wood cribs were placed inside a 12 x 24 foot shed, and the spread of the fire, heating rate, and damage modes to a 30 x 40 x 16 foot building were monitored. Currently, *IBHS* is working on another series of experiments between *ADU's* and structures. The *ADU's* contain household fuels and are internally finished to include the impact of fire development in a multicompartment *structure* from internal and external ignitions.

In the initial structural fuel fire intensity analysis, the potential impact of structural fuels are considered through a point source radiant heat calculation as indicated in *Equation B5-3* (Himoto 2023) utilizing heat release rates from literature and experiments at *IBHS*, and cross referenced with experimental heat flux and flame length measurements at *IBHS*.

$$\dot{q}_r'' = \frac{\chi_R \, HRR}{4\pi R^2} \qquad \textit{Equation B5-3}$$

Where X_R is the radiative fraction, *HRR* is the heat release rate of the fire, and *R* is the distance from the source to the target. The radiative fraction X_R is assumed to be 0.3 for these calculations (Himoto 2023). An analysis of the potential of direct flame contact and convective heating due to plume dynamics is not yet considered in this analysis. Flame shape and plume dynamics of multicompartment fires under wind driven conditions are not well understood and were considered beyond the scope of the capabilities of this document until a better understanding of the problem is established. However, to provide a conservative analysis that does not dismiss the contributions of these heat transfer mechanisms, the measured total heat fluxes at *IBHS* for wind-driven experiments are incorporated in this analysis, shown in *Figure B5.5* and discussed in more detail later in this section.

Heat release rates for *structure* fires are limited in the literature. Values from studies with a variety of compartment sizes and fuel conditions are considered as well as computational fluid dynamic method utilized by Purnomo DM et al. (2024) shown in *Table B5.6*. These HRR and the resulting heat flux exposures determined using *Equation B5-3* are shown in *Figure B5.5*.

Table B5.6 Heat release rates from available literature.

Type	Building Type/ Size (m^2)	Size (m^2)	Peak HRRPUA (kW/m^2)	Peak HRR (MW)
Experimental Measurement IBHS	Shed w/ Wooden Cribs	26.8	2238	60
*Experimental Measurement**	Residence	8.64	255	2.2
*FDS Simulation 1**	Residence	174	575	100
*FDS Simulation 2**	Residence	109.2	687	75
*FDS Simulation 3**	Residence	14.4	1014	14.6

Type	Building Type/ Size (m^2)	Size (m^2)	Peak HRRPUA (kW/m^2)	Peak HRR (MW)
Experimental Measurement NIST	Unfinished Residence (OSB & 2x4)	12	1816	21.8
Experimental Measurement FM Global	Residence	28.06	470.4	13.2

*Adapted from Jiang et al. (2021).

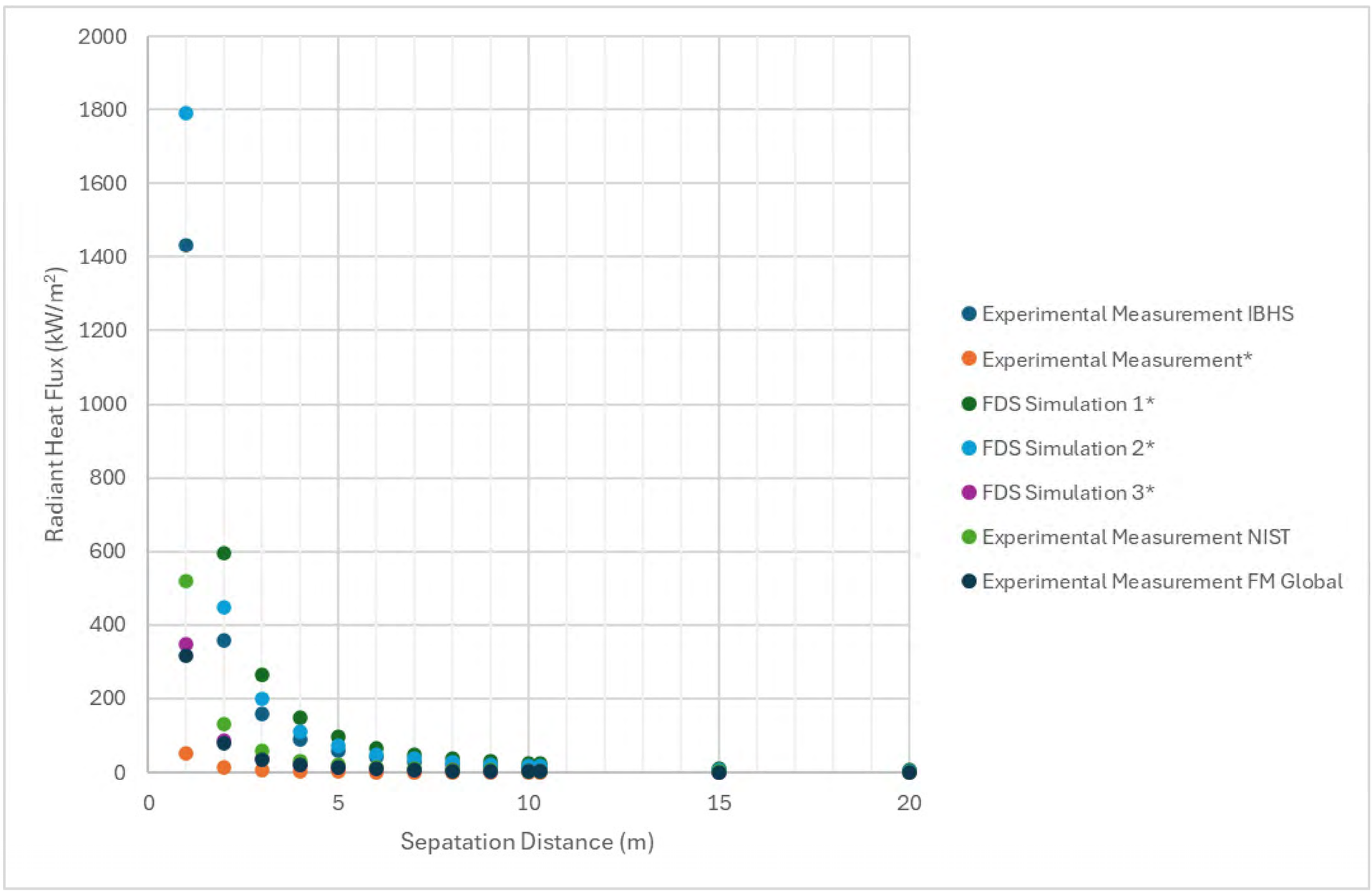


Figure B5.5. Plot of calculated radiant heat fluxes at varying distances using Equation B5-3 and Heat Release Rates for structures from literature and measurements at IBHS.

These calculated radiative heat flux values were compared to total heat flux measurements taken at *IBHS* during wind driven shed experiments at 20, 30, and 60 mile per hour wind speeds. It is known the wind component of the experiments at *IBHS* will have a significant impact of the resulting total heat flux measured downstream due to changes in the burning rate, flame stretch, flame tilt, and plume dynamics depending on the magnitude of the wind speed. The complexity of incorporating theses impacts characteristic of wind-driven fire is beyond the current capabilities of this standard and instead, measurements from experiments at *IBHS* are used to ensure that the methods applied in this standard are sufficient for the potential exposure. In *Figure B5.6* the maximum and minimum fire sources are shown with a power fit, bounding the radiant heat fluxes calculated using the estimated fire sizes in *Table B5.6* and *Equation B5-3*. *IBHS* experiments with wind speeds between 20 and 30 mph are labeled as "*IBHS* Wind Driven Fire Shed Tests" while the 60 mph tests are labeled as "*IBHS* Extreme Wind Driven Fire Tests" in *Figure B5.7*.

IBHS wind driven fire shed tests fall generally within the two HRRs considered aside from measurements at lower *structure separation* distances that are more impacted by the wind component of the test and likely convective heat flux not considered in *Equation B5-3,* however, none of the *IBHS* extreme wind driven fire tests fall within the estimate by *Equation B5-3*. The result suggests the 70-mph gust wind speed, set as the design wind speed for this standard, would have led to an underestimation of the exposure heat flux. The high wind speed impacts the fire by stretching the flame closer to the target, increasing the fire intensity significantly, and introducing a convective heating component not considered in *Equation B5-3,* or a combination of these.

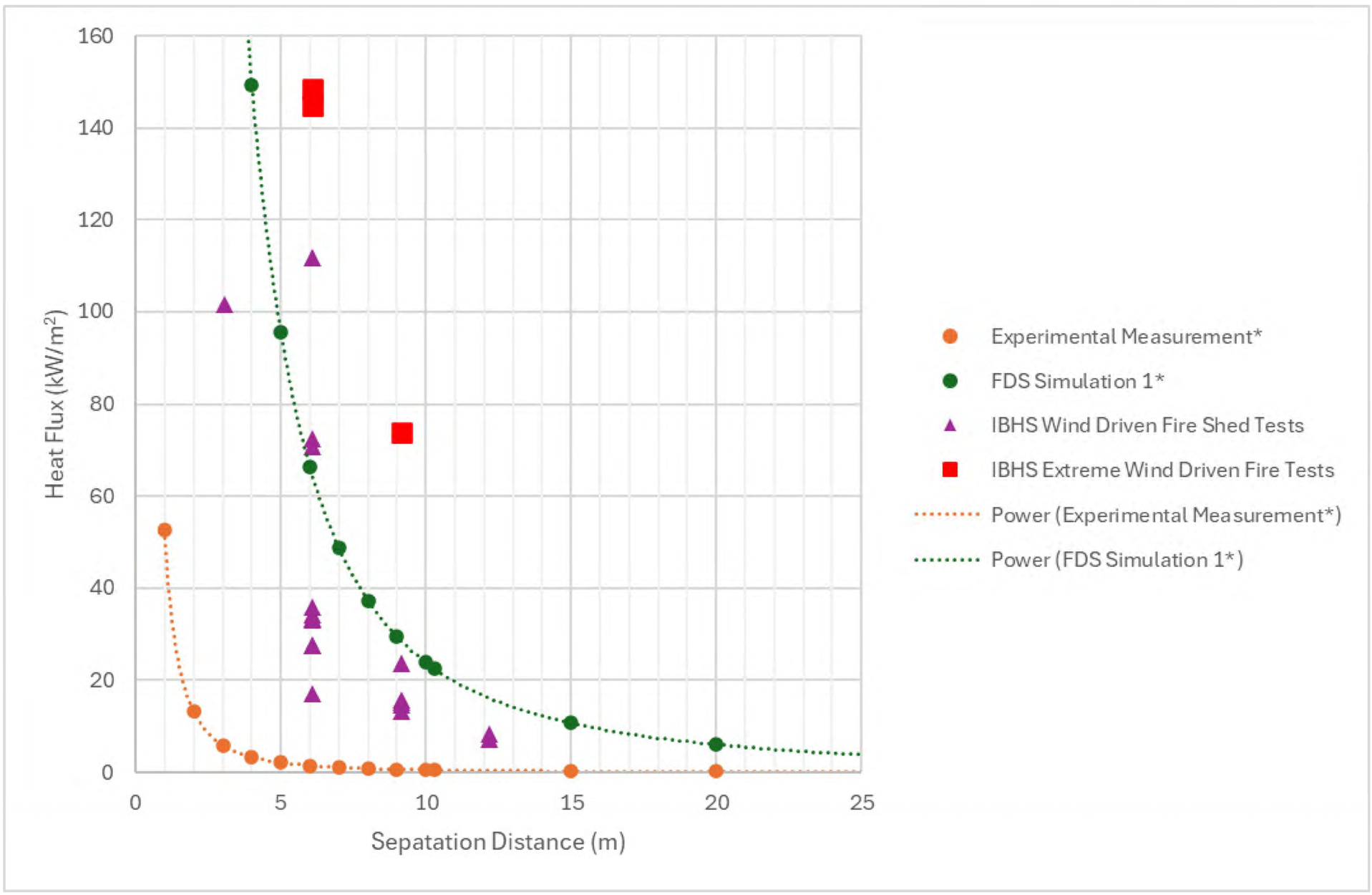


Figure B5.6. Maximum and minimum calculated radiant heat fluxes from Figure B5.5 and measured total heat fluxes from wind driven structure-to-structure fire spread experiments at IBHS.

To account for this underestimation, and to provide a conservative estimate for heating in the extreme wind-driven fire scenario, an effective HRR is determined. The effective HRR is calculated utilizing the measured heat fluxes in the extreme wind-driven fire tests and *Equation B5-3*. A heat release rate of 258 MW is determined using the maximum heat flux measurement from the extreme wind driven fire tests using *Equation B5-3*. Calculated heat fluxes using *Equation B5-3* considering a heat release rate of 258 MW are plotted in *Figure B5.7*.

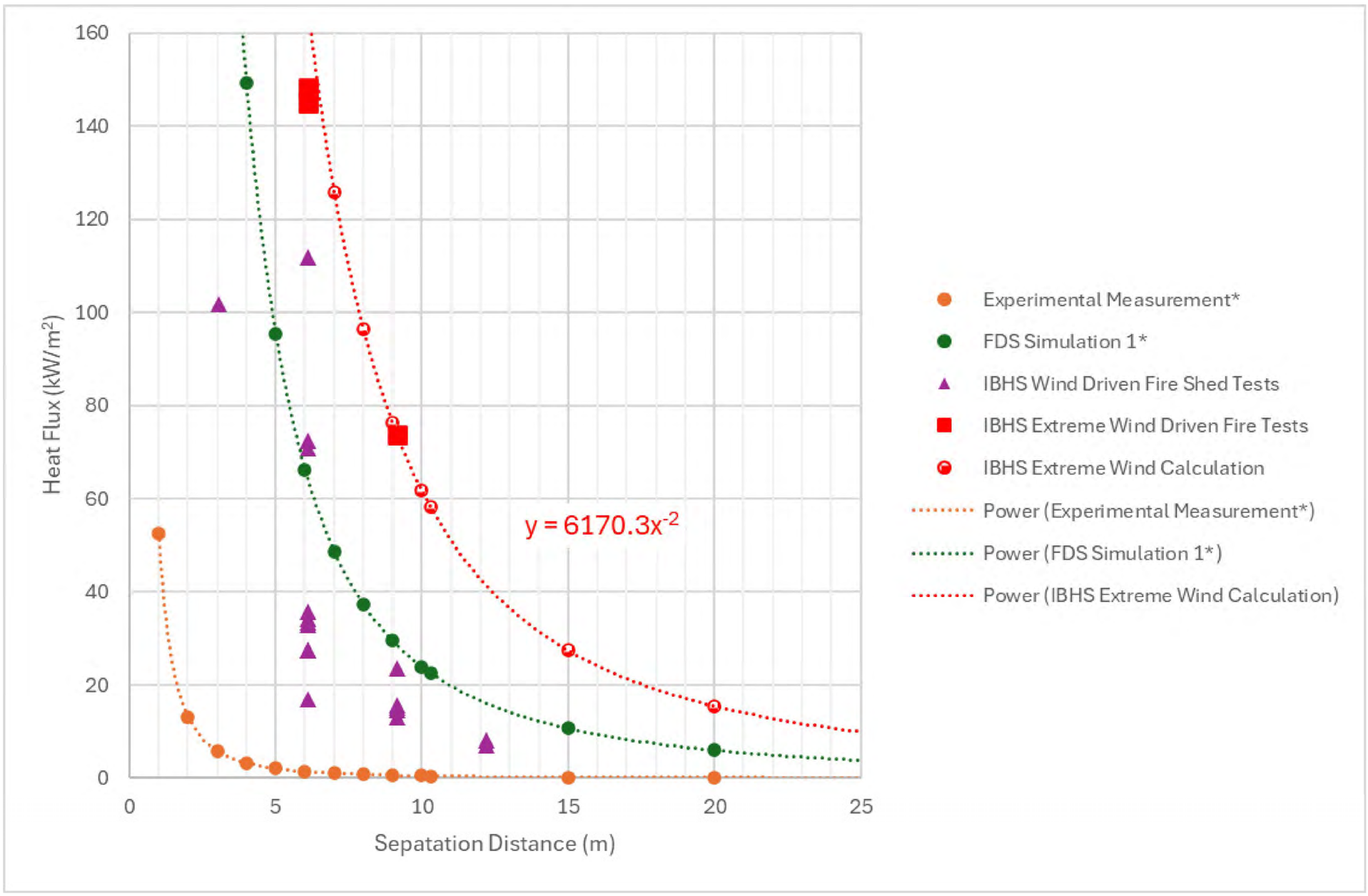


Figure B5.7. IBHS Extreme Wind-Driven Fire Shed Tests experimental measurements of total heat flux and associated curve fit using Equation B.5-3 to estimate the point exposure radiant heat flux, shown as a function of separation distance.

The curve fits for these heat fluxes provides a conservative estimate of distance in which *structures* require mitigation measures due to structural fuels outside the defined *neighborhood*. Solving for the threshold/design level heat flux of 13.1 kW/m^2, a *neighborhood flame zone* distance of 21.7 meters (71 feet) is used for structural fuels.

B5.4 Mitigation provisions for flames and radiant heat

While embers can ignite sporadic spot fires within communities, rapid fire spread from building to building occurs when spot fires grow and engulf *structures*. During such events, towering walls of flame can be driven by the wind, extending beyond the *structure separation* distance between homes and potentially causing direct flame contact. Furthermore, urban ladder/connective fuels—such as vehicles, sheds, fences, and vegetation—can ignite and contribute to the intensity and reach of the flames. As a result, *structures* at risk of direct flame contact must be hardened to withstand low to moderate heat exposure, which is the primary objective of the *IBHS WFPH Plus* requirements.

To achieve this, all primary vertical surfaces of the *structure*, including siding, windows, and exterior doors, should meet the highest fire resistance standards. It is also crucial to remove back-to-back fence rows, as they can facilitate fire spread between *parcels*. Additionally, the eaves and areas beneath bay windows should be enclosed to minimize heat accumulation in these zones. Deck assemblies should either be constructed from noncombustible materials or designed with solid walking surfaces that contain no gaps, further enhancing the home's fire resilience.

B6 *Neighborhood ember zone*

During wildland and WUI fires, numerous *firebrands* (the term embers is used interchangeably with the term *firebrands*)—flaming, glowing, or smoldering—are generated and transported by the fire's convective column and/or wind. Spotting consists of three key processes: generation, transport, and deposition. The likelihood of spot fires depends on fire intensity, ember properties, environmental conditions, and the characteristics of the fuel in which they land on (Filkov et al. 2023).

Fire intensity, driven by the interaction of fuel and local weather, is influenced by factors such as fuel load, wind speed, topography, and humidity. These elements determine the upward velocity of embers, with spotting distance largely dependent on fire intensity, wind conditions, and ember shape. A strong convective column lifts embers to a height where it descends as free-falling particles under wind influence. Disruption of the convective column by wind shear or premature ejection of embers can result in shorter-range spotting (Wadhwani et al. 2022).

Short-range embers, traveling less than 0.5 miles, are typically carried and/or tumbled by the wind rather than the fire plume, moving both vertically at times and/or horizontally over the ground. The travel distance is influenced by wind conditions, topography, and the type of burning material from which it originates. These embers often retain significant unburned material. Long-range ember transport, in contrast, are embers traveling substantial vertical and horizontal distances. These are lofted by the strong rising air associated with the fire’s plume and tend to be less uniform in their dispersion. Several studies have attempted to model this phenomenon; however, the predicted long-range spotting distances in these models are often conservative. This is largely due to simplifying assumptions as there remains substantial gaps in the knowledge about the overall ember size distributions, their mass–diameter relationships, shape distributions, and overall aerodynamic properties.

B6.1 Ember characterization and transport

Several ember transport models have been developed to capture the complex behavior of embers and the environmental factors influencing their spread. Some models, particularly computational fluid dynamics (CFD)-based models, simulate the detailed physical processes of ember generation, lofting, and transport, accounting for convective currents, wind, and ember mass loss over time. While these models offer valuable insights into the interactions between embers, airflow, structures, and topography, it is computationally intensive.

These ember transport models share similar limitations, largely due to simplifying assumptions that affect predicted spotting distances. For instance, models often assume uniform wind profiles, disregarding natural fluctuations in wind speed and direction, which can significantly reduce ember travel. They also idealize ember properties, assuming fixed shapes (often spherical), constant mass with no mass loss during flight, and travel at terminal velocity. Additionally, steady heat conditions are commonly presumed, overlooking environmental cooling effects that can extinguish embers mid-flight. These models also assume unobstructed landscapes, omitting barriers such as vegetation, buildings, and varied topography that would hinder ember movement. Many models further exclude key factors like specific fuel types, detailed atmospheric conditions, and the true strength of the convection column, which influences terminal and initial vertical velocity. Together, these limitations often lead to conservatively large but comparable spotting distance outputs across models. For practical applications such as this standard, simpler, more efficient models are preferred. Applied ember transport models generally rely on statistical or empirical methods to represent ember generation, lofting, and spread over larger scales. Commonly used models include the McArthur (1967), Tarifa et al. (1965), Albini et al. (2012), and Himoto and Iwami (2021) models, each providing similar final transport distances.

McArthur (1967) developed a model for the maximum spotting distance in eucalypt forests, focusing on long-range *firebrand* transport, based on factors such as fire spread rate and fuel load. This model is derived by combining equations that describe the terminal velocity of *firebrands* during flight with models of lofting mechanisms and ambient wind conditions.

$$Average\ max\ spotting\ distance = rate\ of\ spread(4.17 - 0.033\ fuel\ load) - 0.36 \qquad \textit{Equation B6-1}$$

Tarifa et al. (1965) developed a model to estimate ember trajectory of burning wood particles of spherical and cylindrical shapes, representing embers. The particles were ignited and tested at their terminal velocity in horizontal and vertical wind tunnels. A differential equation was formulated using experimental data to predict the change in firebrand radius over time, which is essential for estimating both the flight duration and the time required for vertical ascent. The output of this model is depicted in *Figure B6.1*. One major challenge in this process was the particles typically break during flight and the validity range for the developed relation is not accurate at smaller sizes (Tarifa et al. 1965).

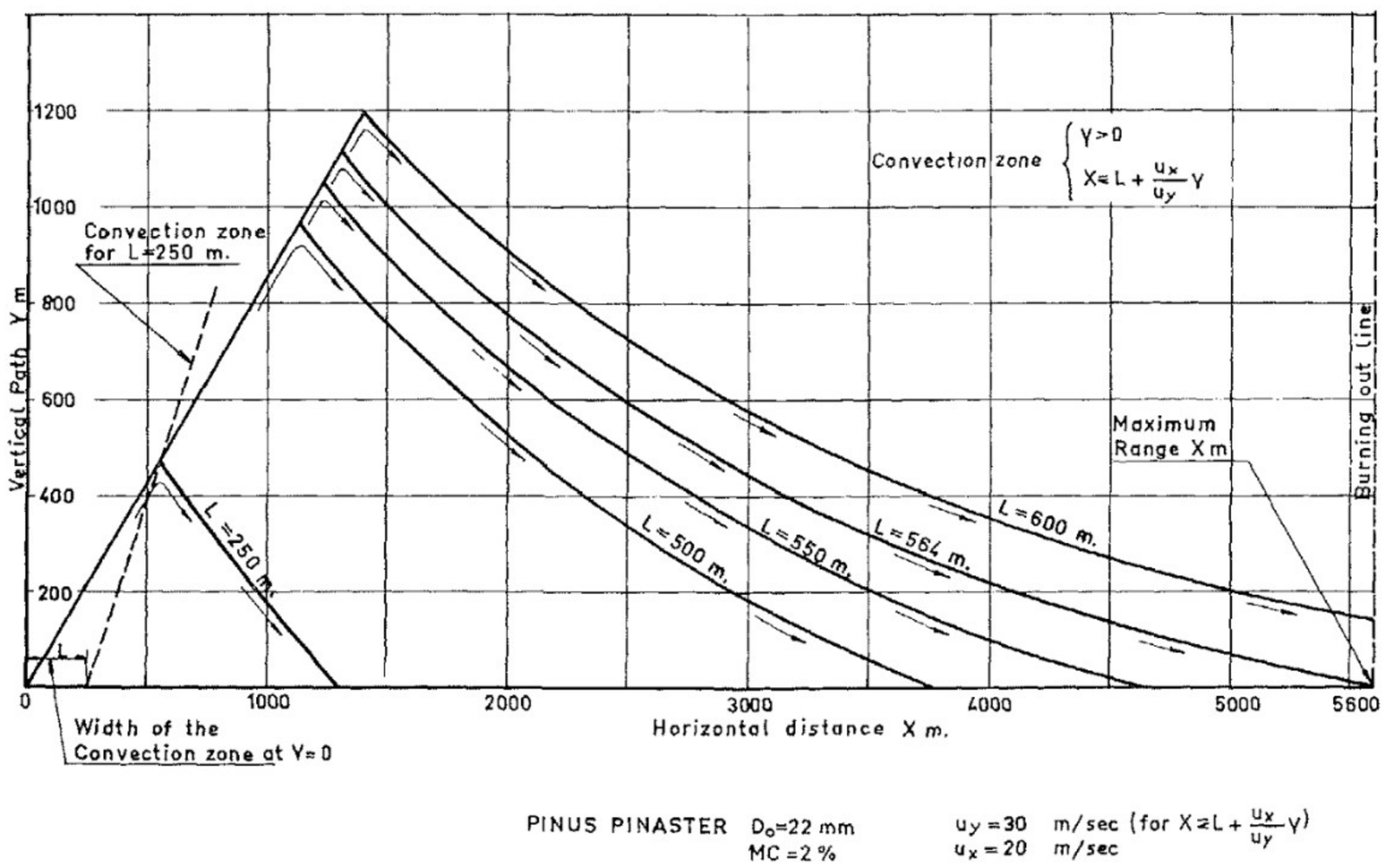


Figure B6.1. Flight paths of spheric firebrands (embers). Inclined convection column model. The initial position of the firebrands on the ground is fixed. From Tarifa et al. (1965).

Albini et al. (2012) developed a semi physical model to estimate the maximum spot fire distance from an active crown fire. This distance is based on flame height above the canopy, wind speed at canopy-top level, and the final size of the ember, represented by the diameter of a woody char cylinder. The model includes several components: a wind-blown flame front model, a two-dimensional buoyant plume model, a logarithmic wind speed profile with height, and an empirical model for the burning rate of a wooden cylinder (the *firebrand*). The ember's trajectory is calculated from its departure from the plume to its re-entry at the canopy, with the spotting distance depending on the ember's final diameter.

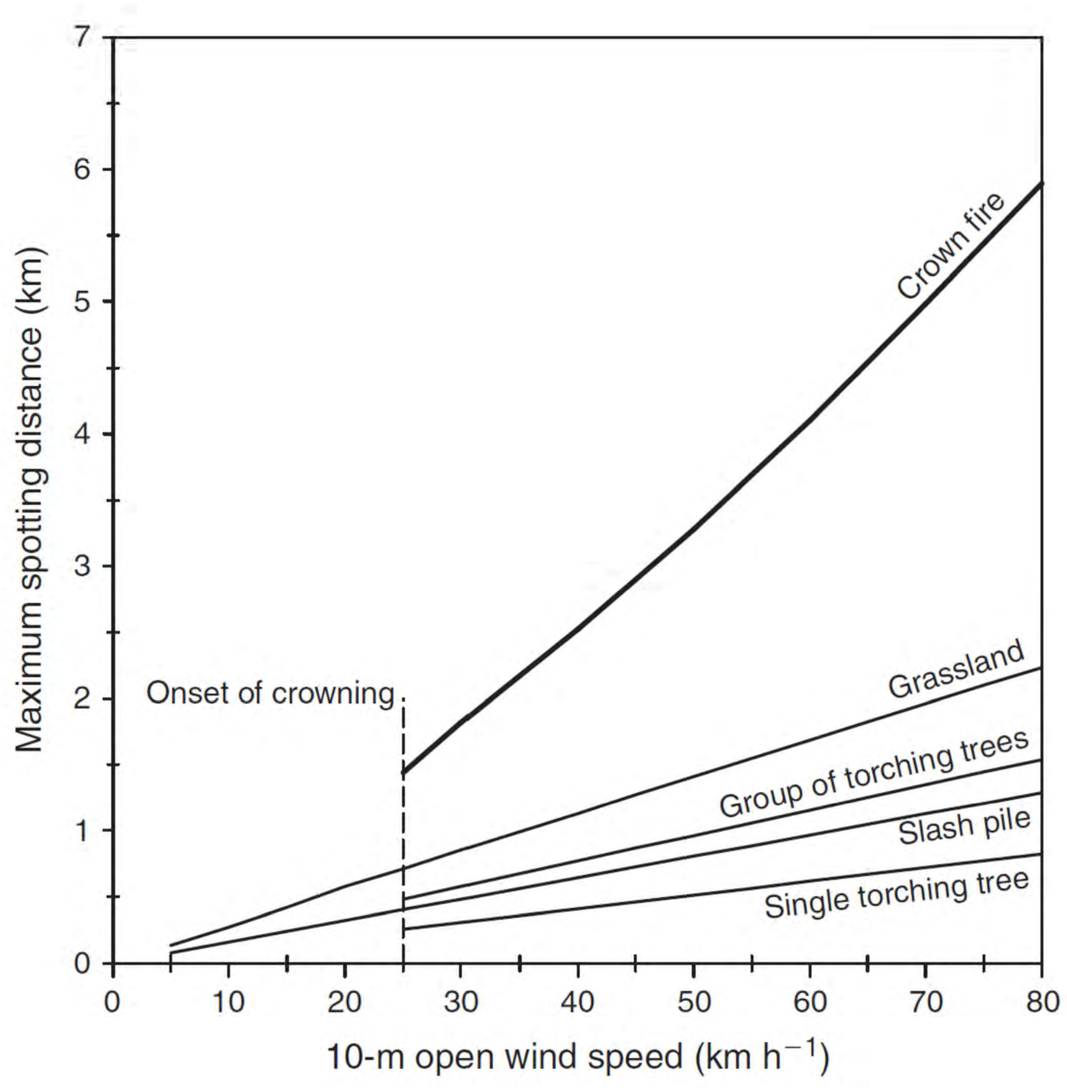


Figure B6.2. Comparison of model predictions for maximum potential spotting distance over level terrain as a function of wind speed for a specified set of burning conditions. From Albini et al. (2012).

Himoto and Iwami (2021) conducted a series of wind tunnel experiments to investigate the probabilistic variations in two of the three processes involved in spot ignition—*firebrand* generation and transport. The key variables studied were the ember ejection height (H), crosswind velocity (U_∞), and the thickness of the wood sticks used to construct the crib (d). Based on the experimental data, the projected area of embers and their downwind transport distances were modeled using simple physical principles. *Figure 3.7* illustrates the inputs for this model and the forces acting on embers. This includes: the ejection velocity, drag, gravitational forces, wind speed, and ejection height.

Himoto and Iwami's (2021) model was selected due to its simplicity in fuel characterization, allowing it to be used across different fuel assessment data sources and it offers a probabilistic approach. The probabilistic approach provides the opportunity to set a design level based on uncertainty in other elements of the standard through proper engineering judgement.

The following discussion outlines the ember transport calculation details used in this standard to ensure reproducibility. Relevant parameters in the Himoto and Iwami (2021) model are depicted in *Figure 3.7* in *Chapter 3*, *Section 3.4*. The constant values used in this standard are presented in *Table B6.1*. The ejection height was assumed to be equal to the fuel height, and all embers were considered to have a diameter of 1 cm. For the building fuel diameter, the equivalent hydraulic diameter of a rectangular (3.6 x 7.3 meters) was utilized. The values for heat release rate are the peak values reported for grass, for trees, and for buildings (sheds) (Overholt et al. 2014; Manzello et al. 2007; Maranghides et al. 2022). Accurately estimating the heat release rate of full-scale fires under windy conditions remains extremely challenging. Only a few studies have attempted to estimate the heat release rate of burning trees and grass. Since the heat release value for buildings is not available, a shed was used as a substitute.

Table B6.1. Constant values used in Himoto and Iwami (2021) model.

Parameter	**Grass**	**Tree**	**Buildings**
Ejection Height	1.5 m	3.45 m	3.45 m
Inflow Velocity		13,22,30 ms^{-1}	
Ember Diameter		1 cm	
Fuel Diameter	50 cm	225 cm	487 cm
Heat Release Rate	0.15 MW	7.5 MW	20 MW
Gravity		9.8 ms^{-2}	

The lognormal distribution has been widely applied to model *firebrand* dispersion in windy conditions.

$$P(x_p|\lambda,\vartheta) = \frac{1}{\sqrt{2\pi}\vartheta x_p} e^{\left(\frac{-1}{2}\left(\frac{\ln x_p - \lambda}{\vartheta}\right)^2\right)} \quad \textit{Equation B6-2}$$

$$\mu = \ln\left(\frac{\mu_x}{\sqrt{1+\frac{\sigma_x{}^2}{\mu_x{}^2}}}\right) \quad \textit{Equation B6-3}$$

$$\vartheta = \sqrt{\ln\left(1+\frac{\sigma_x{}^2}{\mu_x{}^2}\right)} \quad \textit{Equation B6-4}$$

Where μ and ϑ are mean and standard deviation respectively. By analyzing the deposition distribution of *firebrands* from a full-scale burn experiment of a three-story wooden building, Hayashi et al. (2014) derived the following relationships for the mean and standard deviation.

$$\frac{\mu_x}{d} = 41.0\hat{B}^{1.06} \quad \textit{Equation B6-5}$$

$$\frac{\sigma_x}{d} = 4.52 \quad \textit{Equation B6-6}$$

$$\hat{B} = \left(\frac{U_\infty U_0}{g\sqrt{dd_p}}\right)^2 \left(\frac{\rho_\infty}{\rho_p}\right)\left(1+\sqrt{1+\frac{2gH}{w_0{}^2}}\right)^2 \quad \textit{Equation B6-7}$$

Here, $\hat{B}$ governs the deposition behavior and is derived from embers with a diameter d_p, ejected from a fire with a height H and a vertical velocity w_0, subjected to drag forces caused by a crosswind with speed U_∞ , $\hat{B}$ can be viewed as the Froude number modified by the density ratio and initial effects of ejection velocity. The theoretical model for turbulent diffusion flames developed by Baum and McCaffrey (1989) was used to calculate the ejection velocity for intermittent flames.

$$w_0 = 1.85\dot{Q}^{1.5} \quad \textit{Equation B6-8}$$

Where $\dot{Q}$is the heat release rate of the fire, listed in *Table B6.1*. By applying *equation B6-8* along with the values provided in *Table B6.1*, the ejection velocities obtained would be 5.04 m/s for grass embers, 11.02 m/s for tree embers, and 13.41 m/s for building embers. Applying these ejection velocities in *equations B6.2-7* and using the constants listed in *table B6.1*, the reported traveling distance for different embers could be obtained. It is important to note that this approach generates a probability distribution, allowing

the integral of the probability density function to be used for calculating the cumulative density function. For the *IBHS Wildfire Prepared Neighborhood Standard*, the 80th percentile threshold was selected for use in this standard. *Figure B6.4* illustrates the cumulative density function for grass embers at three different wind speeds and serves as an example of this approach.

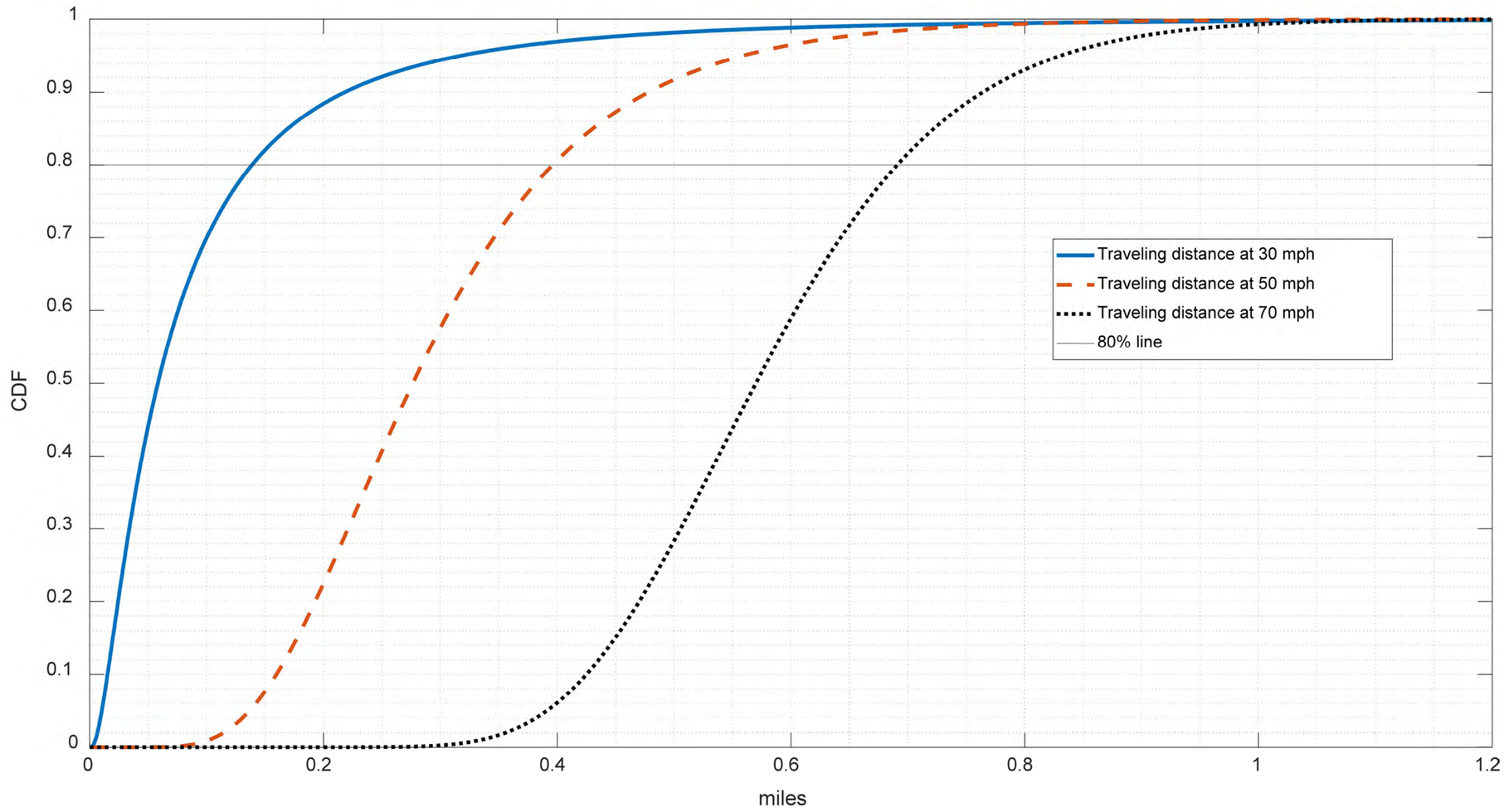


Figure B6.3 Estimated cumulative distribution function (CDF) of transport distance of firebrands from grass, based on parameters listed in Table B6.1

B6.2 Ember mitigation provisions

During wildfires, flying embers, along with wind-blown, ground-traveling burning debris, are the most common mechanisms that ignite *structures*, either directly or indirectly. Direct ignition occurs when embers land and accumulate on combustible building materials or enter through openings to ignite interior components. Indirect ignition happens when embers accumulate on nearby combustibles, igniting them and subsequently causing flames to reach the building through radiant heat or direct contact. While these spot fires typically burn with lower intensity than the main fire front, they can still spread to nearby *structures* under favorable conditions. Notably, only tall, thick flames can radiate enough heat to ignite *structures*; smaller flames must be in proximity or in contact to cause ignition.

Although experimental and numerical studies on ember storms in the *wildland-urban interface* (WUI) exist, predicting ember paths and accumulation locations remain challenging. During flight, embers follow unpredictable trajectories influenced by building features and environmental factors. The geometric characteristics of buildings, community density, and the nature of receptive fuel beds, along with the shape of the embers, their source fuel, and local wind patterns—especially coherent features at both meso- and microscales —affect ember accumulation. This complex thermal exposure necessitates systematic fuel management and home hardening strategies to mitigate the ignition probabilities of *structures*. In the *WUI*, ember-caused spot fires can use vulnerable *structures* as fuel, potentially escalating into tall flames and producing localized extreme fire behavior that threatens neighboring *structures*. While it may be possible to identify likely ignition pathways for an isolated *structure* during an ember storm, the chaotic accumulation patterns in communities complicate the identification of specific vulnerable components in any given *structure*. Recognizing these complexities, a systematic and

comprehensive hardening approach is essential to protect homes and their immediate surroundings against known vulnerabilities, which is the design performance criteria for the *IBHS WFPH Base* level of protection. This includes the requirement for a well-maintained Class A roof and the necessity for all vents to have mechanisms that minimize ember entry into the building. The *structure*'s footprint should provide a 6-inch noncombustible vertical clearance to reduce direct contact between rolling, burning debris and any combustible exterior wall components. To mitigate the risk of indirect ember ignition, it is essential to maintain *defensible space*, with particular focus on the development and upkeep of a *0–5 Foot Noncombustible Zone*.

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APPENDIX C
Practitioner guide

IBHS Wildfire Prepared Neighborhood
Technical Standard
Version 2025

C1 Standard summary

C1.1 Applicability

Construction Types: This standard applies to typical single-family, duplex, and townhome construction types.

Structure spacing: This standard can be applied to a defined neighborhood when 90% or more *structures* are separated by greater than 10 feet and less than 100 feet.

C1.2 Requirements summary

Roof: All structures within the defined neighborhood must have a Class A roof covering. In addition, no wood roofing products of any kind are allowed.

C1.2.1 Neighborhood flame zone

The *neighborhood flame zone* is an area typically located from the boundary of the *neighborhood* inward for up to approximately 450 feet (distances are dependent on fuel characteristics) which has the highest likelihood of experiencing the most severe fire exposure resulting from external fuels.

The *neighborhood flame zone* is determined using the processes described in *Chapter 3*. It accounts for external fuels within 0.25 miles of the neighborhood boundary and how it may produce flames/radiant heat sufficient to ignite common building materials. Any *parcels* which fall on the *neighborhood flame zone* boundary are considered in the *neighborhood flame zone* and must meet its requirements.

Those structures located in the *neighborhood flame zone* must meet the requirements of an *IBHS Wildfire Prepared Home – Plus* as specified in the *IBHS Wildfire Prepared Home Technical Standard* (https://wildfireprepared.org/wp-content/uploads/WFPH-Standard.pdf). This includes a fully 0-5 Foot Noncombustible Zone, ember or ember- and flame-resistant vents, fully noncombustible wall cover materials, noncombustible decks, double paned tempered glass windows, and no *auxiliary structures* within 30 feet, etc.

It is possible that external fuels and/or *fuelbreak/firebreak* features can result in the *neighborhood flame zone* not being needed and required.

Connective fuels: For *structures* located inside the *neighborhood flame zone*, there can be no *connective fuel pathway* to any neighboring *structures*. For *structures* that meet the *IBHS Wildfire Prepared Home – Plus* level there will typically be no connective fuel pathways to any side/elevation of a *structure*. However, care must be taken with regards to the impact of *ADUs* and *accessory structures* and their location relative to neighboring *structures*.

C1.2.2 *Neighborhood ember zone*

The *neighborhood ember zone* is the area, typically the remainder of the neighborhood not within the *neighborhood flame zone* which has a high likelihood of experiencing ember attack from *external fuels* and/or *structures* within the *neighborhood* should fire enter. It is determined by the processes described in *Chapter 3* and considers *external fuels* within 4.25 miles of the defined neighborhood.

Those structures located in the neighborhood ember zone must meet the requirements of an *IBHS Wildfire Prepared Home – Base* as specified in the *IBHS Wildfire Prepared Home Technical Standard* (https://wildfireprepared.org/wp-content/uploads/WFPH-Standard.pdf). This includes a fully 0–5 Foot Noncombustible Zone, Class A rated roof covering, noncombustible gutters and downspouts, 6-inch noncombustible vertical wall clearance, ember or ember- and flame-resistant vents, etc.

It is possible the *neighborhood ember zone* will not cover the entire *neighborhood;* this is contingent on neighborhood size and fuel characteristics.

C1.2.3 *Connective fuels* in the *neighborhood ember zone* and remainder of the neighborhood
Connective fuels are evaluated across clusters of homes as described in *Chapter 3*. In general, within the *neighborhood ember zone* and the remainder of the neighborhood, 90% or more homes must have 1 or less *connective fuel pathways* to any neighboring *structure*. It is possible that a home does not have any connective fuel pathways but does not meet the *IBHS Wildfire Prepared Home Base* or *Plus* levels, however all dwelling units which meet the *IBHS Wildfire Prepared Home Standard* (Base or Plus mitigation levels) will generally meet these criteria except for select circumstances likely involving connective *fuel elements*, *ADUs* and *auxiliary structures* and their relative location compared to dwelling units on neighboring *parcels*.

C1.3 New neighborhoods, builders, developers, and planners

The 100% application of *IBHS Wildfire Prepared Home Plus* construction across a new *neighborhood* development, provided the *structure spacing* applicability criteria is met, will generally meet the requirements of this standard except in special cases related to *ADUs*, *auxiliary structures*, and *connective fuels*.

C2 Critical variables

A sample table of critical variables that are required within the processes described in Chapter 3. Those fields which ensure applicability and compliance with the IBHS Wildfire Prepared Neighborhood Standard are shaded green.

Row number	Variable	Description	Value Options	Assigned value
Applicability				
1.	Construction type	Are all primary and accessory dwelling units in the defined neighborhood one of the three types listed in Chapter 1?	**Yes or No?** If yes, standard is applicable	
2.	Structure separation minimum	Are 90% or more structures within the defined neighborhood separated by a minimum distance of greater than 10 feet	**Yes or No?** If yes, standard is applicable	
3.	Structure separation maximum	Are less than 10% of structures within the neighborhood separated by a minimum distance of 100 feet or more	**Yes or No?** If yes, standard is applicable	
If the answers to rows 1,2, and 3 are yes, continue to roof requirements. If no, the standard is not applicable				
Roof				
4.	Class A roof cover compliance	Do all primary or accessory dwelling units in the defined neighborhood have a Class A roof covering? (*note: wood shake, wood shingles of any kind are prohibited*)	**Yes or No?** If Yes, neighborhood is compliant	
If the answer to row 4 is Yes continue to external fuel assessments				
Flame fuel assessment zone	**Variable**	**Description**	**Value Options**	**Assigned value**

Row number	Variable	Description	Value Options	Assigned value
FZ1a.	Sector 1 identified worst case fuel type flame intensity distance	Fuel model type in sector 1 with the longest distance from Table 3.2	Distance from column 2 *Table 3.2* (feet)	
FZ1b.	Sector 1 final FZ value for use in *Equation 4-1*. Canopy Provision	Is the vegetation canopy provision met in sector 1	**If Yes**, distance assigned from column 4 of *Table 3.2* **if No**, value from **FZ1a**. is used	
FZ2a.	Sector 2 identified worst case fuel type flame intensity distance	Fuel model type in sector 2 with the longest distance from *Table 3.2* sector 2	Distance from column 2 *Table 3.2* (feet)	
FZ2b.	Sector 2 final FZ value for use in *Equation 4-1*. Canopy Provision	Is the vegetation canopy provision met in sector 2	**If Yes**, distance assigned from column 4 of *Table 3.2* **if No**, value from **FZ2a**. is used	
FZ3a.	Sector 3 identified worst case fuel type flame intensity distance	Fuel model type in sector 3 with the longest distance from *Table 3.2* in sector 3	Distance from column 2 *Table 3.2* (feet)	
FZ3b.	Sector 3 final FZ value for use in *Equation 4-1*. Canopy Provision	Is the vegetation canopy provision met in sector 3	**If Yes**, distance assigned from column 4 of *Table 3.2* **if No**, value from **FZ3a**. is used	
FZ4a.	Sector 4 identified worst case fuel type flame intensity distance	Fuel model type in sector 4 with the longest distance from *Table 3.2* sector 3	Distance from column 2 *Table 3.2* (feet)	
FZ4b.	Sector 4 final FZ value for use in *Equation 4-1*. Canopy Provision	Is the vegetation canopy provision met in sector 4	**If Yes**, distance assigned from column 4 of *Table 3.2* **if No**, value from **FZ4a**. is used	
FZ5a.	Sector 5 identified worst case fuel type flame intensity distance	Fuel model type in sector 5 with the longest distance from *Table 3.2* in sector 5	Distance from column 2 *Table 3.2* (feet)	
FZ5b.	Sector 5 final FZ value for use in *Equation 4-1*. Canopy Provision	Is the vegetation canopy provision met in sector 5	**If Yes**, distance assigned from column 4 of *Table 3.2* **if No**,	

Row number	Variable	Description	Value Options	Assigned value
			value from **FZ5a**. is used	
FZ6a.	Sector 6 identified worst case fuel type flame intensity distance	Fuel model type in sector 6 with the longest distance from *Table 3.2* in sector 6	Distance from column 2 *Table 3.2* (feet)	
FZ6b.	Sector 6 final FZ value for use in *Equation 4-1*. Canopy Provision	Is the vegetation canopy provision met in sector 6	**If Yes**, distance assigned from column 4 of *Table 3.2* **if No**, value from **FZ6a**. is used	
FZ7a.	Sector 7 identified worst case fuel type flame intensity distance	Fuel model type in sector 7 with the longest distance from *Table 3.2* in sector 7	Distance from column 2 *Table 3.2* (feet)	
FZ7b.	Sector 7 final FZ value for use in *Equation 4-1*. Canopy Provision	Is the vegetation canopy provision met in sector 7	**If Yes**, distance assigned from column 4 of *Table 3.2* **if No**, value from **FZ7a**. is used	
FZ8a.	Sector 8 identified worst case fuel type flame intensity distance	Fuel model type in sector 8 with the longest distance from *Table 3.2* in sector 8	Distance from column 2 *Table 3.2* (feet)	
FZ8b.	Sector 8 final FZ value for use in *Equation 4-1*. Canopy Provision	Is the vegetation canopy provision met in sector 8	**If Yes**, distance assigned from column 4 of *Table 3.2* **if No**, value from **FZ8a**. is used	

The values determined in rows FZ1b, FZ2b…FZ8b are used to create a polygon inside the defined neighborhood boundary which determines the *neighborhood flame zone*.

Once the *neighborhood flame zone* boundary is determined:

Row number	Variable	Description	Value Options	Assigned value
Neighborhood flame zone				
FRz1.	Structure separation	Are 10% or more *structures* within the *neighborhood flame zone* separated by a minimum distance of less than 30 feet	**Yes or No?** If yes, specific *connective fuel* provisions are required in this zone &	

Row number	Variable	Description	Value Options	Assigned value
			additional ember transport distances are also required (see *Table 3.3*)	
FRz2a.	*Neighborhood flame zone* mitigation requirements – connective fuels	**If FRz1 is Yes**: Does any primary or accessory dwelling unit in the neighborhood flame zone have one or more connective fuel pathways to any side/elevation?	**Yes or No?** If yes, the zone is non-compliant If no, the zone is compliant	
FRz2b.	*Neighborhood flame zone* mitigation requirements – connective fuels	**If FRz1 is No**: Does any primary or accessory dwelling unit in the neighborhood flame zone have more than one connective fuel pathways to any side/elevation?	**Yes or No?** If yes, the zone is non-compliant If no, the zone is compliant	
FRz3.	*Neighborhood flame zone* structure mitigation requirements	Do all primary and accessory dwelling units in the neighborhood flame zone meet the requirements of IBHS *WFPH Plus?*	**Yes or No?** If yes, the zone is compliant If no, the zone is non-compliant	

The *neighborhood ember zone* is determined by the processes stated in *Chapter 3, Section 3.4*. For each sector vector length calculations are required for each sector to determine the final *neighborhood ember zone* provisions.

Row number	Variable	Description	Value Options	Assigned value
Neighborhood ember zone				
Ez1.	Sector 1 longest ember transport vector length	Sector 1 longest ember transport vector length measured from the boundary of the *neighborhood* directed radially inward toward or through the	Calculated distance using *Table 3.3* and the defined *neighborhood* boundary	

Row number	Variable	Description	Value Options	Assigned value
		centroid of the *neighborhood*		
Ez2.	Sector 2 longest ember transport vector length	Sector 2 longest ember transport vector length measured from the boundary of the *neighborhood* directed radially inward toward or through the *centroid* of the *neighborhood*	Calculated distance using *Table 3.3* and the defined *neighborhood* boundary	
Ez3.	Sector 3 longest ember transport vector length	Sector 3 longest ember transport vector length measured from the boundary of the *neighborhood* directed radially inward toward or through the *centroid* of the *neighborhood*	Calculated distance using *Table 3.3* and the defined *neighborhood* boundary	
Ez4.	Sector 4 longest ember transport vector length	Sector 4 longest ember transport vector length measured from the boundary of the *neighborhood* directed radially inward toward or through the *centroid* of the *neighborhood*	Calculated distance using *Table 3.3* and the defined *neighborhood* boundary	
Ez5.	Sector 5 longest ember transport vector length	Sector 5 longest ember transport vector length measured from the boundary of the *neighborhood* directed radially inward toward or through the *centroid* of the *neighborhood*	Calculated distance using *Table 3.3* and the defined *neighborhood* boundary	
Ez6.	Sector 6 longest ember transport vector length	Sector 6 longest ember transport vector length measured from the boundary of the *neighborhood* directed radially inward toward	Calculated distance using *Table 3.3* and the defined *neighborhood* boundary	

Row number	Variable	Description	Value Options	Assigned value
		or through the *centroid* of the *neighborhood*		
Ez7.	Sector 7 longest ember transport vector length	Sector 7 longest ember transport vector length measured from the boundary of the *neighborhood* directed radially inward or through the *centroid* of the *neighborhood*	Calculated distance using *Table 3.3* and the defined *neighborhood* boundary	
Ez8.	Sector 8 longest ember transport vector length	Sector 8 longest ember transport vector length measured from the boundary of the *neighborhood* directed radially inward toward or through the *centroid* of the *neighborhood*	Calculated distance using *Table 3.3* and the defined *neighborhood* boundary	

Row number	Variable	Description	Value Options	Assigned value
Neighborhood ember zone				
Ez9.	*Neighborhood ember zone* coverage	Does the *neighborhood* ember zone cover the remainder of the *neighborhood* not included in the *neighborhood flame zone* or if no *neighborhood flame zone* is present, is the entire neighborhood included in the *neighborhood ember zone*?	**Yes or No?**	
Ez10.	*Neighborhood ember zone* mitigation requirements	Do all primary and secondary dwelling units located in the *neighborhood ember zone* meet the requirements of *IBHS WFPH Base*?	**Yes or No?** If yes, the *neighborhood ember zone* is compliant. If no, the *neighborhood ember zone* is non-compliant	

Connective fuels are evaluated by identified *clusters* of *structures*. Each *cluster* is assigned its own integer identifier. If the *neighborhood flame zone* is present and 10% or more of its *structures* have a minimum spacing of less than 30 feet the *neighborhood flame zone* is evaluated separately for *connective fuels*.

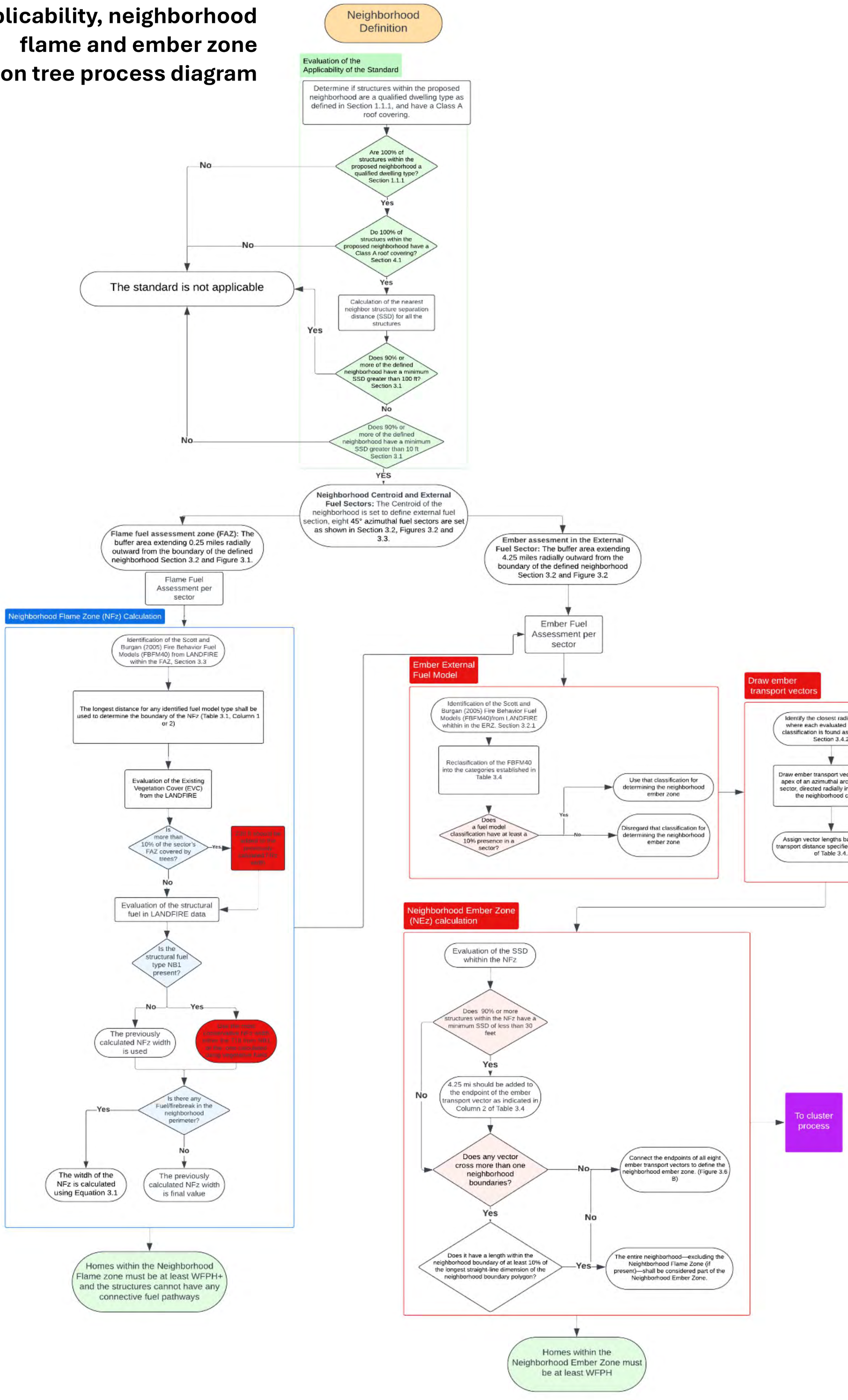
Row number	Variable	Description	Value Options	Assigned value
Connective Fuels				
CF1a.	Connective fuel flagged clusters	How many identified *structure clusters* were flagged for *connective fuels*?	Integer	
CF1b.	Total structures in connective fuel flagged clusters	How many *primary or accessory dwelling units* are located in a *connective fuel flagged clusters*?	Integer	
CF2a.	Connective fuel compliance	**If NFz1 is Yes**, Does the total number of	**Yes or No?**	

		primary and accessory dwelling units inside *connective fuel flagged clusters* AND not inside the *neighborhood flame zone* 10% or less than the total number of *dwelling units* in the *neighborhood*	If yes, the neighborhood not included in the *neighborhood flame zone* is compliant. If no, the area not included in the *neighborhood flame zone* is non-compliant	
CF2b.	Connective fuel compliance	**If NFz1 is No**, Does the total number of *primary and accessory dwelling units* inside connective fuel flagged clusters 10% or less than the total number of *dwelling units* in the *neighborhood*	**Yes or No?** If yes, the entire *neighborhood* is compliant. If no, the entire *neighborhood* is non-compliant	

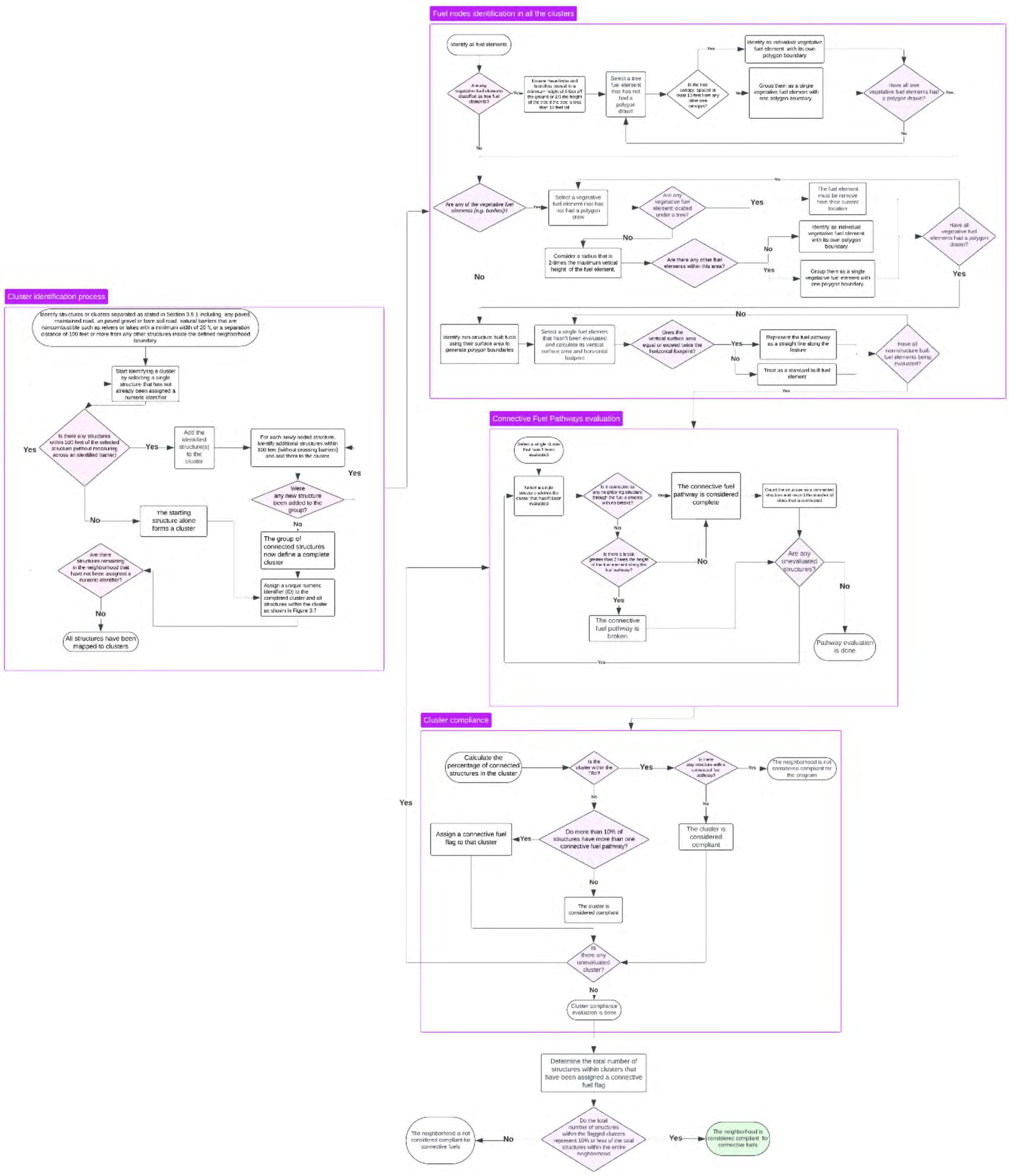
C3 Process diagrams

The decision-tree process diagrams for the standard applicability, neighborhood flame zone, neighborhood ember zone, cluster, and connective fuels are provided on pages 105–106 and available to download at wildfireprepared.org along with this standard.

Applicability, neighborhood flame and ember zone decision tree process diagram



Cluster and connective fuels process



Appendix D

IBHS - Wildfire Prepared Home Technical Standard

WILDFIRE PREPARED

A PROGRAM OF IBHS

TECHNICAL STANDARD

WILDFIRE PREPARED HOME

WILDFIRE PREPARED HOME PLUS



2025 Wildfire Prepared Home Technical Standard

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2025 Wildfire Prepared Home™ Technical Standard

1 PROGRAM OVERVIEW

1.1 Designations

The Wildfire Prepared Home™ program provides homeowners with science-based actions to help protect their properties from wildfire. Developed by the Insurance Institute for Business & Home Safety (IBHS) and based on research from IBHS's Suburban Wildfire Adaptation Roadmaps, this program follows a systems-based, two-tiered approach to reducing parcel-level wildfire risk.

A home earns a "designation" by meeting all wildfire mitigation requirements for its selected level in the Wildfire Prepared Home program. Applicants may use the How-To Prepare My Home Checklist to complete the wildfire mitigation work before applying. To apply, homeowners pay a nonrefundable application fee, submit eligibility photos for IBHS review, and verified documentation will be collected by a third-party evaluation company. Once all requirements are confirmed, IBHS issues a designation certificate for the home.

1.1.1 Designation Levels

Two designations are available. To earn a designation, a home shall meet all the requirements for the chosen designation level, as evaluated by an authorized third-party, and verified by IBHS. The Plus level builds upon the Base level requirements. *See Figure 1.*



Figure 1. Abbreviated List of Requirements

- **Wildfire Prepared Home Base –** Applicants for this level must meet criteria such as creating the 0–5 Foot Noncombustible Zone, upgrading building features, and maintaining the defensible space surrounding the parcel to 30 feet. This is typically achieved when retrofitting existing homes.
- **Wildfire Prepared Home Plus –** This level includes additional protective measures beyond the Base level for key building features of the home, and it is easiest to achieve with newly constructed homes or those undergoing exterior renovations.

1.1.2 Designation Level Goals

Wildfire Prepared Home is a designation program that reduces wildfire risks to homes through a system of mitigation actions at the parcel level, based on the latest science and research from the nonprofit Insurance Institute for Business & Home Safety (IBHS).

- **Wildfire Prepared Home Base –** Helps protect a home from embers by addressing vegetation and items on and around the home, breaking the pathway of connective fuels for fire to spread to the structure by embers.

- **Wildfire Prepared Home Plus –** Adds extra protection by using specific building materials to help defend against radiant heat and direct flames.

1.1.3 Designation Process and Timelines: Initial, Annual Reviews, and Designation Renewal and Expiration

1.1.3.1 Initial Designation

Homes earn a **Wildfire Prepared Home designation** by meeting all wildfire mitigation requirements for their selected level in the program. The designation is **valid for three years** and remains in **Active status** by completing an **Annual Review** each of the first **two years** following the initial designation, leading up to the **3-year designation expiration**.

Before applying, applicants can complete the required wildfire mitigation using the **How-To Prepare My Home Checklist,** based on the Technical Standard.

How to Apply

- Visit the website at https://wildfireprepared.org and click "Apply Now."
- Pay the nonrefundable application fee.
- Take and submit eligibility photos for IBHS review.

Once eligibility photos are approved, a third-party evaluation company will conduct an in-person evaluation to collect documentation that will be verified. Once all requirements are confirmed, IBHS will issue a **Wildfire Prepared Home designation certificate** for the home.

1.1.3.2 Annual Reviews

To remain in **Active designation status** and ensure continued maintenance compliance, homeowners must complete an **Annual Review** each of the first **two years** following their initial designation, leading up to the **3-year designation expiration**. This process verifies that your property remains mitigated to reduce wildfire risk.

On Time Annual Reviews

- **When to Apply:** To maintain Active status, designated properties must apply for the Annual Review during the 60-day period leading up to the Anniversary Date, as indicated on the most recent designation certificate. Submissions after the Anniversary Date will incur a late fee.
- **Application & Fee:** Applicants must submit an Annual Review application, pay the nonrefundable Annual Review fee in effect at the time of submission, and provide photo documentation demonstrating maintenance compliance.
- **Paid Grace Period:**
  - **Active:** If the Annual Review has been paid for by the Anniversary Date, the property will remain in Active status for 60 days following the Anniversary Date (Active 60-day grace period) to allow time to complete the Annual Review process.
  - **Inactive:** If the Annual Review has been paid for by the Anniversary Date but is not completed and approved by IBHS within the Active 60-day grace period, the application will become Inactive. Inactive applications will be automatically closed 60 days before either the second Annual Review Anniversary or Expiration Date listed on the most recent designation certificate, whichever comes first.

Late Annual Reviews

- **When Is It Late?** An Annual Review is considered late if submitted after the Anniversary Date listed on the most recent Wildfire Prepared Home designation certificate.
- **Application & Late Fee:** Applicants must submit an Annual Review application, pay the nonrefundable Annual Review fee, as well as an additional late fee in effect at the time of submission. They must also provide photo documentation demonstrating maintenance compliance.
- **Grace Period:**
  - If the Annual Review is paid for within the 60-day "Active" Grace Period following the Anniversary Date but is not completed and approved by IBHS within this timeframe, the application will automatically become Inactive.
  - If the Annual Review is paid for after the 60-day "Active" Grace Period following the Anniversary Date, the property will remain Inactive until the application is approved by IBHS. Inactive applications will be

automatically closed 60 days before either the second Annual Review or the Expiration Date listed on the most recent designation certificate, whichever comes first.

Ongoing Maintenance Requirements for Annual Reviews

Regular maintenance is required to ensure your home and defensible space continue to meet the designation standard to meaningfully reduce wildfire risk. Growing, fallen, or dead vegetation, as well as new structures, can increase ignition risk. Think of your Annual Review like a **Red Flag Warning** – take proactive maintenance measures to help protect your home. To stay compliant, complete all of the following annual maintenance steps:

- Keep **gutters, downspouts, and the roof clear** of debris.
- Ensure the **0–5 Foot Noncombustible Zone** is properly maintained.
- Ensure the **5-30 Foot Defensible Space** is properly maintained.
- Regularly maintain all **decks and porches**.
- Ensure any **new additions or changes** (e.g., fences, structures, decks, hot tubs, propane tanks) remain compliant.
- **Note:** For specific maintenance requirements, see the appropriate sections in this Technical Standard.

1.1.3.3 Designation Renewal and Expiration

At the end of the 3-year designation period, a property's Wildfire Prepared Home designation will expire. To maintain an Active designation status, homeowners must complete the full designation process to verify continued compliance with the most current Technical Standard.

Designation Renewal

- **When to Apply:** To maintain an Active designation, homeowners must submit their application and complete the full process before the Expiration Date listed on the most recent designation certificate. Allow enough time to complete all required steps. If approved, the new certificate will align with the initial designation date and extend the designation for another 3 years.
- **How to Apply:** See Initial Designation requirements.

Expired Designation

- **Expired Status:** A Wildfire Prepared Home designation is considered Expired if the full re-designation process is not completed by the Expiration Date listed on the most recent designation certificate.
- **How to Apply:** Once expired, applicants must complete the full designation process as a new application, verifying compliance with the most current Technical Standard. The designation will remain Expired until IBHS approves the new application. See Initial Designation requirements.

1.1.4 Designation Eligibility

- **Applicant –** The applicant shall be the homeowner who is responsible for paying a nonrefundable application fee and submitting eligibility photos.
- **Eligibility Photo Requirements –** The applicant will provide clear and adequate documentation to IBHS to qualify for an evaluation, as required by the program. This includes photos of all sides of the home, capturing key building features and the 0–5 Foot Noncombustible Zone. To qualify, all requirements for the desired designation level shall be met, including the 0–5 Foot Noncombustible Zone around the home and any attachments (e.g., decks).
- **Qualifying Dwelling Types –** The designation is available for a single-family detached home, a freestanding residential building occupied by one family, limited to three stories above grade. This also includes a detached single-family factory-built modular home on a permanent foundation that is designed, built, and sited to meet all local building code requirements.
- **Non-qualified Dwelling Types –** Manufactured homes, townhomes, multifamily housing, and nonresidential buildings are not eligible for a Wildfire Prepared Home designation.
- **Applicable Locations –** The home shall be in California or Oregon.
  - The designation has strict no-exception requirements. Protected trees may disqualify some homes, and homeowners may need to work with neighbors and Homeowners Associations (HOAs) to meet the 0–5 Foot Noncombustible Zone setback.
  - Designations cannot be granted for homes under active construction. All home components and defensible space requirements shall be complete to receive designation.

1.2 Red Flag Warning and Extended Absence Preparedness

To help protect your home during Red Flag Warning days and during extended absences, take the following maintenance steps:

- **0–5 Foot Noncombustible Zone –** Clear all accumulated vegetative debris and combustible items from this critical area.
- **Roof and Gutters –** Ensure no vegetative debris, such as leaves or needles, is left on your roof or in gutters.
- **Combustible Items –** Relocate combustible items indoors or at least 30 feet away from the home. Examples include small door mats, chair cushions, potted plants, trash and recycle bins, kids' toys, pet beds, pool accessories, decorations, and BBQ grills with a propane tank.
- **Parked Items –** Move vehicles, motorcycles, trailers, boats, campers, RVs, ATVs, and similar vehicles at least 30 feet away from the home.

2 BASE LEVEL DESIGNATION REQUIREMENTS

To achieve a **Wildfire Prepared Home Base** designation, a home shall meet all listed requirements for this level, including specific building features and maintaining 30 feet of defensible space or to the property line around the home. These requirements must be met and maintained to qualify and receive a designation certificate.

2.1 Building Feature Requirements for the Base Level

2.1.1 Roof Covering

- The **roof covering material** shall have a **Class A rating** when tested in accordance with ASTM E108 or UL 790. Class A rated roof covering types include, but are not limited to, fiberglass composition asphalt shingles, concrete and clay tiles, metal shingles or sheets, and slate.
- **Roof cover maintenance** shall also meet all the following:
  - Kept **clear of vegetative debris**.
  - Where provided, barrel tile or corrugated roof coverings shall include **noncombustible bird stops** at the eave ends to prevent the entry of embers and debris.
- **Note:** Given the potential service life uncertainties of both ignition-resistant treatments and applied ignition-resistant coatings, the use of wood shake, wood shingle, or any wood roof covering material regardless of test rating are not permitted.

2.1.2 Gutters and Downspouts

- Where gutters and downspouts are provided, shall include all the following:
  - Gutters and downspouts shall be made of **noncombustible material** (e.g., metal).
  - Gutters and downspouts shall be maintained **clear of vegetative debris**.

2.1.3 Vents

Ventilation openings, including for enclosed attics, gable ends, ridge ends, under eaves and cornices, enclosed eave soffit spaces, enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters, underfloor ventilation, foundations, and crawl spaces, or for any other opening intended to permit ventilation, shall meet one of the following requirement options:

- **Performance-based Option –** Corrosion-resistant vents installed, conforming with the following ASTM E2886 test requirements for **flame- and ember-resistance**:
  - No flaming ignition of the cotton material during the Ember Intrusion Test.
  - No flaming ignition during the Integrity Test portion of the Flame Intrusion Test.
  - Temperature of the unexposed side of the vent does not exceed 662°F.
  - ***Note:*** Joints around such vents shall be sealed with sealants in accordance with vent manufacturer installation instructions to avoid ember and flame intrusion through the joints.
- **Prescriptive Option –** Vents shall be **covered with a noncombustible, corrosion-resistant mesh** with openings not to exceed 1/8-inch in diameter for ember-resistance.
  - ***Exceptions:***
    - Forced air vents (e.g., dryer and central vacuum) shall have a functional louver or flap in lieu of mesh.
    - Plumbing vents are excluded from this requirement.

2.1.4 6-inch Vertical Noncombustible Wall Covering Clearance

All exterior walls shall have at least **6-inches of noncombustible material** (e.g., exposed concrete foundation, fiber-cement, brick or stone veneer, stucco, metal flashing) applied vertically on the **base of the wall** measured from the ground at grade and the nearest horizontal surface (e.g., decks and patios).

- **Note:** All combustible deck posts shall include the 6-inch Vertical Noncombustible Wall Covering Clearance requirement, see 2.1.5 and 2.1.6 below.

2.1.5 Attached Patios, Decks, and Overhead Structures (e.g., Covered Porches, Pergolas, Carports, and Gazebos)

Attached patios and decks, including stairs and overhead structures, are considered part of the building footprint as illustrated in Figure 2 and shall meet all the following requirements:

2.1.5.1 Around the Structure –

The structure shall have its own **0–5 Foot Noncombustible Zone**, measured from the outermost posts (see 2.2.1 0–5 Foot Noncombustible Zone for requirements).

- ***Exception:*** Noncombustible patio walking surface and completely noncombustible (e.g., metal) pergola.

2.1.5.2 Top of Walking Surfaces –

Vegetation Maintenance

- All walking surfaces shall be **clear of vegetative debris, planter boxes, and climbing vines**.
- Woody vegetation, including plants, shrubs, bushes, and trees, are not permitted.
    - ***Exception:*** Up to 10 noncombustible potted plants (e.g., terra cotta or clay) are permitted, provided:
        - Each plant, including the noncombustible pot, shall not exceed 36 inches in height and width.
        - Potted plants can be relocated indoors or at least 30 feet from the home during Red Flag Warnings or extended absences.

Furniture

- Shall be **noncombustible framed** (e.g., cast iron, aluminum, or metal), including but not limited to hanging chairs, rocking/lounge chairs, swinging benches, picnic benches, tables and chairs, and sectional furniture with ottomans.
    - ***Exception:*** A small number of combustible items (e.g., chair cushions) that can be relocated indoors or 30 feet away on Red Flag Warning days or during extended absences are permitted.

Combustible Items

- Shall be **clear of combustible items** including, but not limited to, sheds, saunas, storage containers, combustible privacy dividers, artificial turf, large area rugs, plastic covers, hanging lamps, window-mounted AC units, drapes, shade screens, plastic rain barrels, wine barrels, wood planters, and retractable shade screens without a noncombustible housing or replaced with noncombustible alternatives.
    - ***Exceptions:***
        - A limited number of items including, but not limited to, door mats, string lights, TVs, speakers, bird feeders, ceiling fans, pet doors and beds, trash/recycle bins, kids' toys, pool accessories, decorations, garden hoses, and BBQ grills with propane tank and covers are permitted.
        - All movable combustible items need to be relocated indoors or 30 feet away on Red Flag Warning days or during extended absences.

2.1.5.3 Additional Structures –

Overhead Structures (e.g., covered porches, pergolas, carports, and gazebos)

- **Roof Covering –** Shall meet one of the following requirements:
    - A solid roof covering material with a Class A rating when tested in accordance with ASTM E108 or UL 790, or
    - Constructed of combustible slats (e.g., pergola) that cover no more than 15% of the total surface area.
- **Setback –** A detached combustible overhead structure (e.g., pergola and gazebo) on an attached deck shall be at least **10 feet from all exterior walls** of the home. (see 2.2.3 Detached Accessory Dwelling Units and Accessory Structures for additional requirements).
    - ***Exception:*** An overhead structure constructed entirely of noncombustible materials is permitted with no setback requirement.
- **Posts –** Combustible posts shall have at least **6-inches of noncombustible wall covering material** (e.g., fiber-cement, metal flashing, masonry veneer, or stucco) applied vertically on the base of the posts measured from the ground at grade and the nearest horizontal surface (e.g., decks and patios).
- **Other –** Shall be free of any vegetation, curtains, drapes, and shade screens.
    - ***Exception:*** Shade screens that retract into noncombustible housing are permitted.

- **Carports and Garages –** In addition to having at least **6-inches of vertical noncombustible wall covering material and the 0–5 Foot Noncombustible Zone** under and around the structure, shall meet all of the following requirements**:**
    - Shall not store combustible items.
    - An open carport with exposed combustible interior wall covering (e.g., wood), shall be enclosed.

Other Large Combustibles

- **Hot Tubs –**
    - Where provided, shall be at least **10 feet from the home's exterior walls and other large combustibles**, and **not under a combustible overhead structure** (e.g., covered porch, pergola, or gazebo).
    - Where provided, **on a combustible surface** (e.g., wood or composite deck), shall have noncombustible material under the hot tub and extending to 2 feet around all sides of the hot tub.
    - Where provided, **on a noncombustible surface or patio**, shall have the 0–5 Foot Noncombustible Zone around the hot tub.
- **Outdoor Kitchens, Bars, and Built-ins –**
    - Where provided, shall be constructed entirely of **noncombustible materials**.
    - If attached to the home, shall have 6-inches of noncombustible material applied vertically on the wall (e.g., backsplash) measured above any horizontal surface of the kitchen, bar, and built-in.

2.1.5.4 Underneath an Elevated Deck –

- **Vegetation and Groundcover -** Shall **remove all vegetation and combustible groundcover** (e.g., grass, weeds, plants, shrubs, bushes, trees, exposed weed cloth, wood and rubber mulch) to bare mineral soil.
    - **Note:** Noncombustible hardscape materials (e.g., gravel, pavers, river rocks, decomposed granite, steppingstones, and concrete) are permitted.
- **6-inch Vertical Noncombustible Clearance –** Shall have at least **6-inches of noncombustible wall covering material** (e.g., fiber-cement, metal flashing, masonry veneer, or stucco) applied vertically at the base of all posts, supporting walls, and stairs measured from the ground at grade.
- **Lattice and Mesh –** Where provided, **combustible lattice material** (e.g., wood or plastic), shall be removed from at least the bottom 6-inches or replaced with noncombustible material (e.g., metal). Where noncombustible corrosion-resistant metal mesh is provided, the mesh shall be installed on the outside of the lattice.
- **No Storage –** Shall have **nothing stored underneath**.
    - ***Exception:*** An open outdoor living area under the deck shall meet the same requirements (see "Top of walking surfaces" above).
- Additionally, **decks with a walking surface of 4 feet or less above the ground**, shall be enclosed with the following:
    - When measured from the walking surface to the ground, the underdeck area with this height or less shall be **enclosed with noncombustible, corrosion-resistant mesh**. The mesh openings shall not exceed 1/8-inch in diameter and shall fully enclose the outer edge of the deck from the walking surface to the ground. This enclosure is required to reduce debris accumulation and limit ember intrusion beneath the deck.

2.1.6 Detached Decks and Overhead Structures (e.g., Covered Porches, Pergolas, Carports, and Gazebos)

Where provided, detached decks and overhead structures within 30 feet of the home shall meet the same requirements as attached decks (see 2.1.5 Attached Patios, Decks, and Overhead Structures).

2.2 Defensible Space Requirements for the Base Level

2.2.1 0–5 Foot Noncombustible Zone – Area within 5 Feet of the Home and Attachments

The first five feet surrounding the home and its attachments (e.g., decks, patios, overhead structures, stairs) is the **most critical area of defensible space.** This zone shall be established and maintained as noncombustible.

The 0-5 Foot Noncombustible Zone is measured horizontally from the **edge of the home's exterior walls** and, if present, the outermost posts of a deck or overhead structure, extending outward to 5 feet (see Figure 2). This noncombustible area also extends vertically to the sky.



Figure 2. The 0–5 Foot Noncombustible Zone

The **0–5 Foot Noncombustible Zone** shall meet <u>all the following requirements</u>:

- **Vegetation –**
  - Shall **remove all vegetation** (e.g., grass, artificial turf, weeds, flowers, succulents, cacti, plants, shrubs, bushes, and vegetative debris) **within 5 feet** to bare mineral soil.
  - Shall **remove all trees**, limbs, branches, and vines that are within **and that overhang** the 0–5 Foot Noncombustible Zone.
- **Groundcover –**
  - Shall **remove all combustible groundcover materials** (e.g., wood and rubber mulch and exposed weed cloth) within 5 feet to bare mineral soil.
    - **Note:** Noncombustible hardscape materials (e.g., gravel, pavers, river rocks, decomposed granite, steppingstones, and concrete) are permitted.
- **Fencing and Retaining Walls –**
  - Shall **remove combustible fencing materials** (e.g., wood and vinyl), posts, gates, and retaining walls **within 5 feet** or replace with noncombustible material.
- **Parked Items –**
  - Shall not store vehicles, motorcycles, trailers, boats, campers, RVs, ATVs, and similar vehicles within 5 feet. Relocate them at least 30 feet away on Red Flag Warning days or during extended absences.
- **Combustible Items –**
  - **Removal Requirement:** Shall **remove all combustible items within 5 feet** including, but not limited to, drapes, hot tubs, outdoor kitchens, bars, built-ins, firewood, furniture, hanging lamps, window-mounted AC units, large area rugs, combustible privacy dividers, plastic rain barrels, wine barrels, wood planters, playsets, saunas, sheds, storage containers, shade screens, and retractable shade screens <u>without</u> a noncombustible housing.
  - **Replacement Option:** Certain combustible items (e.g., furniture) may be replaced with noncombustible-framed alternatives.
  - ***Exceptions:***
    - A limited number of items including, but not limited to, door mats, string lights, TVs, speakers, bird feeders, pet doors and beds, trash/recycle bins, kids' toys, pool pumps and accessories, garden hoses, BBQ grills with propane tank and cover, HVAC units (e.g., compressor fans), plastic downspout extensions, retractable shade screens <u>with</u> noncombustible housing, solar panel battery enclosures, and irrigation valves are permitted.
      - **All movable combustible items need to be relocated** indoors or at least 30 feet away on Red Flag Warning days or during extended absences.
- **Reference Sections for Other Items:**
  - For large combustibles (e.g., hot tubs, outdoor kitchens, and built-ins), see section 2.1.5.3.
  - For pergolas, see section 2.1.5.3.

- For large structures (e.g., sheds, ADU units), see 2.2.3 for Base and 3.2.2 for Plus.

2.2.2 5–30 Foot Defensible Space Zone – Area Surrounding the Home and Attachments

To slow fire spread and reduce flame intensity near the home, horizontal and vertical separation of vegetation, structures, and other connective fuels shall be created and maintained within 5 to 30 feet around the structure and its attachments or to the property line, whichever is closest. The 5–30 Foot Defensible Space Zone shall meet all the following requirements:

2.2.2.1 Vegetation

- **Tree Spacing –**
  - Shall have tree limbs and branches pruned to a minimum height of **6 vertical feet above the ground** or one-third the height of the tree if less than 18 feet tall.
  - Shall regularly prune tree branches to provide at least **10 feet of horizontal spacing** between crowns of adjacent trees. **Privacy rows of trees are not permitted.**
  - Shall keep all branches a minimum of **10 feet away from chimney** and stovepipe outlets.
- **Shrub Spacing –**
  - Shrubs, bushes, and plants shall **not be placed under larger trees**.
  - Individual shrubs or shrubs clustered in small groupings or islands, shall have total foliage covering less than **10 feet in horizontal diameter** and shall be treated as a single shrub.
  - Individual shrubs, bushes, and plants or groupings shall have a minimum horizontal spacing between other trees, shrubs, bushes, and plants of **2 times the height of the tallest plant** (i.e., a 3-foot-tall shrub must have a 6-foot clearance surrounding it) with a maximum required horizontal spacing of 10 feet. Privacy hedges and rows of bushes are not permitted.
- **Maintenance –**
  - Shall cut down annual grasses to **less than 4 inches** in height.
    - ***Exception:*** Grass may be kept to less than 18 inches in height on slopes where necessary to stabilize the soil and prevent erosion.
  - Shall routinely **remove dead and dying vegetation** (e.g., grass, weeds, plants, shrubs, bushes, trees, logs, stumps, branches, leaves, and pine needles).
  - Shall place **wood piles at least 30 feet away** from the home unless the wood is stored in an accessory structure (see 2.2.3 Accessory Dwelling Units and Accessory Structures for Base Level requirements or 3.2.2 for Plus Level requirements). Fire-retardant tarps are not permitted.

2.2.2.2 Other items

- **Liquid Propane Gas Storage Tanks and Fuel Tanks (e.g., diesel and kerosene)** – Where provided, shall meet one of the following requirements:
  - Shall be at least 30 feet from the home, or
  - Shall be at least 10 feet from the home and have the following minimum clearance, and
    - **0-10 feet –** Shall have 10 feet of noncombustible clearance to bare mineral soil under and around the tank, including removal of vegetation, groundcover, fencing, and all combustible items. Noncombustible hardscape materials (e.g., gravel, pavers, river rocks, decomposed granite, steppingstones, and concrete) are permitted.
      - ***Exception:*** Healthy, mature trees are permitted if limbed up to maintain at least 6 feet of clearance above the tank.
    - **10-20 feet –** Shall extend clearance an additional 10 feet around their exterior. The additional 10 feet of clearance includes cutting annual grasses down to less than four inches in height; removing plants, shrubs, bushes, and small trees; and removing dead plants, shrubs, bushes, trees, limbs, branches, logs, and stumps.
      - ***Exception:*** Healthy, mature trees are permitted if limbed up to maintain at least 6 feet of clearance above the tank.

- **Combustible Water Storage Tanks –**
  - Where provided, shall be at least **5 feet from the home's exterior walls** and other large combustibles and not under a combustible overhead structure (e.g., covered porch, pergola, or gazebo).
    - ***Exception:*** Multiple water storage tanks within 5 feet of each other are permitted.
  - Shall have the 0–5 Foot Noncombustible Zone (e.g., bare dirt, gravel, concrete) underneath and surrounding the tank.

2.2.3 Detached Accessory Dwelling Units and Accessory Structures (within the 5-30 Foot Defensible Space Zone)

- **All Structures [e.g., Overhead Structures (e.g., Pergolas, Carports, Garages, Gazebos) Sheds, Greenhouses, Playsets, etc.]** with a footprint greater than or equal to 15 square feet and within 30 feet of the home and attachments, where provided, shall meet all the following requirements:
  - Structures shall be at least **10 feet from the home and attachments**.
  - Structures shall meet the same wildfire resilience requirements for the home, such as roof covering, gutters and downspouts, vents, 6-inch vertical noncombustible wall covering clearance, decks, and the 0-5 Foot Noncombustible Zone surrounding them.
  - Space **multiple structures** at least **10 feet apart** from each other. Each structure's 0–5 Foot Noncombustible Zone under and around the structure shall not overlap the 0–5 Foot Noncombustible Zone required for the home, decks, or other structures within 30 feet.
  - Shall have **no more than 3 total** ADUs and accessory structures within 30 feet.
  - Additionally, **open detached carports and garages**, where provided:
    - Shall not store combustible items.
    - An open carport with exposed combustible interior wall covering (e.g., wood), shall be enclosed.
  - **Note – Ongoing Research:** As of publication of this standard, IBHS continues active research into the spacing required between structures to reduce the likelihood of structure-to-structure fire spread, including the impact of structural openings, building materials, and connective fuels. The provisions of this section of the standard may be updated as this research matures.

3 PLUS LEVEL DESIGNATION REQUIREMENTS

To achieve a **Wildfire Prepared Home Plus** designation, a home shall first meet all the requirements of the **Base** level, except where the **Plus** level designation requirements are more restrictive. In addition, the home shall include additional building features and shall meet all of the following **Plus** requirements:

3.1 Building Features Requirements for the Plus Level

3.1.1 Gutters and Downspouts

Where provided, in addition to having noncombustible material for gutters and downspouts as required for the Base level, gutters shall also be **covered with a noncombustible material** to prevent the accumulation of vegetative debris.

3.1.2 Eaves and Soffits

In addition to the vent opening requirement for eaves and soffits listed for the Base level requirements, eaves shall be **enclosed or protected on the exposed underside** using one of the following required options:

- Noncombustible materials
- Materials approved for not less than 1-hour fire-resistance-rating
- 2-inch nominal dimension lumber

3.1.3 Vents

In addition to having a functional louver or flap for forced air vents (e.g., dryer and central vacuum) as required for the Base level requirements, they shall also be **made of noncombustible material** (e.g., metal).

3.1.4 Exterior Wall Covering

- In addition to having the bottom 6-inches of exterior walls made of noncombustible material as required for the Base level, **all exterior wall covering shall be made of a noncombustible material** (e.g., metal, fiber-cement, masonry veneer, stucco, brick, concrete).
- Where provided, all shutters (e.g., decorative and operable) shall be made of noncombustible material.
- **Note:** Combustible and ignition-resistant wall cover material (e.g., wood shake, wood shingle, or any other wood siding material including ignition-resistant treatments and coatings) by construction or assembly are not permitted.

3.1.5 Exterior Glass (Windows, Skylights, and Glazed Openings within Doors)

All exterior windows, skylights, and glazed openings within doors shall comply with one of the following requirements:

- Multipaned glass with **at least two tempered panes.**
- Glass with a minimum of 20-minutes fire-resistance rating when tested in accordance with NFPA 257.
- Glass blocks (windows only).
- **Operable skylights** shall be protected by a noncombustible mesh screen where mesh openings shall not exceed 1/8-inch in diameter.

3.1.6 Exterior Doors

All exterior doors shall comply with one of the following requirements:

- Exterior doors shall be approved **noncombustible construction**, or solid-core wood not less than 1-¾ inches thick (44 mm). The exterior doors shall be constructed with noncombustible threshold. Windows within doors and glazed doors shall be in accordance with this standard's exterior glass requirements (see 3.1.5 Exterior Glass).
- Exterior door assembly shall have a fire-resistance rating of not less than 20-minutes when tested according to NFPA 252.
- Doors made of combustible material (e.g. non-solid core wood doors) are permissible provided a noncombustible exterior storm door is installed as the outermost door.

3.1.7 Decks and Stairs

In addition to the Base level requirements, decks shall meet <u>one of the following</u> required options:

- **Option 1: New Construction -** All deck components, including posts, joists, railings, stairs, and walking surfaces, shall be constructed with noncombustible materials.
- **Option 2: Retrofit -**
  - **Deck Walking Surfaces** shall be constructed with a solid, noncombustible material (e.g., metal or light-weight concrete) with no gaps.
  - **Deck Railings** within 5 feet of the home shall be constructed with noncombustible material, including where they attach to the home.
  - **Deck posts** shall have a minimum of 6-inches of noncombustible material (e.g., metal flashing or fiber-cement board) applied vertically to the base.
  - **Stairs Attached to a Deck** shall meet <u>one the following</u> requirements:
    - **Stairs Less than 4 Feet Wide and Open Underneath:**
      - A minimum of **6-inches** of noncombustible material (e.g., metal flashing or fiber-cement) shall be applied vertically at the exterior base, measured from the ground at grade.
      - Stair treads shall be a **solid (no gaps)** and made of noncombustible material (e.g., metal or lightweight concrete).
      - ***Exception:*** If stairs are constructed with closed risers, they shall also be **solid (no gaps)** and made of noncombustible material.
    - **Stairs Wider Than 4 Feet**:
      - The area underneath shall be enclosed with **noncombustible, corrosion-resistant mesh** with openings not to exceed $^{1}/_{8}$-inch in diameter.
      - A minimum of **6-inches** of noncombustible material (e.g., metal flashing or fiber-cement) shall be applied vertically at the exterior base, measured from the ground at grade.
      - Stairs shall have **closed risers.** Stair treads and risers shall be a solid, and made of noncombustible material (e.g., metal or light-weight concrete) with no gaps.

3.2 Defensible Space Requirements for the Plus Level

3.2.1 Parallel Fences within 5 to 30 feet

Back-to-back (parallel) combustible fencing (meaning separate fences that are combustible and closer than 5 feet apart) are not permitted.

- ***Exception:*** If one or both **back-to-back (parallel) fences** are constructed with noncombustible materials (e.g., concrete or metal).
- **Note:** Meeting this requirement may necessitate coordination with neighbors or an HOA to eliminate at least one of the combustible parallel fences.

3.2.2 Detached Accessory Dwelling Units and Accessory Structures

- **All Detached Accessory Dwelling Units (ADUs) and Accessory Structures [e.g., Overhead Structures (e.g., Pergolas, Carports, Garages, Gazebos) Sheds, Greenhouses, Playsets, Etc.]** with a footprint greater than or equal to 15 square feet shall be **located a minimum of 30 feet away** from the home and attachments.
- **Note:** As of publication of this standard, IBHS continues active research into the spacing required between structures to reduce the likelihood of wind-driven building-to-building fire spread, including the impact of structural openings, building materials, and connective fuels. The provisions of this section of the standard may be updated as this research matures.

4 APPENDIX A. TECHNICAL RESOURCES

Wildfire Prepared Home offers tools to assist homeowners, applicants, and other stakeholders achieve designations. Find them at wildfireprepared.org.

4.1 Applicant: How-To Prepare My Home Checklist

To meet the wildfire mitigation requirements for a designation, use the How-To Prepare My Home Checklist to ensure all the necessary steps for your chosen level are complete before applying.

4.2 IBHS Portal, Contact Information, and Status Updates

After creating an account, log in at wildfireprepared.org/portal to ask questions and check your application status.

4.3 Definitions

- **Combustible –** Materials that can ignite and burn.
- **Fire-Resistance-Rated Construction –** The use of materials and systems in the design and construction of a building or structure to safeguard against the spread of fire within a building or structure and the spread of fire to or from buildings or structures to the wildland-urban interface area. Where this standard requires 1-hour fire-resistance-rated construction, the fire-resistance rating of building elements, components or assemblies shall be determined in accordance with the test procedures set forth in ASTME119 or UL 263.
    - ***Exceptions:*** The fire-resistance rating of building elements, components, or assemblies based on:
        - The prescriptive designs prescribed in Section 721 of the International Building Code.
        - The calculation procedures in accordance with Section 722 of the International Building Code.
- **Noncombustible –** Made from material of which no part will ignite and burn when subjected to fire. Any material passing ASTM E136 shall be considered noncombustible.
- **Red Flag Warning –** A Red Flag Warning is determined by local offices of the National Weather Service (NWS) and is specific to those local areas. A Red Flag Warning means warm temperatures, very low humidities, and strong winds are expected to combine to produce an increased risk of fire danger.
- **Roof covering –** The material applied to the roof deck to provide weather resistance, achieve fire classification, or enhance appearance.
- **Wall covering –** An exterior wall material applied to provide a weather-resistant barrier, insulation, or aesthetic appeal.
- **Performance-based Option –** A standard specifying desired outcomes by requiring compliance with a certain standard(s), without prescribing specific methods or materials.
- **Prescriptive Option–** A standard that specifies exact methods or materials to achieve compliance, rather than focusing on desired outcomes.

4.4 List of Referenced Standards

4.4.1 ASTM

- E84 – Standard Test Methods for Surface Burning Characteristics of Building Materials
- E108 – Standard Test Methods for Fire Tests of Roof Coverings
- E136 – Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C
- E2768 – Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test)
- E2886 – Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement

4.4.2 NFPA

- 252 – Standard Methods of Fire Tests of Door Assemblies
- 257 – Standard on Fire Test for Windows and Glass Block Assemblies

4.4.3 UL

- 723 – Standard for Test for Surface Burning Characteristics of Building Materials
- 790 – Standard Test Methods for Fire Tests of Roof Coverings

4.4.4 ISO

- 17065 – Requirements for Bodies Certifying Products, Processes and Services

Appendix F

City of Laguna Beach Fuels and Fire Analysis Technical Memo

JENSEN HUGHES

Technical Memo

October 3, 2025

To:	Robert Montaghami
From:	Rachel Smith, Tim Metzger
cc:	Darlene Rini
Subject:	City of Laguna Beach Fuels & Fire Modeling Tech Memo

Introduction

This technical memo summarizes our evaluation of the City of Laguna Beach's Fuel Modification Zone (FMZ) Program and recommends improvements and prioritizations to strengthen the City's wildfire resiliency.

We understand that Governor Newsom's Executive Proclamation of March 1, 2025, which was issued following the 2025 Los Angeles Fires, has prompted the City of Laguna Beach to undertake an evaluation of its existing FMZ to identify any gaps or modifications needed to help improve or enhance the City's resiliency to wildfire threats. The proclamation declared a state of emergency to expedite critical fuel reduction projects in high wildfire risk communities by suspending environmental reviews under CEQA (Division 13) and the Coast Act (Division 20 of the Public Resources Code) for projects initiated in 2025 and completed by 2026. Consequently, our team conducted a detailed wildfire hazard and risk assessment to identify high-risk areas not currently covered by the existing FMZ Program that would qualify as critical fuel reduction projects under the proclamation's fast-track process.

A high-level summary of our analysis and recommended fuel treatment opportunities are presented below, and are organized into three primary sections:

+ Current Fuel Modification Zone Program
+ Methodology and Key Assumptions
+ Summary of Results and Recommendations

Additional products and narrative are provided in **Appendix A**.

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Current Fuel Modification Zone Program

OVERVIEW

The City of Laguna Beach has an established Fuel Modification Zone (FMZ) Program that includes an extensive fuel break and fuel management program throughout the City. The program was established in 1991 following the Oakland Hills fire and consists of approximately 285 acres of maintained lands – primarily using targeted goat grazing and hand crews – to help reduce fire intensity, improve firefighter safety, and support people management during wildfires. **Figure 1** shows the current fuel management zones across the City and the form of prescribed treatment.

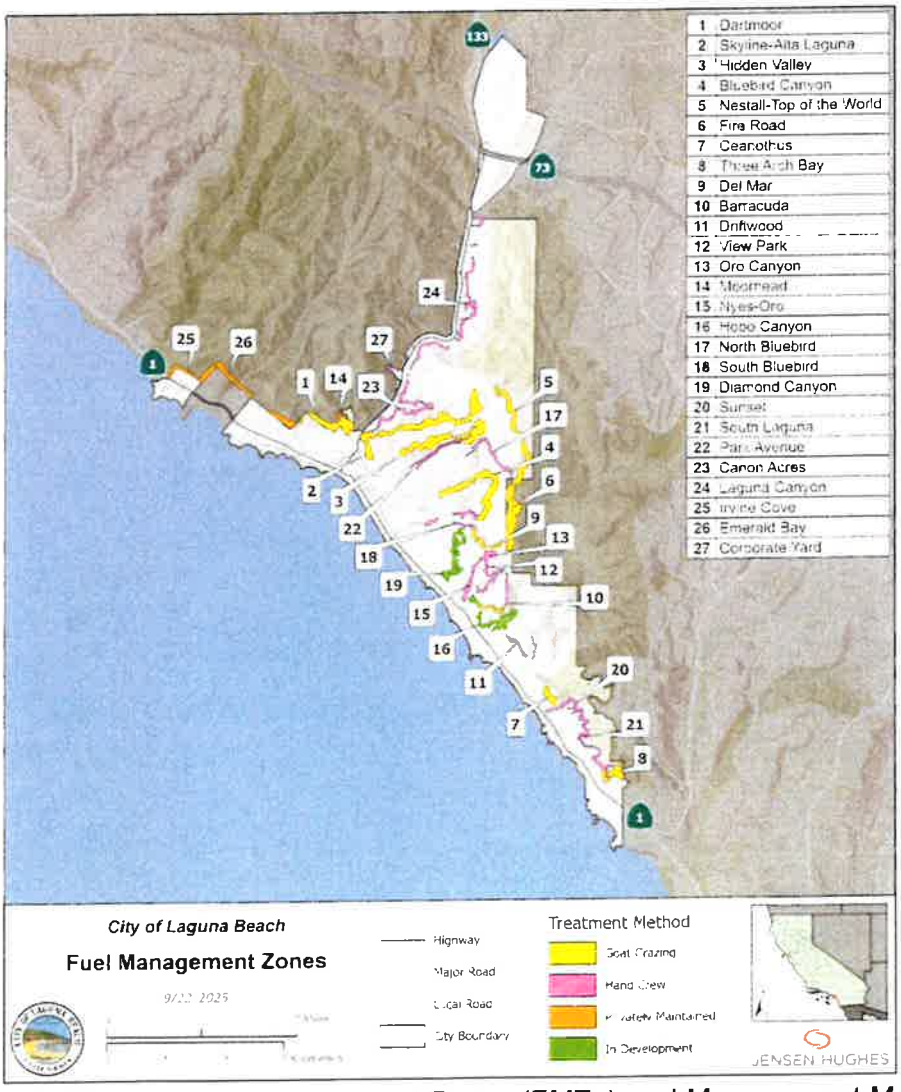


***Figure 1**. Current Fuel Management Zones (FMZs) and Management Method*

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Table 1 Provides a Tabulated Breakdown of the Current FMZs and Their Associated Status.

Table 1. Breakdown of Current Fuel Modification Zones (FMZ), Treatment Method and Status

FMZ #	FMZ Name	Acreage	Treatment Method	Status
1	Dartmoor	8.8	Privately Maintained	Implemented
1	Dartmoor	22.4	Goat Grazing	Implemented
2	Skyline-Alta Laguna	60.2	Goat Grazing	Implemented
3	Hidden Valley	43.0	Goat Grazing	Implemented
4	Bluebird Canyon	40.0	Goat Grazing	Implemented
5	Nestall-Top of the World	30.5	Goat Grazing	Implemented
6	Fire Road	37.8	Goat Grazing	Implemented
7	Ceanothus	7.2	Goat Grazing	Implemented
8	Three Arch Bay	10.9	Goat Grazing	Implemented
9	Del Mar	7.5	Goat Grazing	Implemented
10	Barracuda	4.9	Goat Grazing	Implemented
10	Barracuda	2.9	Hand Crew	Implemented
11	Driftwood	2.6	Hand Crew	Implemented
12	View Park	1.4	Hand Crew	Implemented
13	Oro Canyon	5.7	Hand Crew	Implemented
14	Moorhead	2.4	Privately Maintained	Implemented
15	Nyes-Oro	15.0	Hand Crew	Implemented
16	Hobo Canyon	17.0	To Be Determined	In Development
17	North Bluebird	8.6	Hand Crew	Implemented
18	South Bluebird	9.2	Hand Crew	Implemented
19	Diamond Canyon	19.7	To Be Determined	In Development
20	Sunset	7.9	Hand Crew	Implemented
21	South Laguna	12.6	Hand Crew	Implemented
22	Park Avenue	7.0	Hand Crew	Implemented

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FMZ #	FMZ Name	Acreage	Treatment Method	Status
23	Canon Acres	15.0	Hand Crew	Implemented
24	Laguna Canyon	28.9	Hand Crew	Implemented
25	Irvine Cove	6.9	Privately Maintained	Implemented
26	Emerald Bay	17.3	Privately Maintained	Implemented
27	Corporate Yard	1.5	Hand Crew	Implemented

EXISTING FUEL TREATMENT RESTRICTIONS

Given the location of the City of Laguna Beach, the vast majority of the City is located in the Coastal Commission Zone. The sole exception is the northern most tip of the City north of El Toro Road. The Coastal Zone boundary was established in the Coastal Act and represents the jurisdictional boundary of the Coastal Commission.

The Coastal Commission also created the Critical Coastal Areas (CCA) program, which aims to protect high resource-value coastal waters from polluted runoff. Approximately half of the City lies in these CCAs, being mostly concentrated in the northern and southeastern parts of the City.

The California Protected Areas Database (CPAD) contains national/state/regional parks, forests, preserves, wildlife areas, land trust preserves, special district open space lands (watershed, recreation, urban parks, etc.) and other types of open space. It is important to note that not every Protected Area has specific requirements. The Protected Areas with the highest concern in the City are the Laguna Coast Wilderness Park and Aliso & Wood Canyons Wilderness Park. These parks do have mandated management plans.

The City of Laguna Beach also has self-identified habitats of High or Very High value. The majority of these areas lie on City or County property; however, some areas do extend into privately owned areas.

There are no currently listed Endangered or Threatened Habitat areas in the City or Analytical Area.

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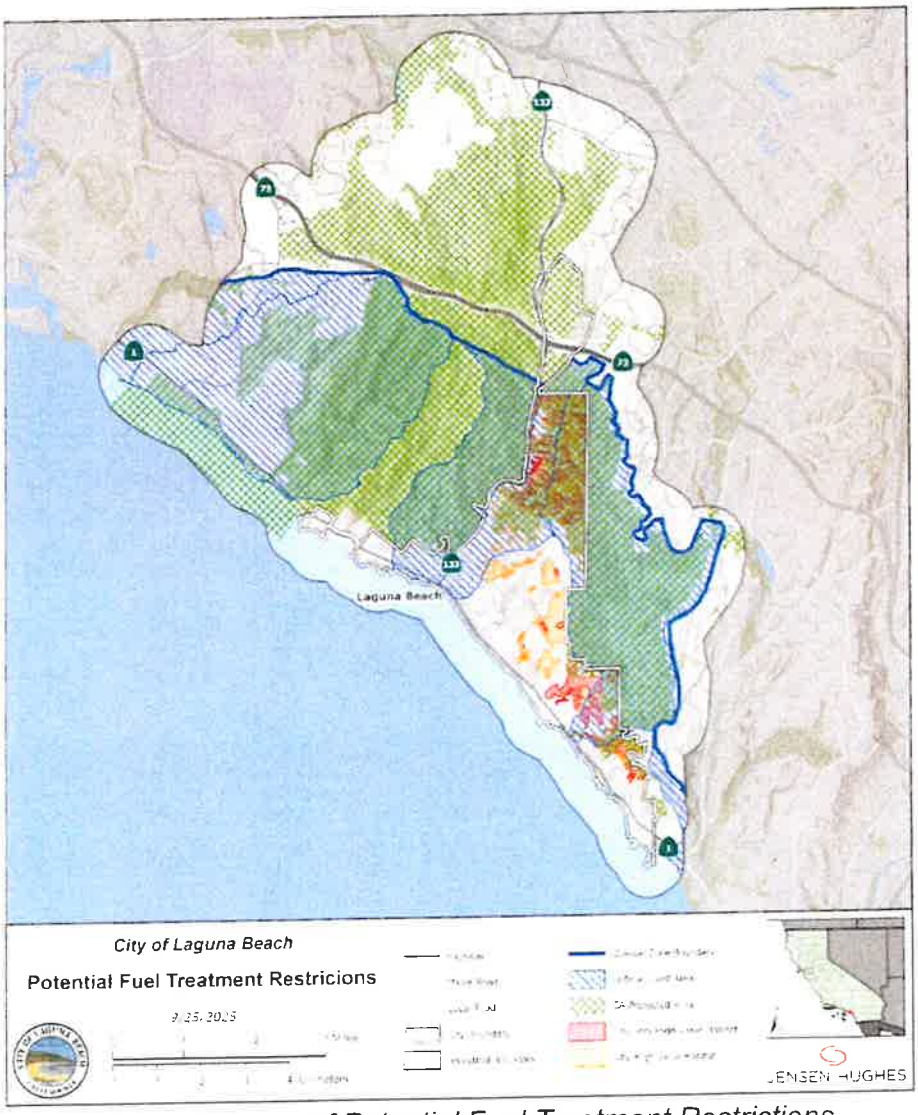


***Figure 2**. Areas of Potential Fuel Treatment Restrictions*

Methodology and Key Assumptions

To evaluate the City's Fuel Modification Zone (FMZ) Program, we conducted a detailed wildfire hazard assessment using the latest tools, research, and best practices in fire behavior modeling. The objective was to identify areas within the City's boundary that are prone to high frequency-high severity fire conditions. This analysis then served as a basis for identifying and prioritizing fuel treatments not currently covered by the City's FMZ Program.

We performed fire behavior modeling to understand potential fire characteristics (e.g., flame length, fire line intensity, rate-of-spread), assess potential impacts to community assets, and

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identify potential opportunities for fuel treatments to mitigate those risks. All key assumptions and input data for the modeling are documented in Appendix A and fall into the following six categories:

1. Analytical Boundary – See **Figure 3**
2. Software
3. Key Input Data Sources
4. Weather Data and Analysis
5. Fuel Moisture
6. Fuel Types and Fuel Models

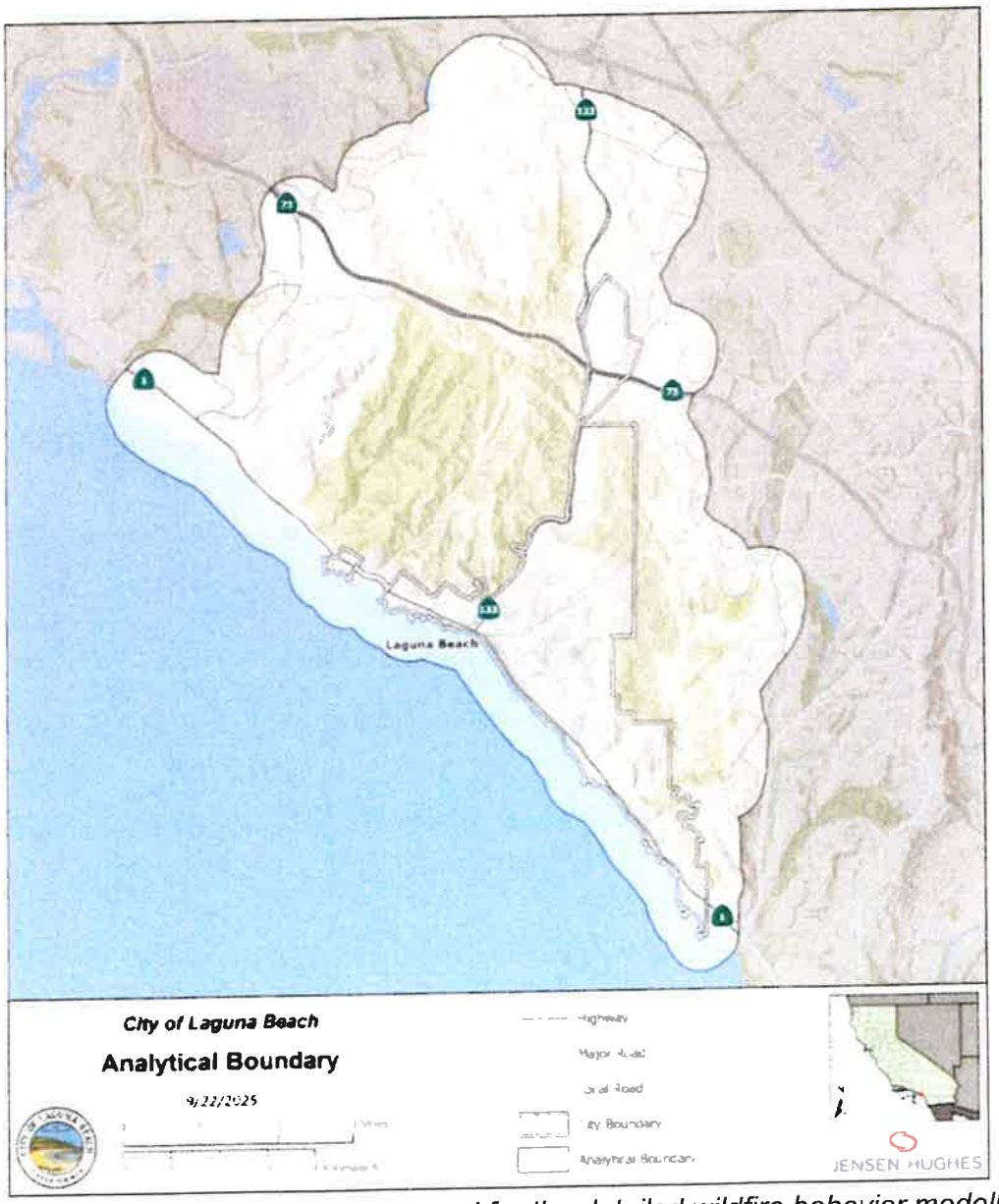


Figure 3. *Analytical boundary assumed for the detailed wildfire behavior modelling*

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Summary of Results and Recommendations

Based on the fire modelling approach and key assumptions in Section 3.0 and Appendix A, we developed and evaluated several potential fire behavior outputs to help inform our understanding of high fire severity-high fire frequency areas across the City. This output was used to identify gaps in the City's current FMZ program. The key outputs are as follows:

- Fire Severity
- Fire Frequency ("Simulated")
- Combined Hazard – Fire Severity + Fire Frequency
- Fire Flow Paths

FIRE SEVERITY

Fire severity can be characterized from a variety of fire behavior outputs that provide an indication of how severe a fire will burn or behave. The fire severity analysis that was conducted for the Laguna Beach area represents a combination of four fire behavior and fire effects outputs merged into one representation to display the alignment of potential problematic areas on the landscape that would exhibit high severity fire. The four modeling outputs used to develop this analysis are:

- Flame length
- Fireline intensity
- PM10 emissions
- Fuel loading

Each layer is classified into five rating classes (Low to Very High) and merged to display the alignment of these fire behavior and fuel characteristics. The results of this analysis can be used to assist managers in 1) prioritizing fuel treatments on the basis of predicted fire behavior and fire effects and 2) assessing the effectiveness of fuel treatment opportunities in a geospatial context. Data was leveled across the Planning Area using the least to the highest possible score.

Figure 4 displays the estimated Fire Severity for the analytical boundary of the project. Locations shown in red have the highest potential for high severity fires and indicate areas where fuel treatments would provide beneficial effects to reduce the potential impacts to high value resources and assets, while improving firefighter and public safety and enhance fire suppression efficiencies.

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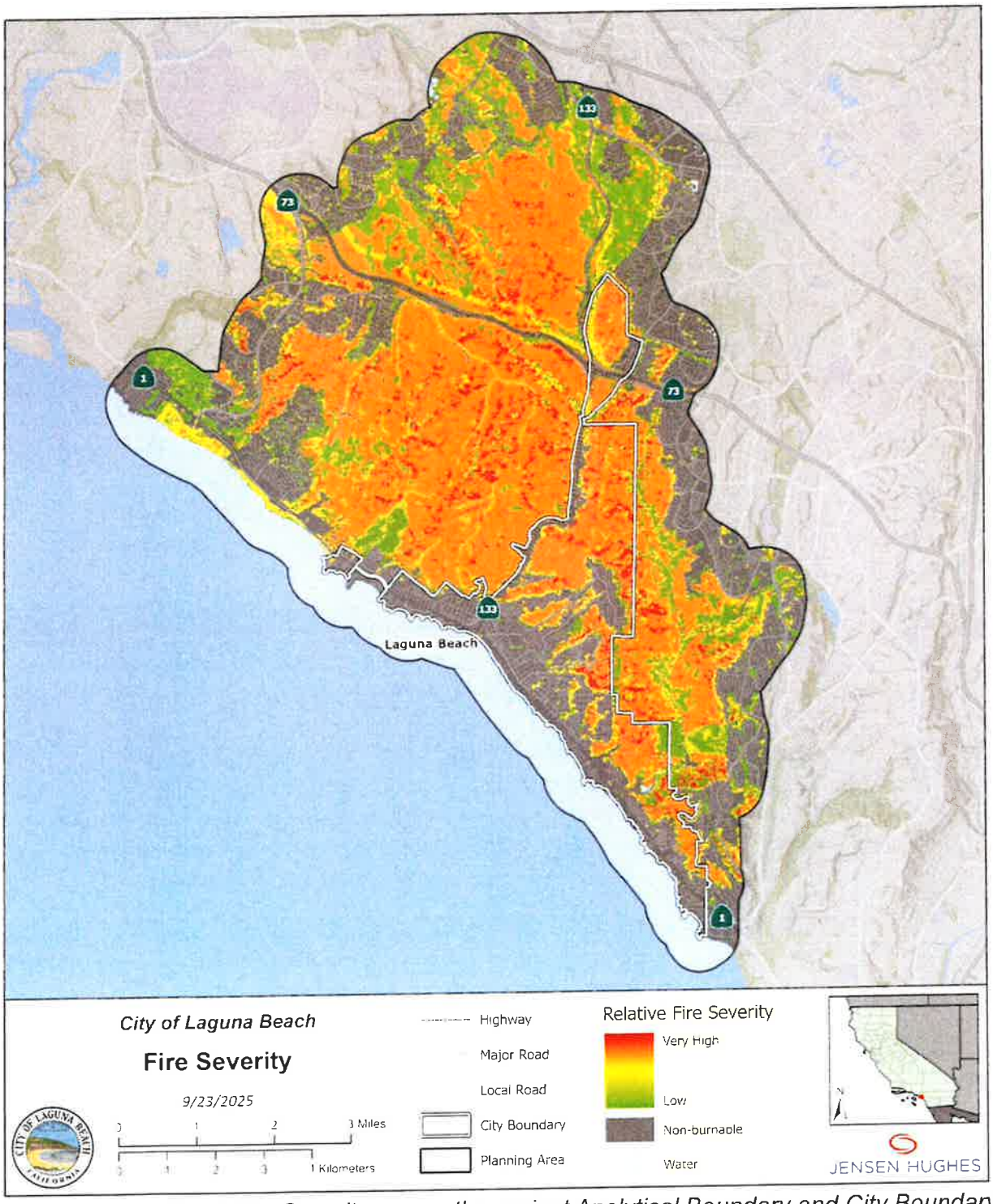


Figure 4. *Calculated Fire Severity across the project Analytical Boundary and City Boundary*

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Table 2. *Summary of High and Very-High Severity Areas in the City of Laguna Region*

Area	High	Very High
City Boundary	1,803 (32.5%)	437 (7.9%)
Analytical Boundary	11,565 (35.8%)	2,403 (7.4%)

FIRE FREQUENCY

Fire Frequency or Simulated Fire Frequency illustrates areas in the landscape where fires are more likely to burn given fire spread from historical ignition points and no suppression activities. For this representation, historic ignitions that occurred within and adjacent to the Laguna Beach area from 1992-2020 were utilized. These ignitions were independently simulated for 6-hours of active burning and overlaid in GIS. As the City and surrounding landscapes have had limited historical ignitions, our analysis also included some additional random ignitions to provide increased certainty on where fires are more likely to spread.

See **Figure 5** for fire frequency across the analytical boundary and across the city.

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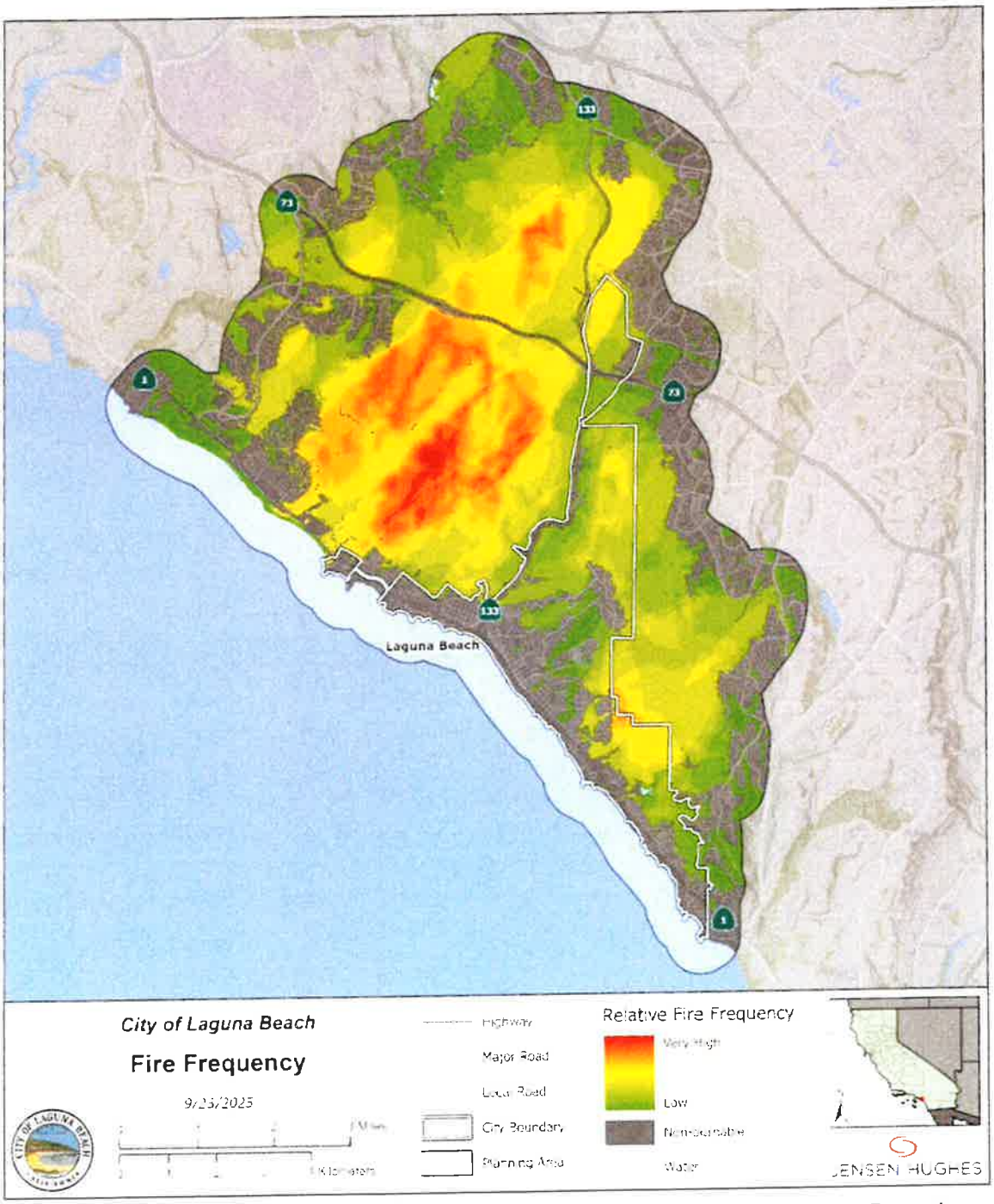


Figure 5. *Fire Frequency across the project Analytical Boundary and City Boundary*

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COMBINED FIRE HAZARD

Combined fire hazard represents a visual overlay of wildfire severity and ignition frequency. Displaying wildfire severity and ignition frequency on the same map enables a comprehensive spatial analysis of wildfire risk by highlighting areas with both high ignition likelihood and potential for severe impacts. This integrated approach supports more effective prioritization of resource allocation for mitigation and response strategies. It also facilitates the identification of high-risk zones where proactive management can reduce future fire damage.

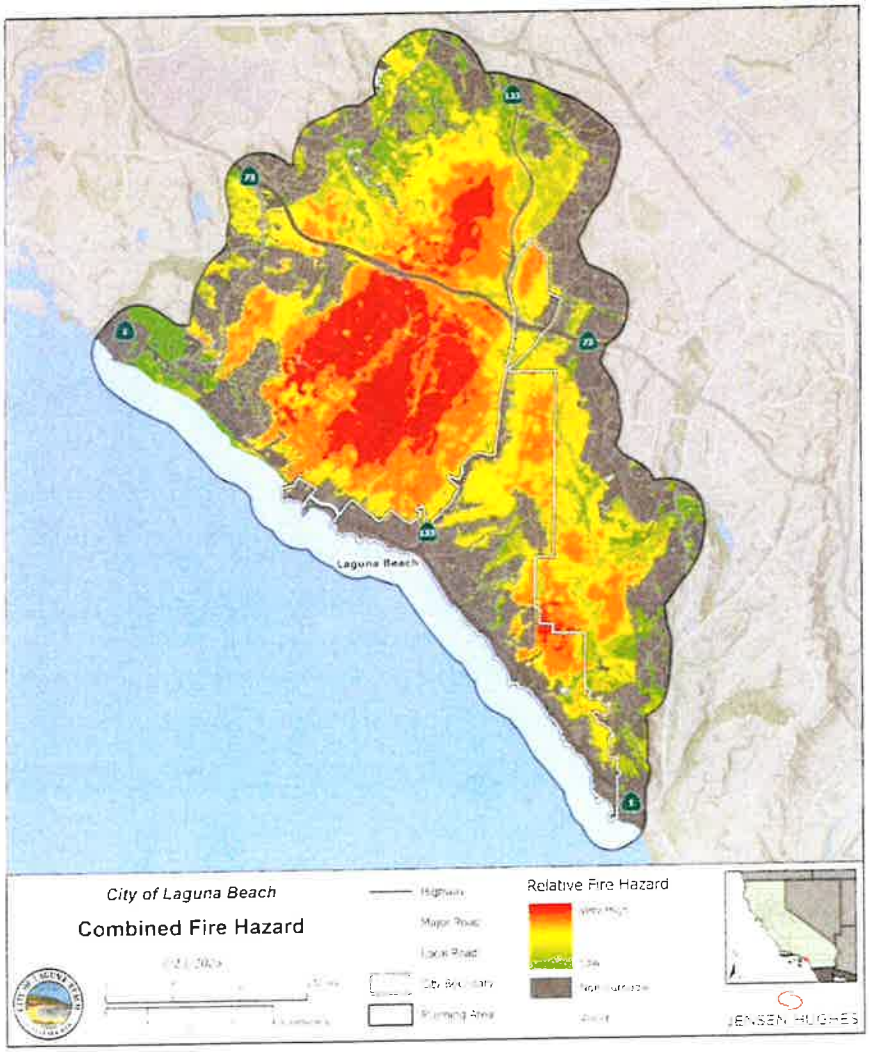


Figure 6. *Combined Fire Hazard (Severity + Frequency) across the project Analytical Boundary and City Boundary*

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Table 3. Summary of High and Very-High Combined Hazard Areas in the Analytical and City Boundaries

Total High- and Very-High Hazard Area [acres]		
Area	High	Very High
City Boundary	878 (15.8%)	111 (2.0%)
Analytical Boundary	5,705 (17.7%)	3,657 (11.3%)

FIRE FLOW PATHS AND EVACUATION ROUTES

Fire flow paths are fire behavior outputs developed to examine the intersection and concentration of where fires originating from different parts of the landscape would converge or intersect at near or adjacent to areas of concern. Fire Flow Paths Analysis follows the same methodology as described above in the fire frequency. While the fire behavior outputs are not absolute and are bound by the assumptions and limitations of data and individual models, the model outputs allow for the evaluation of multiple fires burning under identical conditions on a large landscape highlighting areas where these fires would converge into central locations that would benefit from fuels mitigation strategies.

Figure 7 is graphic illustration of the frequency or concentrations of the fire flow paths intersecting the travel routes and community exposure across the Laguna Beach area. This information can be helpful to evaluate the need as determined by Fire Hazard and prioritize fuel mitigation opportunities along travel routes to improve access/egress or implement ignition reduction measures or other types of strategies.

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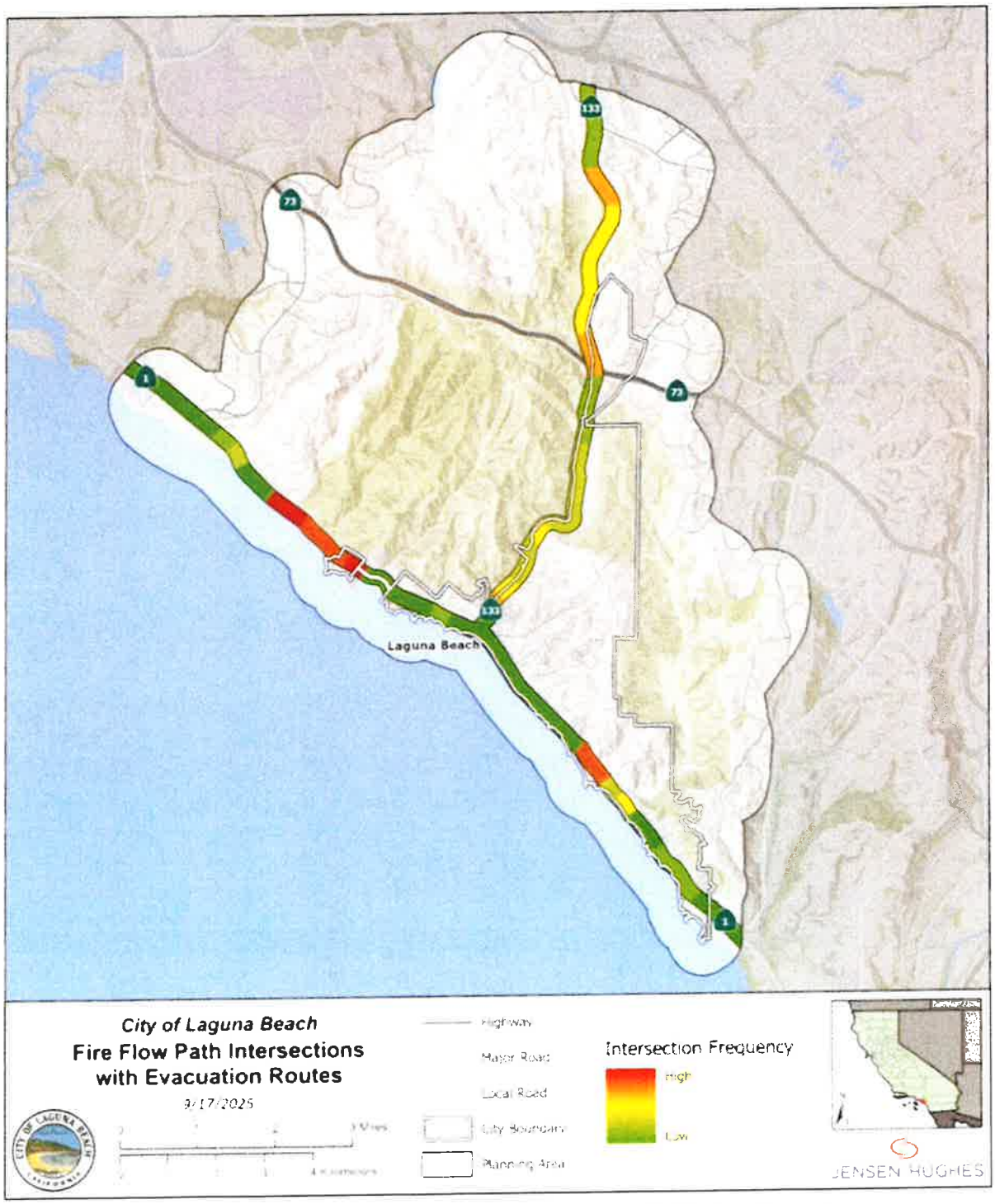


Figure 7. *Locations Where Fire Frequently Intersects Primary Evacuation Routes*

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EVALUATION OF EXISTING FMZS

Figure 8 illustrates the location of the existing FMZs in Laguna Beach relative to the results of the Combined Fire Hazard analysis presented above.

Table 4 summarizes the acreage and percent acreage of each existing FMZ that is considered high- or very-high fire hazard. This provides an indication of whether the existing FMZ is appropriately located to reduce wildfire risk to the City.

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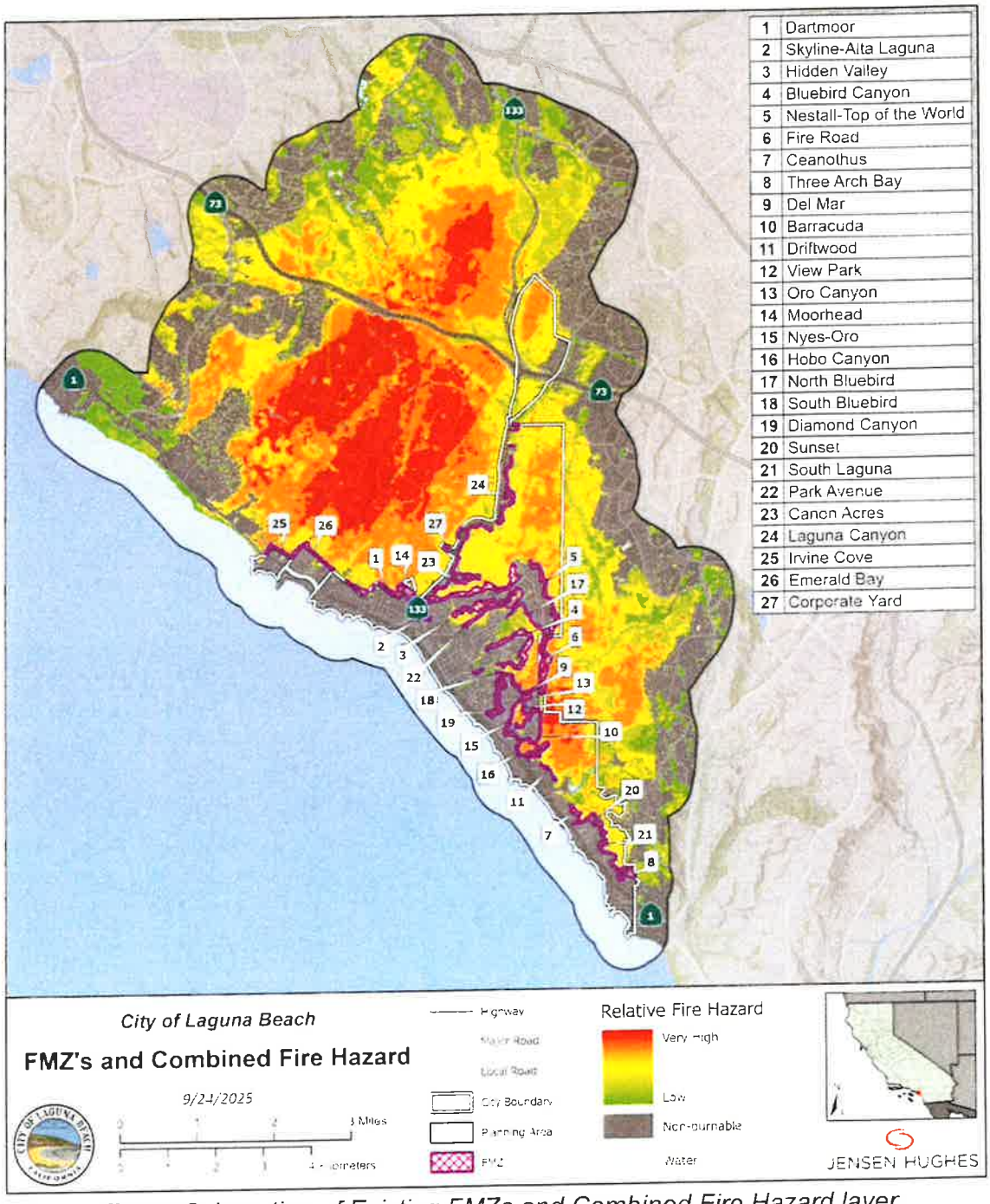


Figure 8. *Location of Existing FMZs and Combined Fire Hazard layer*

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Table 4. *Summary of High and Very-High Hazard Areas by existing FMZ*

FMZ #	Total Acreage	High and Very-High Hazard Area per Existing FMZ [acres]		% Treated Area in High and Very-High
		High	Very High	
Zone 1 Dartmoor	31.2	3.5	0	11.3%
Zone 2 Skyline-Alta Laguna	60.2	2.8	0	4.7%
Zone 3 Hidden Valley	43	0.2	0	0.5%
Zone 4 Bluebird Canyon	40	0.5	0	1.2%
Zone 5 Nestall-Top of the World	30.5	6.7	0.2	22.5%
Zone 6 Fire Road	37.8	12.1	0.5	33.3%
Zone 7 Ceanothus	7.2	0.4	0	5.9%
Zone 8 Three Arch Bay	10.9	0	0	0.0%
Zone 9 Del Mar	7.5	1.3	0.4	22.6%
Zone 10 Barracuda	7.8	1.2	0	15.1%
Zone 11 Driftwood	2.6	0	0	0.0%
Zone 12 View Park	1.4	0.1	0.2	23.0%
Zone 13 Oro Canyon	5.7	<0.1	0.4	7.9%
Zone 14 Moorhead	2.4	2.08	0	88.4%
Zone 15 Nyes-Oro	15	0.3	0.1	3.1%
Zone 16 Hobo Canyon	17	2.3	0.2	14.7%
Zone 17 North Bluebird	8.6	0.2	0	2.7%
Zone 18 South Bluebird	9.2	0.6	0	6.0%
Zone 19 Diamond Canyon	19.7	0.2	0	0.9%
Zone 20 Sunset	7.9	0.3	0	3.6%
Zone 21 South Laguna	12.6	0.1	0	0.8%
Zone 22 Park Avenue	7	0.1	0	1.8%
Zone 23 Canon Acres	15	0.5	0	3.6%
Zone 24 Laguna Canyon	28.9	1.2	0	4.1%
Zone 25 Irvine Cove	6.9	0.5	0	7.8%
Zone 26 Emerald Bay	17.3	1.3	0	7.4%
Zone 27 Corporate Yard	1.5	<0.1	0	2.5%
All FMZs	**454.7**	**38.5**	**2.1**	**8.9%**

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RECOMMENDATIONS

Based on the detailed wildfire hazard and risk assessment, eight proposed fuel treatment opportunities have been identified. These proposed areas are located in key high-risk areas not currently covered by the existing FMZ Program. **Figure 9** shows the location of the proposed fuel treatment opportunities, while **Table 5** provides a tabulated summary of each proposed fuel treatment area/zone in priority order.

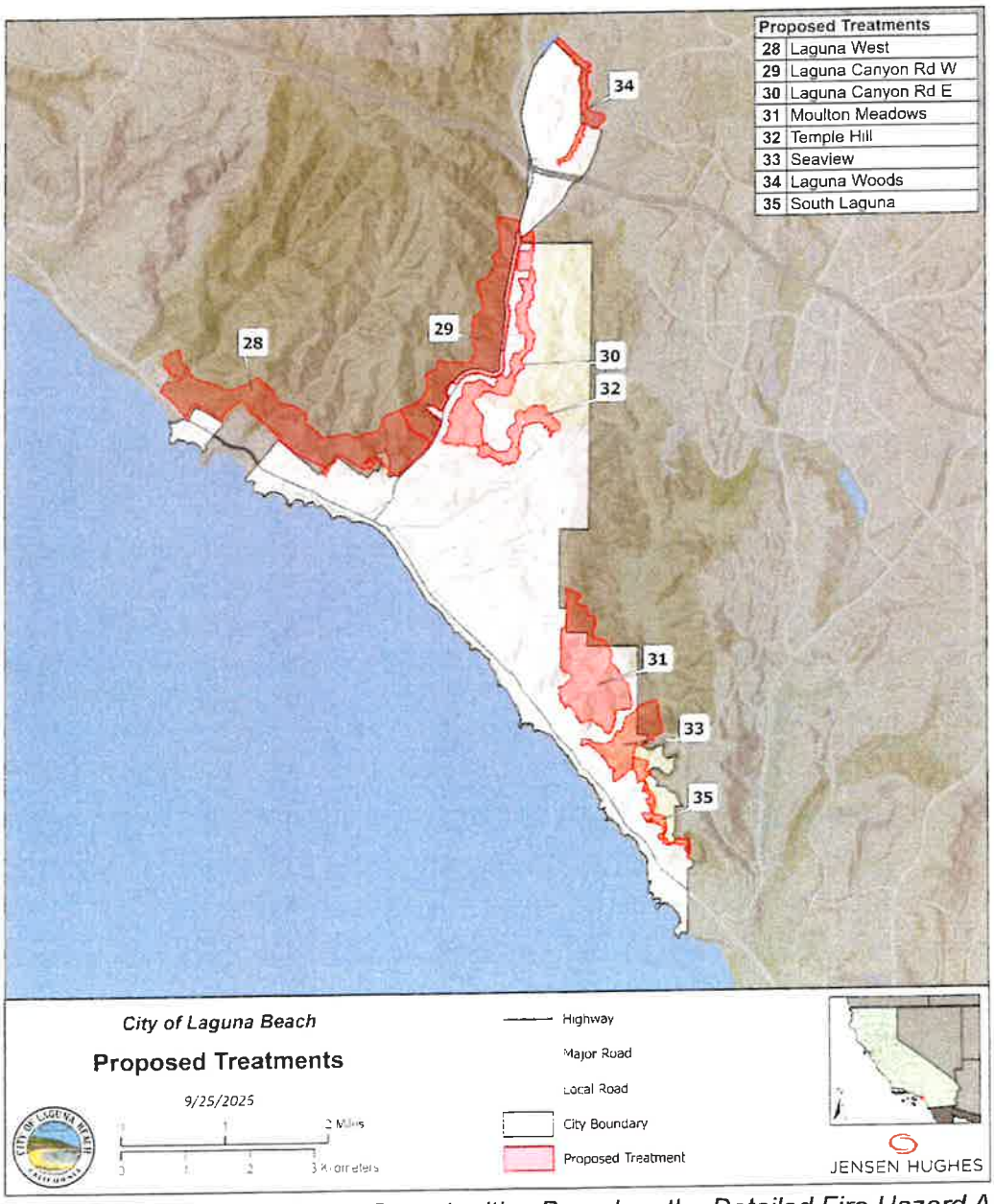


Figure 9. *Proposed New Treatment Opportunities Based on the Detailed Fire Hazard Analysis*

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Table 5. Prioritized New Treatment Opportunities

New FMZ #	Treatment Opportunity Name	Area [Acres]
28	Laguna West	554
29	Laguna Canyon Road West	396
30	Laguna Canyon Road East	224
31	Moulton Meadows	344
32	Temple Hill	87
33	Seaview	144
34	Laguna Woods	66
35	South Laguna	50
	Total	**1,864**

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Appendix A – Detailed Wildfire Behavior Modelling Assumptions

A.1 INTRODUCTION

This Appendix provides additional details regarding the fire behavior modelling assumptions, analysis and results of the City of Laguna Beach's current FMZ program.

A.2 METHODOLOGY AND KEY ASSUMPTIONS

A.2.1 Analytical Boundary

For the purposes of this analysis, the analytical boundary was defined as the jurisdictional boundary of the Laguna Beach Fire Department. To ensure a more comprehensive assessment of wildfire risk, this boundary was expanded to include adjacent burnable lands that may influence fire behavior and pose a threat to areas within the city limits. This approach allows for a more accurate evaluation of external wildfire hazards and their potential impact on the protected area.

A.2.2 Software

The analysis utilized a suite of specialized wildfire modeling and decision-support software to assess fire behavior and risk. Fire Family Plus 5.0 was used to analyze historical weather and fire occurrence data, providing essential inputs for fire behavior modeling. Wildfire Analyst Enterprise, FlamMap 6, and Nexus 2.1 were employed to simulate fire spread, intensity, and crown fire potential under varying conditions, enabling a comprehensive evaluation of potential wildfire impacts across the study area.

A.2.3 Weather Data and Analysis

Weather is the most variable element of the wildland fire environment. Important components of fire weather that influence fire behavior are temperature, relative humidity, precipitation, wind, and atmospheric stability. These elements have the potential to enhance or retard wildfire spread and intensity.

Laguna Beach's summer fire season is defined by persistent eastern Pacific high pressure that suppresses marine clouds and rain, producing hot, dry afternoons, with coastal highs in the mid-70s to low-80s°F and inland canyons often reaching the 90s during heat waves.

Relative humidity commonly drops to the teens in peak heat periods, drying fine fuels (grasses, chaparral litter) across late spring and into summer. Rainfall is minimal; aside from occasional high-based thunderstorms, there is typically little summer moisture input. While onshore breezes moderate conditions on many days, episodic offshore winds (e.g., Santa Anas) can rapidly lower humidity and accelerate spread, especially on foothills, canyons, and

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exposed ridges. The primary danger window runs July-September, though autumn offshore events can extend fire danger until the first persistent rains.

Weather information was obtained from https://famauth.wildfire.gov/index.html/ for Aliso Laguna Remote Automated Weather Stations (RAWS) 2015 through 2025 and analyzed in Fire Family Plus Version 5.0 (USDA Forest Service 2020) to compare historical and current fire weather parameters associated with temperature, wind, and precipitation.

A.2.4 Fuel Moisture

Fuel moisture is a dynamic variable controlled by seasonal and daily changes in the weather and is an important component influencing wildland fire behavior. Simply stated, vegetation is most flammable when fuel moisture levels are low and less flammable when they are high. Fuel moisture levels will largely determine if a fire will ignite and spread. Fuel moisture is typically categorized into dead and live fuel moisture.

- **Dead fuels.** Dead fuels act like a sponge absorbing or giving up moisture to the air and ground which surrounds them. The moisture exchange rate between dead fuels and their surrounding environment varies by the size of the dead fuel particle, with fuels less than ¼ in diameter reaching equilibrium with their surroundings within one-hour. Because of this rapid exchange rate, these smaller size class fuels exert significant control over wildfire burning characteristics, especially in the grass and shrub dominated fuels associated with the Planning Area.
- **Live fuels.** Live fuel moisture is the moisture in living, growing vegetation and is controlled by the internal physiological mechanisms of the vegetation and external influences such as rainfall, drought, aspect, elevation, and seasonal drying patterns. Typically, live fuel moistures are highest in the spring through early summer and at their lowest in late summer through early winter when seasonal rains typically begin.

Live fuel moisture of 60% or below is a "critical" threshold where live fuels display similar burning characteristics as dead fuels.

For the weather analysis specific to Laguna Beach, Fire Family Plus version 5 software was used to determine historical fuel and weather conditions at the 90th and 97th percentile (hottest, driest 10% and 3% of the period analyzed) specific to the weather analysis areas. In addition to the historical percentiles an offshore scenario was incorporated into the simulated fire frequency and exposure analysis. Weather and fuel moisture parameters utilized in the offshore scenario were obtained from the Same RAWS station on January 7, 2025, the day of the Palisades fire.

The following table is the result of the analysis which was utilized in the fire spread model to evaluate the potential fire behavior and effects.

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Table 6. *Laguna Beach Fuel Moisture and Weather Historical Weather Percentiles and Potential Offshore Impacts From January 7, 2025*

Fuel Moisture/Weather Inputs	Off-Shore Scenario	97th Percentile
1 Hour Fuel Moisture %	7%	4%
10 Hour Fuel Moisture %	8%	6%
100 Hour Fuel Moisture %	9%	10%
Herbaceous Fuel Moisture %	30%	30%
Woody Fuel Moisture %	60%	60%
Wind Gusts	40 mph out of the NE	34 mph out of the west
20-ft Wind Speed	25 mph out of the NE	21 mph out of the west
Temperature	67°F	85°F

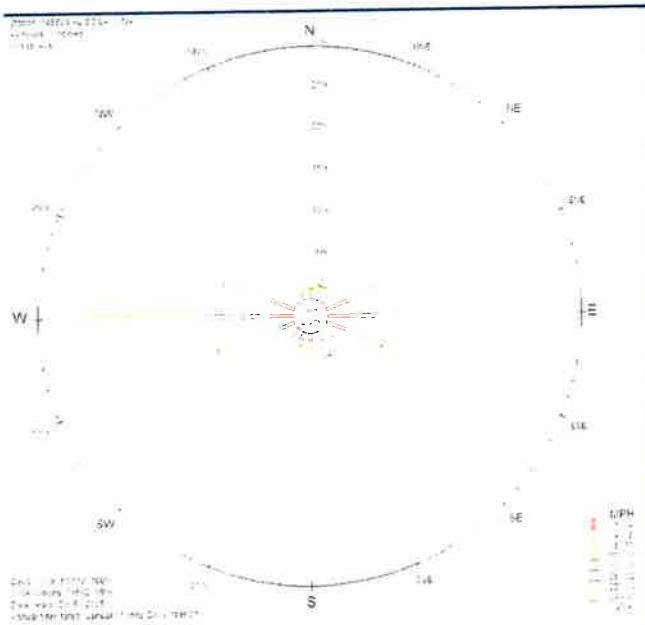


Figure 10*. Wind rose illustrating prevailing wind directions and associated wind speeds recorded at the site, which were used in the weather analysis for this study.*



Figure 11*. Remote Automated Weather Station (RAWS) installation at Aliso Laguna, which provides continuous, site-specific meteorological data for fire behavior modeling and hazard assessment*

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A.2.5 Fuel Characteristics and Fuel Models

The key characteristics of vegetative fuels that affect fire behavior include fuel type, fuel moisture, fuel loading, chemical properties, horizontal continuity, and vertical arrangement. These characteristics are combined to-create fuel models that describe fire behavior when used in combination with weather and topography.

Understanding fuel models, their effects on fire behavior, and how the models change after the implementation of a fuel treatment can help fire managers design effective wildfire mitigation strategies.

A.2.6 Fuel Types/Fuel Models

Fuel types associated with the Laguna Beach Area include grasslands, chaparral, broadleaf and conifer forest. These fuel types are categorized into specific fuel models (e.g., non-burnable, grass, grass-shrub, shrub, and timber-litter), which describe the physical properties of the vegetation that support fire. Fuel models are grouped by fire-carrying fuel type and the number of fuel models within each fuel type varies. Each fuel type has been assigned a mnemonic two-letter code.

- **Non-burnable fuel model (NB).** Land areas that are considered non-burnable portions of the landscape are displayed on a fuel model map as NB. Urban development, barren land and water, all considered unburnable in fire behavior models. There are approximately 10,705 acres represented by this fuel type within the Planning Area.
- **Grass (GR).** The primary carrier of fire in the GR fuel models is grass. Grass fuels can vary from heavily grazed grass stubble or sparse natural grass to dense grass more than 6 feet tall. Fire behavior varies from moderate spread rate and low flame length in the sparse grass to extreme spread rate and flame length in the tall grass models. There are approximately 2,571 acres represented by this fuel type within the Planning Area.
- **Grass-Shrub (GS).** The primary carrier of fire in the GS fuel models is grass and shrubs combined; both components are important in determining fire behavior. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model. There are approximately 17,287 acres represented by this fuel type within the Planning Area.
- **Shrub (SH).** The primary carrier of fire in the SH fuel models is live and dead shrub twigs and foliage in combination with dead and down shrub litter. A small amount of herbaceous fuel may be present, especially in SH1. There are approximately 538 acres represented by this fuel type and represents the bulk of the fuels within the Planning Area.

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+ **Timber-Litter (TL).** The primary carrier of fire in the TL fuel models is dead and down woody fuel. Live fuel, if present, has little effect on fire behavior. There are approximately 971 acres represented by this fuel type within the Planning Area.

To quantify the potential fire behavior characteristics across the planning area, a fuel model is one of the primary inputs for fire behavior modeling. A fuel model is chosen by the primary carrier of the fire (e.g. grass, brush, timber litter, slash) and its fuel characteristics (e.g. fuel loading, surface area to volume ratio, fuel depth, etc.). **Table 7** below provides a breakdown of vegetative fuels by fuel type for the Laguna Beach Area. In addition, **Figure 12** shows the spatial distribution of fuel models across the planning area.

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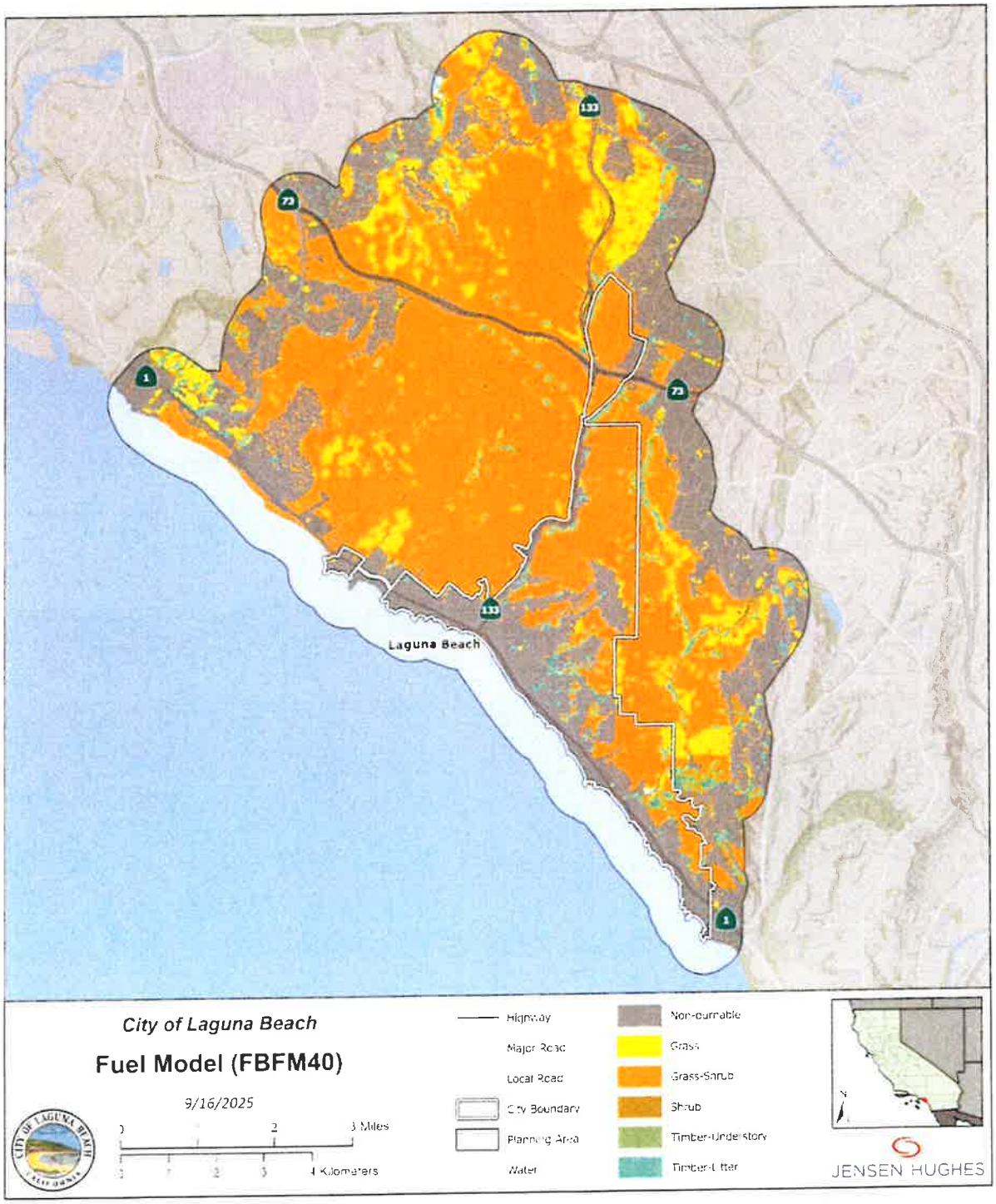


Figure 12. *Fuel Model (40 Scott and Burgan Fire Behavior)*

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Table 7. Breakdown of Generalized Fuel Model Types

Fuel Model Type	Vegetation Group	Fuel Type Acres	% Coverage
NON-BURNABLE: Urban, agricultural, barren land, represented by NB1, NB3, NB9	Non-burnable	10,705	33.3%
GRASS: Nearly pure grass and/or forb types are represented GR1- GR9	Grassland/Forb	2,571	8.0%
GRASS-SHRUB: Up to about 50% shrub coverage are represented by GS1-GS4	Grassland/Forb Broadleaf Forest and Woodland	17,287	53.8%
SHRUBS: Cover at least 50 percent of the site; grass sparse to non-existent are represented by SH1-SH9	Chaparral	538	1.7%
TIMBER-UNDERSTORY: Grass or shrubs mixed with litter from forest canopy are represented by TU1-TU5	Conifer Forest and Woodland	56	0.2%
TIMBER-LITTER: Dead and down woody fuel (litter) beneath a forest canopy is represented by TL1-TL9	Broadleaf Forest and Woodland Conifer Forest and Woodland	971	3.0%
Total:		**32,129**	**100.0%**

A.3 WILDFIRE HAZARD ASSESSMENT

The objective of the wildfire hazard assessment is to identify areas within the Planning Area that are prone to severe fire conditions, and to use this as the basis for designing and prioritizing fuel treatments.

FlamMap (Version 6.0) - a fire behavior model based on static fuel and weather conditions - was used to understand potential fire characteristics (e.g., fire severity, rate-of-spread, flame length), potential impacts to community values or assets at risk, and then prioritize various hazard-based mitigation activities. The Wildfire Hazard Assessment was performed to identify

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where on the landscape unwanted ignitions are likely to be most problematic for the Planning Area.

The Wildfire Hazard Assessment includes:

1. Simulated Fire Frequency
2. Fire Severity
3. Fire Hazard
4. Fire Flow Paths
5. Exposure Assessment

The landscape spatial files (LCP) used in the assessment were obtained from the LANDFIRE program. For this analysis, LCP files were constructed to represent current conditions and fuel conditions as they existed post Caldor and Mosquito fires. An LCP file contains eight spatial layers (slope, aspect, elevation, fuel model, canopy cover, canopy height, canopy bulk density, and canopy base height) and is a required input into the fire behavior models used in the analysis.

A.3.1 Simulated Fire Frequency

Simulated Fire Frequency was created using the Minimum Travel Time module in FlamMap to better understand where on the landscape wildfire has the greatest probability of spreading and highlight where the greatest threat is of fires converging on the landscape and threatening values at risk. The minimum travel time (MTT) feature is a two-dimensional fire growth model that calculates fire growth and behavior by searching for the set of pathways with minimum fire spread times from an ignition source.

For the Simulated Fire Frequency representation, historic ignitions that occurred within and adjacent to the Laguna Beach area from 1992-2020 were utilized. The United States Forest Service's Fire Program Analysis data set provided ignition locations for all ownerships and all agencies. These ignitions were independently simulated for 6-hours of active burning and over-laid in GIS to develop a frequency of where fires would likely impact the analysis area with no suppression activities based on the point of origin from the fire. **This type of analysis can help delineate areas of potential fire threat to values at risk and where fuel reduction activities may be considered to interrupt or alter the spread, direction, and intensity of fire. This type of analysis does not determine the level of fuel reduction or types of treatments but rather address the question of where on the landscape would fuels reduction or mitigation measures provide beneficial impacts to reduce the threat of fire movement across the landscape.** Simulated fire threat does not determine or pinpoint the level of or potentially hazardous fuels conditions.

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A.3.2 Fire Severity

Fire severity can be characterized from a variety of fire behavior outputs that provide an indication of how severe a fire will burn or behave. The fire severity analysis that was conducted for the Laguna Beach area represents a combination of four fire behavior and fire effects outputs merged into one representation to display the alignment of potential problematic areas on the landscape that would exhibit high severity fire. **Fire hazard** can be characterized by how a fire will burn or fire behavior. Fire behavior is the product of the natural environment or the unique combination of topography, weather and fuels. Topography and weather are factors on which humans have little effect but, fuels can be altered through human intervention or natural processes such as fire (rapid) or decomposition (very slow). Therefore, when assessing fire hazard, the focus can be on fuels and the associated fire behavior, determined by fire behavior characteristics such as rate of spread, flame length, fireline intensity, torching, crowning, spotting, fire persistence and resistance to control.

A.3.3 Combined Fire Hazard

The **Fire hazard analysis** that was conducted for the Laguna beach area represents a combination of five fire behavior and fire effects outputs merged into one representation to display the alignment of potential problematic areas on the landscape that would exhibit high severity fire. The six modeling outputs used to develop this analysis are flame length, fireline intensity, potential spotting distance, PM10 emissions, and finally fuel loading. Each layer is classified into five rating classes (Low to Very High) and merged to display the alignment of these fire behavior and fuel characteristics to represent highlighted areas on the landscape where the highest potential or hazardous conditions exist. The intent of this analysis is to assist managers in 1) prioritizing fuel treatments on the basis of predicted fire behavior and fire effects and 2) assessing the effectiveness of fuel treatment proposals in a geospatial context. Data was leveled across the Planning Area using the least to the highest possible score.

A.3.4 Fire Flow Paths and Strategically Placed Treatments

Fire flow paths are fire behavior outputs developed to examine the intersection and concentration of where fires originating from different parts of the landscape would converge or intersect at or adjacent to areas of concern. Fire Flow Paths Analysis follows the same methodology as described above in the simulated fire frequency. While the fire behavior outputs are not absolute and are bound by the assumptions and limitations of data and individual models, the model outputs allow for the evaluation of multiple fires burning under identical conditions on a large landscape highlighting areas where these fires would converge into central locations that would benefit from fuels mitigation strategies.

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A.3.5 Exposure simulations

These exposure analyses spatially depict the amount of time a fire may impact a point of concern or define a fireshed.

In addition to exposure, the intent of this analysis can help inform several different types of analysis such as fuels reduction/mitigation, evacuation planning, emergency procedures, notifications/warnings etc. etc.

Spatial fire modeling was completed to develop a probabilistic exposure output on the amount of time it would take a fire to reach individual or clusters of building within the Laguna Beach Area. The range of colors indicate the probability of fire impacting all structures within 2 hours of active fire spread that may occur under percentile or an offshore weather event. The simulation assumes no suppression actions.

In brief: if a fire under very high to extreme fire danger conditions occurred or intersected anywhere within the output, the color represents the probability of the fire impacting a structure within the predefined simulation timeframe of 2 hours.

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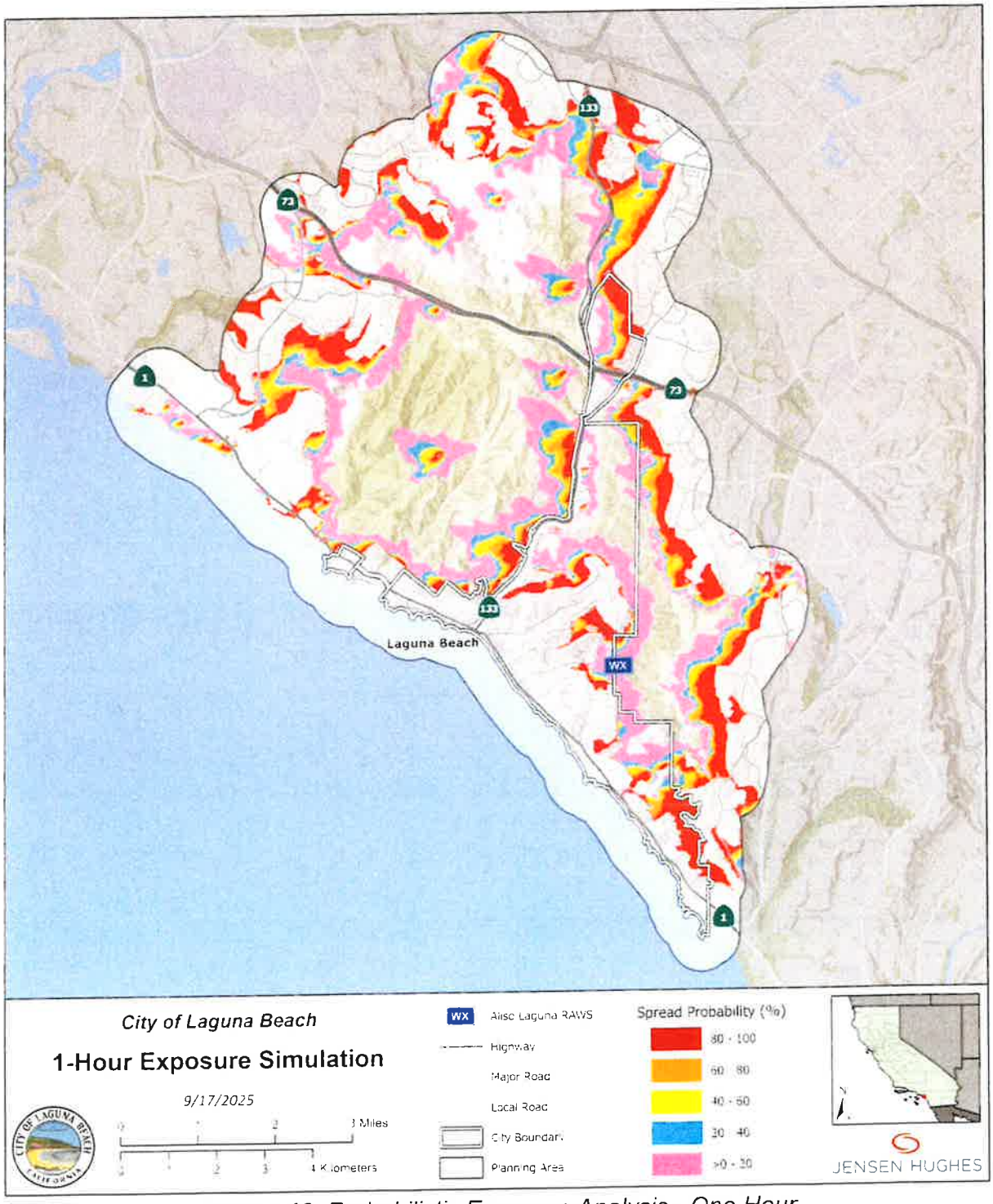


Figure 13. *Probabilistic Exposure Analysis - One Hour*

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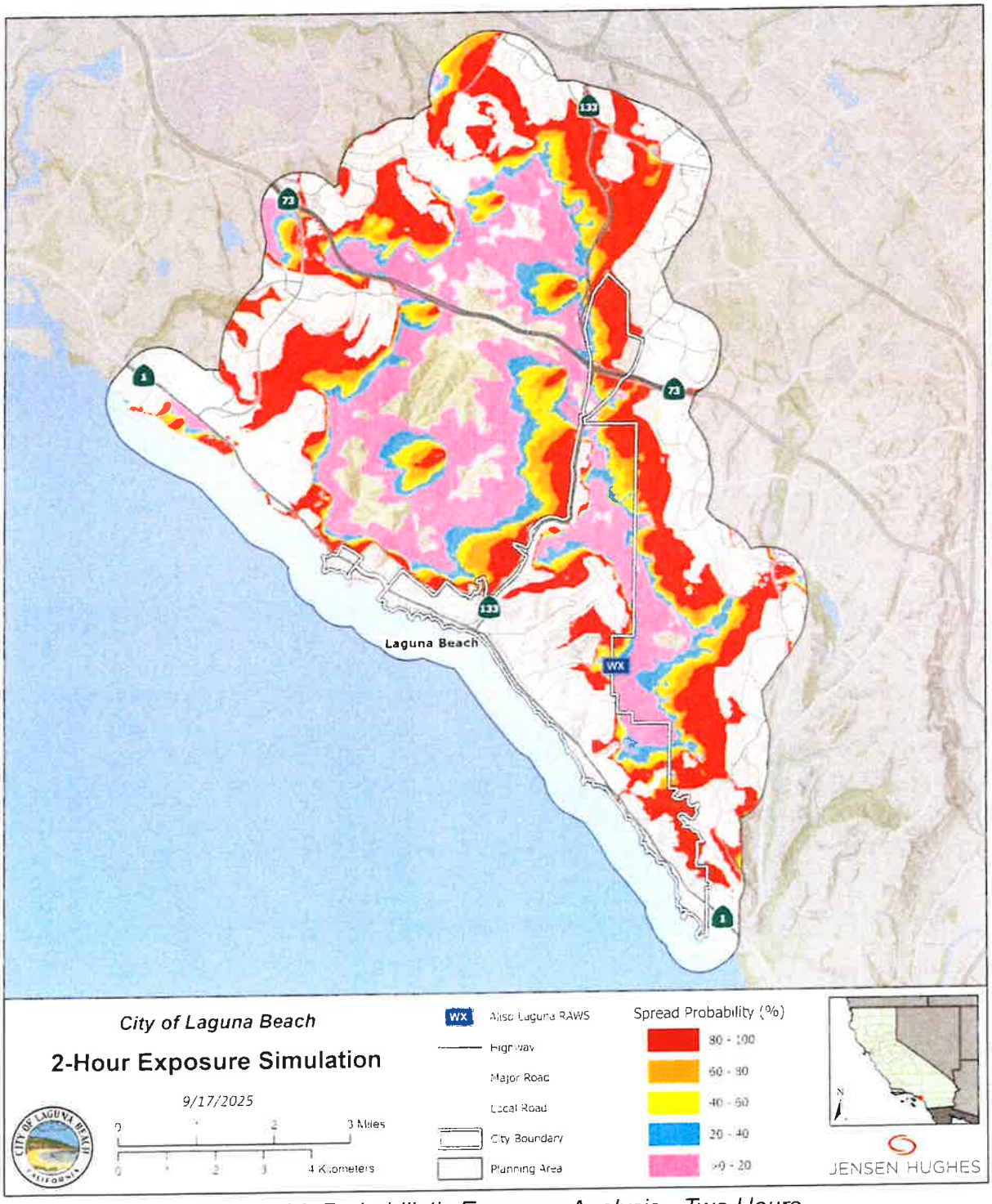


Figure 14. *Probabilistic Exposure Analysis - Two Hours*

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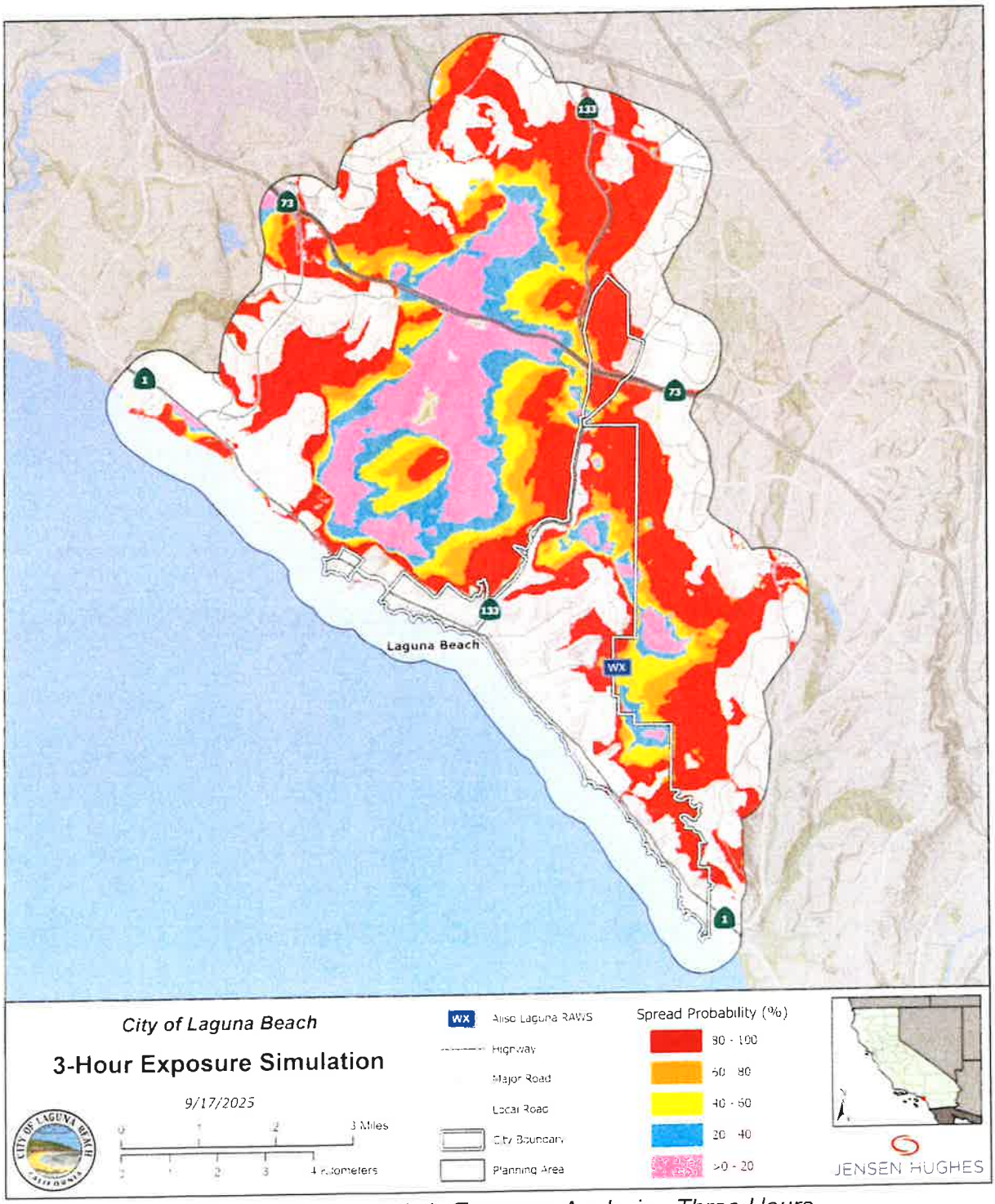


Figure 15. *Probabilistic Exposure Analysis - Three Hours*

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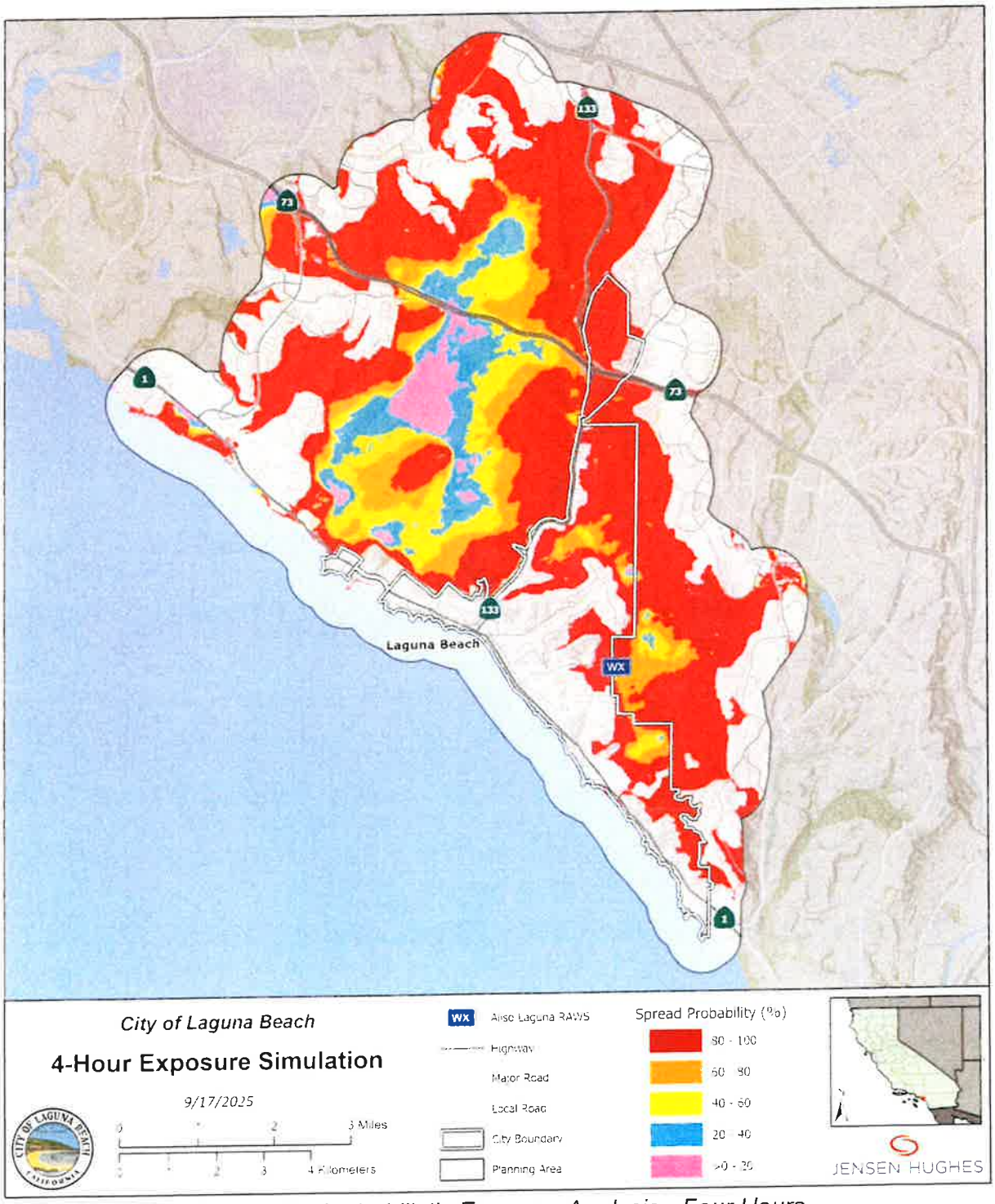


Figure 16. *Probabilistic Exposure Analysis - Four Hours*

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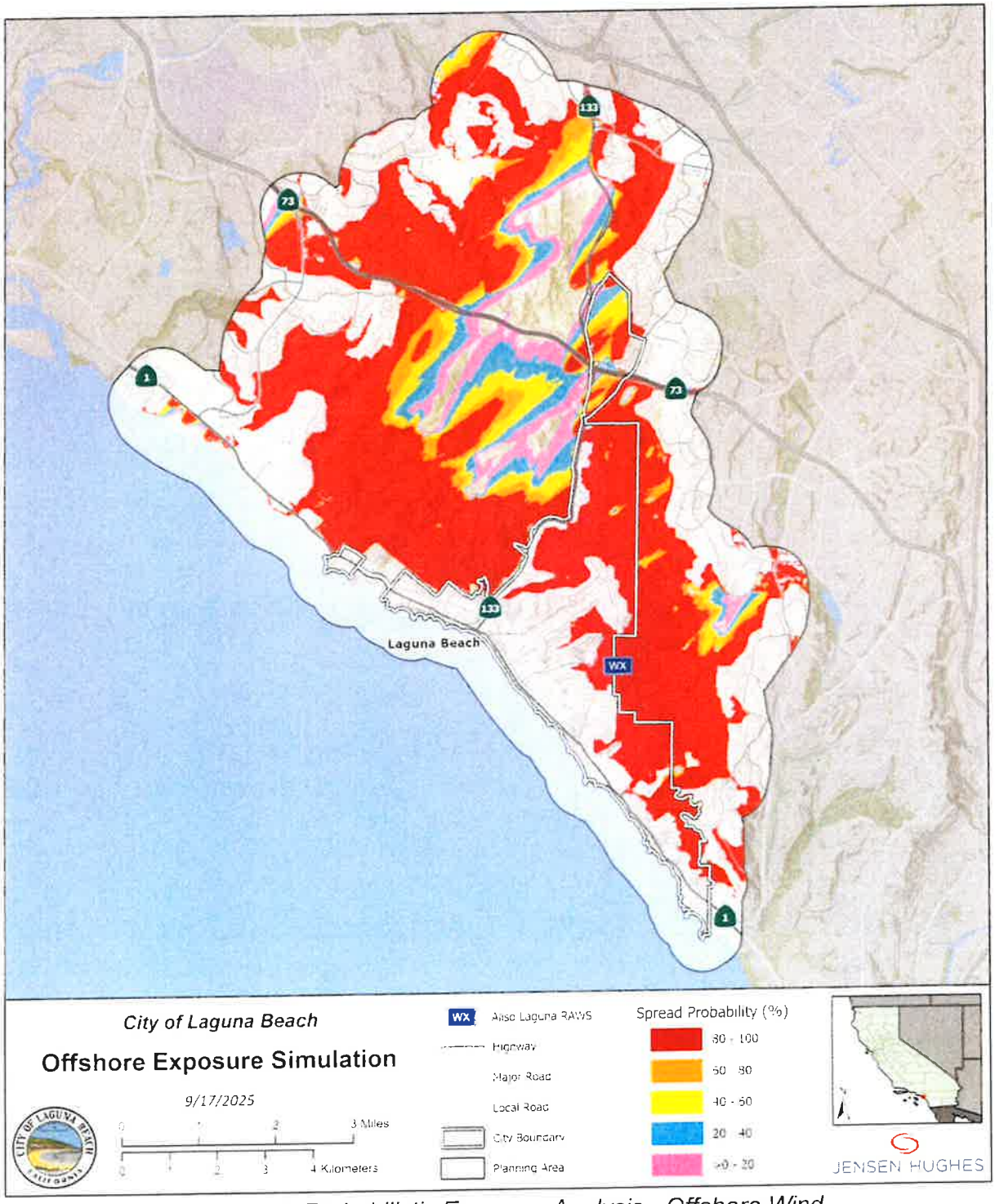


Figure 17. *Probabilistic Exposure Analysis - Offshore Wind*

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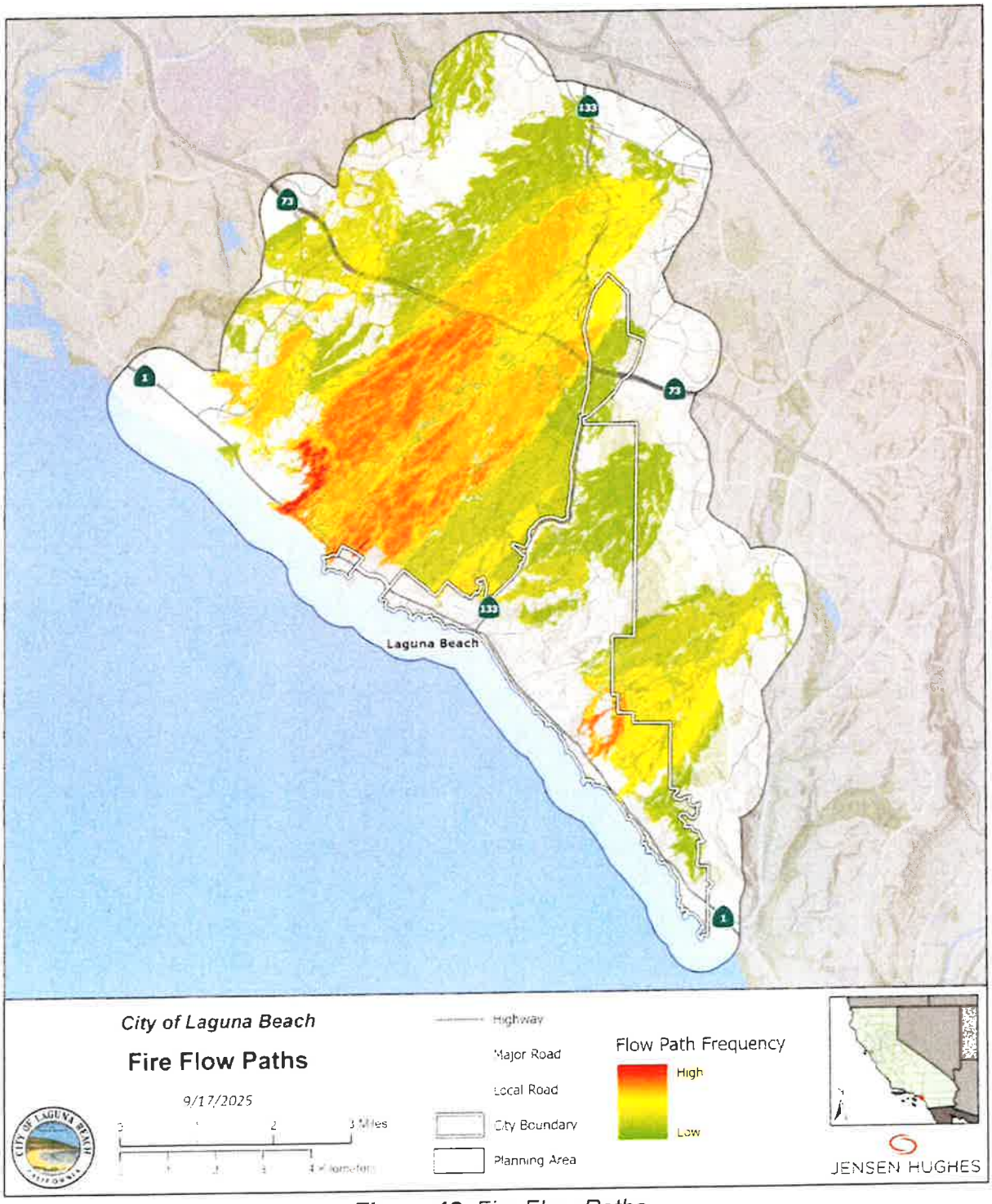


Figure 18. *Fire Flow Paths*

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A.4 EVALUATION OF EXISTING FMZ PROGRAM

The City's existing FMZs, goat-grazed polygons, and hand-crew treatments are shown in **Figure 1**. Units above Emerald Bay and South Laguna overlap effectively with modeled hazard corridors, but significant gaps remain at the mouth of Laguna Canyon and along Top of the World. These untreated outlets align with high hazard (**Figure 4**) and repeated fire frequency corridors (**Figure 7**), making them priority areas for new or widened FMZs.

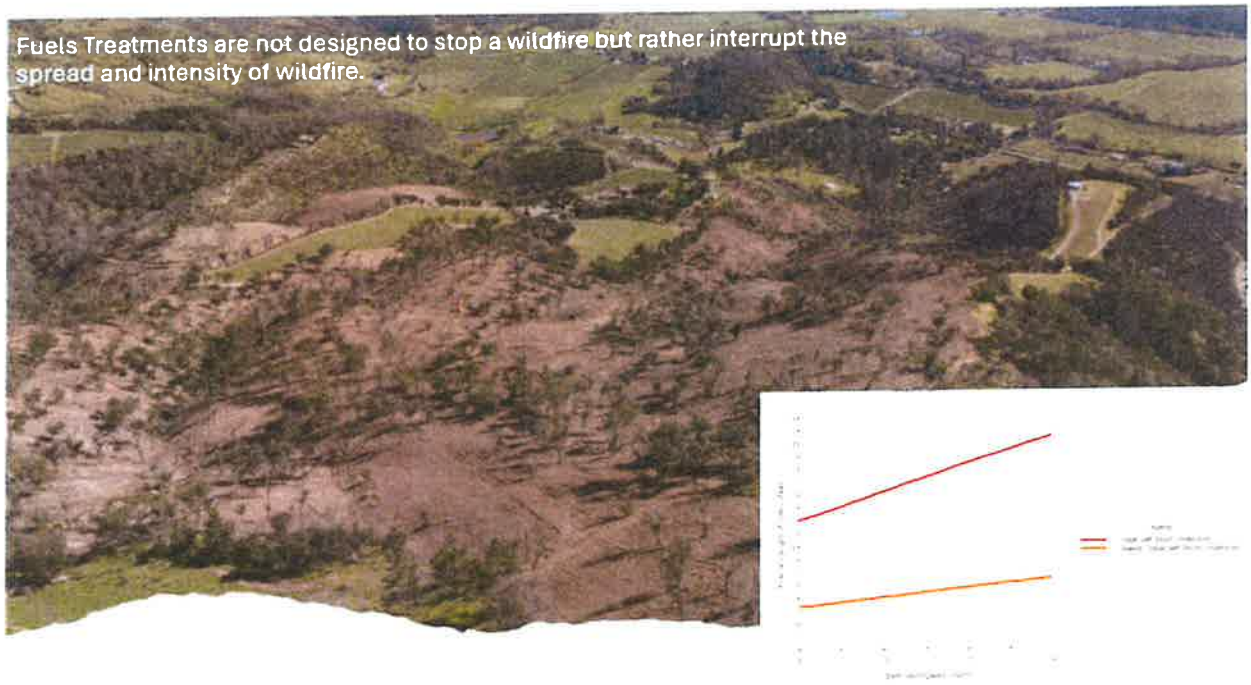


Figure 19. *Fuel Treatment Infographic*

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Appendix G

OCFA – Ready! Set! Go!

Wildfire Home Risk Assessment

Are You READY?

READY! SET! GO!

Directions: Answer each question using assigned point values as it applies to the home. If the question does not apply, score it as a zero. Total the points to determine the risk level for the home.

Home

Condition found	Recommendation	Points	Total
The **home** has all non-combustible siding (brick, stucco, metal)		**0**	
The home has some vinyl siding	Replace siding with non-combustible material	**5**	
The home has some wood siding		**10**	
The **roof material** is non-combustible (metal, composition, tile) with no areas for fire embers to intrude (i.e. has bird stops, flashing at valleys, and blocking)		**0**	
The roof has wood shakes or areas for fire embers to intrude	Replace wood shake with Class A roof assembly with approved "blocking" material. Eliminate intrusion areas	**20**	
All **chimneys** have spark arresters		**0**	
Some chimneys do not have spark arresters	Install spark arresters with 1/2" non-combustible mesh[1]	**5**	
All **gutters** and roof are clear of combustible debris		**0**	
Some gutters and/or roof have combustible debris present	Clear all combustible debris from roof and gutters. Install screens on gutters to reduce the accumulation of combustible debris[1]	**5**	
All **eaves** are boxed to prevent ember collection underneath		**0**	
Some eaves are not boxed	Plug openings in open-eave areas with durable caulk. Install a non-combustible covering over blocking to eliminate openings	**5**	
All windows are dual pane with durable frame (one pane is tempered).		**0**	
Some windows are single pane or have wood frames or do not have any tempered glass	Replace with dual pane windows with a durable frame. One pane should be tempered	**5**	
All eave and cornice **vents** are baffled. All other vents are protected with 1/8" non-combustible mesh		**0**	
Some eave vents and cornice vents are present and are not baffled or some vents are not protected by 1/8" non-combustible mesh	Replace eave and cornice vents with approved baffled vents. Protect all other vents with 1/8" non-combustible mesh. Keep the areas around the vents clear of vegetation	**10**	
Patio cover is constructed or covered with non-combustible material (brick, stucco, metal) or is not within 10' of home		**0**	
Patio cover is constructed with uncovered combustible material and is within 10' of home	Replace with non-combustible material or cover with non-combustible material (brick, stucco, metal)	**5**	
All **balconies** are constructed or covered with non-combustible material (brick, stucco, metal, tile, etc.). Undersides are protected to prevent ember accumulation		**0**	
Some balconies are constructed with combustible material or combustible material is exposed or undersides are unprotected	Replace with non-combustible material or cover with non-combustible material. Protect undersides	**5**	
All **decks** are constructed with non-combustible material (composite, tile, brick, etc.)		**0**	
Some decking is constructed with combustible material (un-approved vinyl, wood, etc.)	Replace with non-combustible material or cover with non-combustible material	**10**	
The undersides of all **raised decks** are constructed or covered with non-combustible material (brick, stucco, metal, tile, etc.)		**0**	
The undersides of some raised decks are constructed with combustible material and not covered with non-combustible material (brick, stucco, metal, tile, etc.)	Replace with non-combustible deck or cover with non-combustible material (brick, stucco, metal, tile, etc.)	**10**	
All **fences, gazebos, and trellis's are** 10' or more from the home or are constructed with non-combustible material		**0**	
Some fencing, gazebos or trellis's are less than 10' from the home and constructed with combustible material	Replace fencing, gazebo or trellis with non-combustible material within 10' from the house	**5**	

Landscape

Condition found	Recommendation	Points	
All **vegetation** is green and well watered (not annual grasses) and/or drought resistant		**0**	
Some vegetation is dead or not drought or fire resistant	Remove ALL dead vegetation and replace with fire resistant planting material. Visit www.ocfa.org for recommendations	**10**	
All **shrubs** are at least 5' from structures		**0**	
Some shrubs are within 5' of structures	Replace shrubs with low lying vegetation or thin shrubs to 50% density	**10**	
All overhanging **limbs** are at least 10' above roofs and at least 10' away from structures		**0**	
Some overhanging limbs are less than 10' from roofs and structures	Remove all limbs within 10' from structures[1]	**5**	
All **taller vegetation** is pruned and separated from underbrush and separated from trees. Separation between shrubs and trees is at least 3 times height of shrubs. Separation between low lying vegetation and shrubs is at least 3 times height of low lying vegetation. Spacing between shrubs is at least three times width of shrubs		**0**	
Some taller vegetation hangs over underbrush creating a "fuel ladder" that can carry fire up and toward the home	Provide separation between low lying vegetation and shrubs. Provide separation between shrubs and trees.	**10**	
All **outbuildings** and secondary structures are at least 20' from the home or constructed with non-combustible material		**0**	
Some outbuildings and secondary structures are within 20' of the home and constructed with combustible material	Replace with non-combustible material or cover with non-combustible material	**5**	

Perimeter

Condition found	Recommendation	Points	
Home has at least 100' of **brush clearance** around it or is protected by a formal and compliant "fuel modification" program		**0**	
Home has 30' - 100' of defensible space	Remove dead or dying vegetation within 100' of homes. Remove native vegetation within 30' of home. Thin native vegetation 50% density within 30' to 100' of home[1]	**5**	
Home has less than 30' of defensible space		**10**	
All firewood and other **combustible materials** are stored at least 30' from the home		**0**	
Some firewood or other combustible materials are stored against or within 30' of home	Move firewood and other combustible storage at least 30' away from home[1]	**10**	

TOTAL SCORE _____

For follow up questions regarding this risk assessment, please contact:

Consultation Performed by:

Name: _____

Phone: _____

Date: _____

SCORING:
During a wildfire, firefighters are better able to protect homes that have low scores. Firefighters may not be able to protect homes that have higher scores.

0: Your home has the **greatest potential for survivability** during a hostile wildfire.

5-20: Your home has been identified as a **low risk**. Recommendations indicated on this checklist should be addressed to increase the survivability of your home during a hostile wildfire.

25-40: Your home has been identified as a **moderate risk**. Survivability of your home will be an issue during a hostile wildfire. Recommendations indicated on this checklist should be completed.

45 and above: Your home has been identified as a **high risk**. The survivability of your home is low. Your home may be in extreme danger during a hostile wildfire. Recommendations indicated on this checklist are strongly encouraged to be completed.

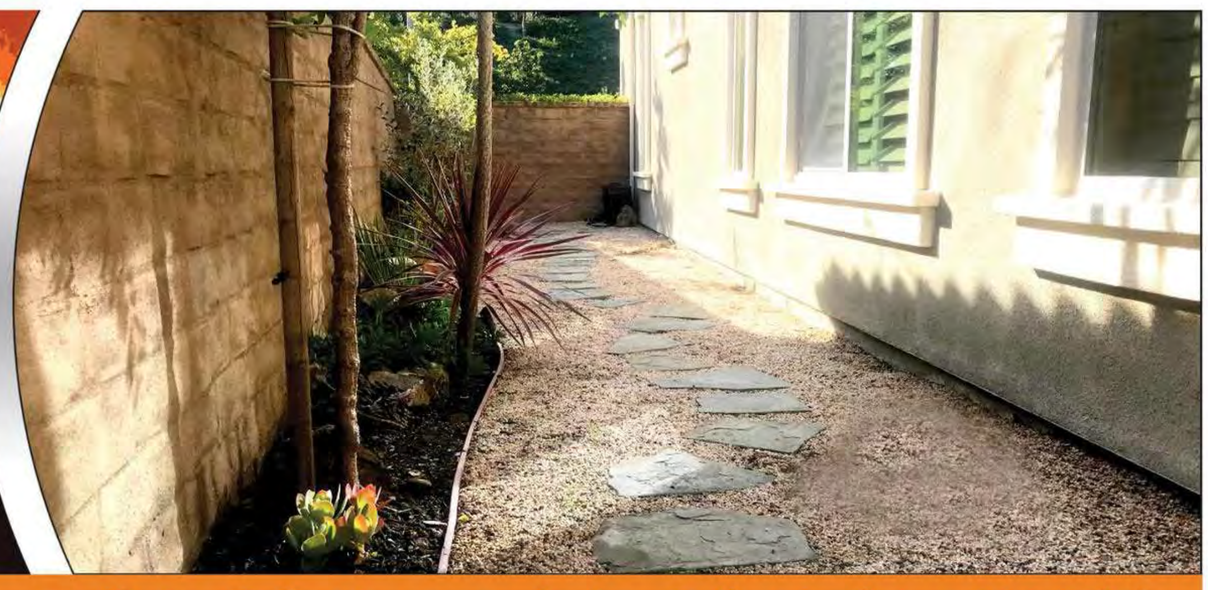
For additional information on how to increase the chance your home will survive a wildfire, please visit the Orange County Fire Authority's Safety and Education page at **www.ocfa.org** and the State Fire Marshal's wildland urban interface products page at **http://osfm.fire.ca.gov/licensinglistings/licenselisting_bml_searchcotest.**

If you walk your property without an OCFA inspector and have questions afterwards feel free to contact us at 714-573-6774 or rsgoc@ocfa.org

[1] For some homeowners, these recommendations may be requirements of the fire code. If the property is near a wildland area and is subject to a Defensible Space inspection, this is not just a recommendation, but a requirement and subject to a Wildland Inspection Notice.

READY, SET, GO!

IMMEDIATE ZONE



The main objective of the Immediate Zone, or 0 to 5 feet zone, is to reduce the potential that embers landing near a building will ignite fuels and expose the area around a home to a direct flame.



The Immediate Zone is the most important zone to reduce home ignition from flying embers. Install hard surfaces, reduce vegetation, and eliminate combustible mulch.

Changes made to the Immediate Zone can make a big impact in reducing structure loss during a wildfire

- Use hardscape like gravel, pavers, concrete and other noncombustible material. No combustible bark or mulch
- Remove all dead and dying weeds, grass, plants, shrubs, trees, branches and vegetative debris (leaves, needles, cones, bark, etc.); Check your roofs, gutters, decks, porches, stairways, etc.
- Remove all branches within 10 feet of any chimney or stovepipe outlet
- Limit plants in this area to low growing (below 2 feet), nonwoody, properly watered and maintained plants
- Limit combustible items (outdoor furniture, storage, planters, etc.) on top of decks
- Relocate firewood and lumber 30 feet away from buildings
- Replace combustible fencing, gates, and arbors attached to the home with noncombustible alternatives
- Consider relocating garbage and recycling containers outside this zone
- Consider relocating boats, RVs, vehicles and other combustible items outside this zone



Orange County Fire Authority

www.ocfa.org/RSG

For more information, please visit the OCFA website or call **(714) 573-6774** to schedule a Wildfire Home Assessment.



Early evacuation is the best way to protect yourself and your loved ones during a wildfire. As a wildfire approaches, follow these steps to help prepare your family and home, and make your evacuation safer.



Review your Wildfire Action Plan so all family members have the same information and know what to do.

Have all necessities ready, including the 6 P's, in case you have to evacuate:

1. People and pets
2. Papers, phone numbers, and important documents
3. Prescriptions, medical equipment, and eyeglasses
4. Pictures, family keepsakes, and other meaningful items
5. Personal computers, hard drives, tablets, or other data storage devices, including cell phones, and chargers
6. Plastic credit cards, ATM cards, and cash

Load everything into your car, including your Disaster Supply Kit and Go! Bag. Then, back the car into the driveway and close the windows and doors. Keep the keys with you, in case you need to leave quickly.

At Home:

- Close all windows and doors
- Shut off air conditioning and fans
- Close the fireplace flue
- Leave lights on, including porch lights
- Move outdoor combustible items (patio furniture, door mats, charcoal, firewood, lighter fluid, brooms, trash cans, etc.) away from the house or bring them inside
- Turn off propane tanks
- Close the garage door
- Connect garden hoses to spigots and place them so they can reach any area of the house
- Don't leave sprinklers on or water running as this can waste critical water pressure

Orange County Fire Authority

www.ocfa.org/RSG

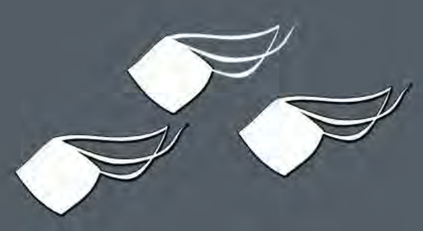
For more information, please visit the OCFA website or call **(714) 573-6774** to schedule a Wildfire Home Assessment.

READY, SET, GO!

BE EMBER AWARE



Embers are burning pieces of vegetation or other flammable material and are the leading cause of structural damage and home loss from a wildfire.



In order to successfully protect your home, you need to understand the real threat during a wildfire.

Once they're picked up by strong winds, embers can travel as much as five miles in front of the active front of a wildfire. Before flames get anywhere near your home, embers can land in dry or flammable vegetation or small open spaces on your roof or walls, and ignite, threatening your home.

If embers fall on and ignite nearby plants, the radiant heat created by the fire can burn combustible siding, doors, or window frames. Radiant heat can also cause windows to break, creating openings that allow flames and embers to enter your home. Once the home is on fire, it will create more embers that can be picked up by winds, travel to other homes and neighborhoods, and increase fire damage for the entire community.

Embers create a huge threat during a wildfire. It's the steps you take now to make your home and landscaping more ember-resistant that will protect your family, your home, and your community during the next wildfire. Take responsibility!



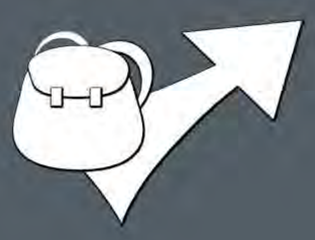
Orange County Fire Authority

www.ocfa.org/RSG

For more information, please visit the OCFA website or call **(714) 573-6774** to schedule a Wildfire Home Assessment.



A Disaster Supply Kit and a GO! Bag contain a collection of basic items your family may need during or after a wildfire.



Creating a Disaster Supply Kit in advance will prepare your family, not only for an evacuation, but for a long stay at home if escape routes are blocked during or after a wildfire.

Orange County Fire Authority

www.ocfa.org/RSG

The American Red Cross, FEMA, and the California Emergency Management Agency recommend putting together a Disaster Supply kit with supplies for at least 72 hours, including food, water, and supplies for pets.

After a disaster, basic services, such as electricity, gas, water, and phone may be out of service for days or even weeks. This may affect some people more than others, especially if they have special needs. It's important to consider the needs of every member of your household when creating your kit so your family is prepared to survive until additional resources are available.

A GO! Bag should contain some of the 6 P's like prescription medication, copies of important documents (papers), and personal supplies (credit cards, toothbrush/toothpaste, phone list, maps, etc.). If you're forced to evacuate and can grab only your GO! Bag, the items inside will make it easier for you to during and after a wildfire, earthquake, or other disaster.

Keeping extra supply kits in your car and at work is also a great idea in case a wildfire or other disaster stops you from going home.





For more information, please visit the OCFA website or call **(714) 573-6774** to schedule a wildfire home assessment.

READY, SET, GO!

WILDFIRE EVACUATION



Wildfires are unpredictable. Strong winds can change a fire's direction and strength in an instant, making it impossible for law enforcement to carry out evacuation orders or make door-to-door announcements.



GO EARLY! If your family is in danger from a wildfire, leave immediately. Early evacuation is the safest choice and gives your family the best chance of survival.

Whether you go early or leave during a mandatory evacuation, it's important to follow your Wildfire Action Plan.

- Make sure all family members are dressed in cotton or natural-fiber clothing
- Load your family, pets, Disaster Kit and Go! Bag into one car if possible
- Follow one of your pre-determined escape routes or evacuate as directed by law enforcement. The escape route should take you away from the fire, which is the same direction it's traveling
- Tune in to a local radio station and listen for instructions
- Drive with your headlights on for better visibility. Be aware of potential road hazards, including fire vehicles
- Don't attempt to pick up children from school or daycare. Teachers and staff members will respond according to the school's disaster plan
- Drive immediately to your family's meeting location. If you're separated from one or more family members, make contact according to your communication plan

Early evacuation is the safest choice during a wildfire, but it's only possible if you're prepared.

- If you don't have a Wildfire Action Plan, start one today. Make sure it includes at least two possible escape routes, a Family Communication Plan, and a Pet Disaster Plan
- Put together a Disaster Kit and Go! Bag
- Find out about the disaster plans at your workplace and your children's schools
- Keep the car fuel tank at least half-full at all times

FIRE ORANGE COUNTY CALIFORNIA AUTHORITY Est. 1995

Orange County Fire Authority

www.ocfa.org/RSG

For more information, please visit the OCFA website or call **(714) 573-6774** to schedule a Wildfire Home Assessment.



Appendix H

Emerald Bay Service District Emergency Siren Presentation

Emerald Bay Emergency Alert Siren

Proposed by Emerald Bay Service District

Reasons Needed: Emerald Bay is bordered by an area prone to wildland fires.

- 1993 Laguna Fire resulted in 66 homes lost and 58 damaged.
- 2012 Emerald Fire started about 4:00 a.m. and burned 154 acres.
- Required the evacuation of Emerald Bay residents starting at 4:30 a.m.

Emerald Bay residents **had no advance** warning of the evacuation.

Many residents place their **telephones on silent mode at night**, so they did not hear emergency telephone notifications from the Emerald Bay Community Association or Nixle.

An emergency siren will also provide **critical warnings to residents** of Irvine Cove and guests of Crystal Cove State Park.

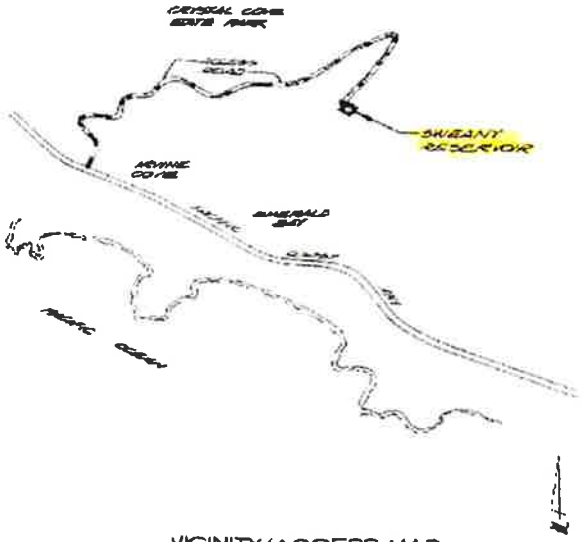
Loss of life was narrowly avoided due to Emerald Bay staff assisting in **evacuating elderly and disabled residents.**

The installation of an emergency siren could **save lives in future** wildland fires.

Emerald Bay Emergency Alert Siren

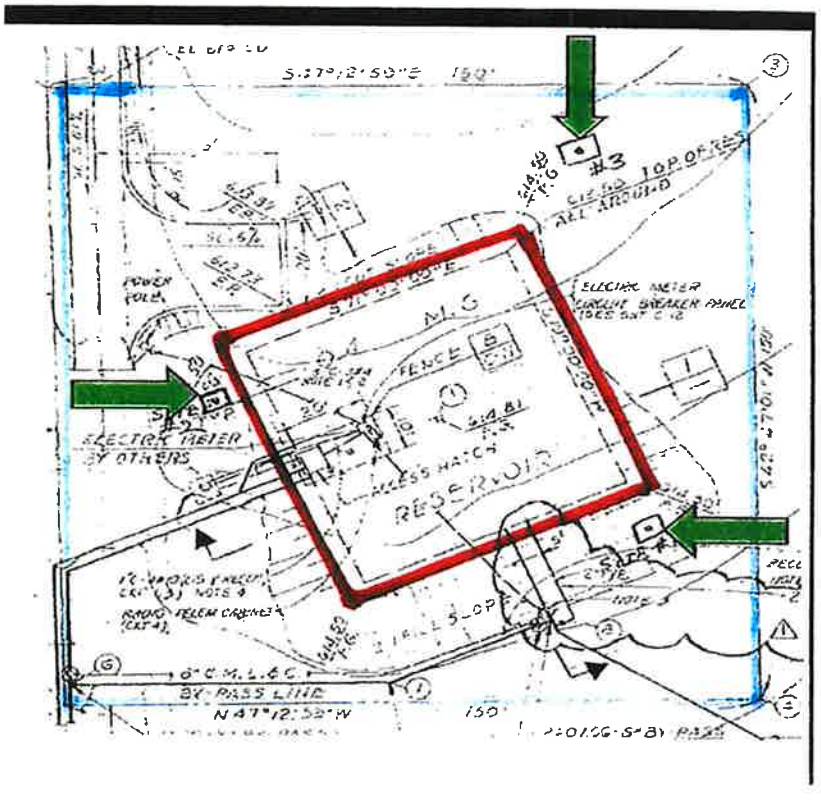
- Proposed siren would only be used to provide actual emergency notifications and testing.
- The proposed location at the **Sweany Reservoir** was determined by experts to be the **optimal location** to notify the largest number of residents of an immediate threat.
- Location at the Sweany Reservoir may not result in a significant compromise of undisturbed habitat.
- The Laguna Beach County Water District consents to installation of the siren at the Sweany Reservoir.
- The existing **LBCWD equipment pole has deteriorated and needs to be replaced**
- EBSD and LBCWD have agreed to place both the siren and LBCWD equipment on **one new shared pole** in one of three proposed locations.
- Location of the siren at the Sweany Reservoir would allow easy access for installation and service over existing LBCWD roads and easements.
- EBSD will work with State Parks on **mitigation measures** to reduce raptor exposure at the top of the new shared pole.

Sweany Reservoir



VICINITY/ACCESS MAP

Emerald Bay Emergency Alert Siren - Three Proposed Sites



- The existing Sweany Reservoir is a square reservoir that is buried (as outlined in red).
- The entire Sweany Reservoir site is outlined in blue.
- The three proposed sites (concrete pad) are indicated with green arrows.
- All proposed sites require the installation of a 6 foot square concrete pad

Pole Location Option #1



Pole Location Option # 1 - Discussion

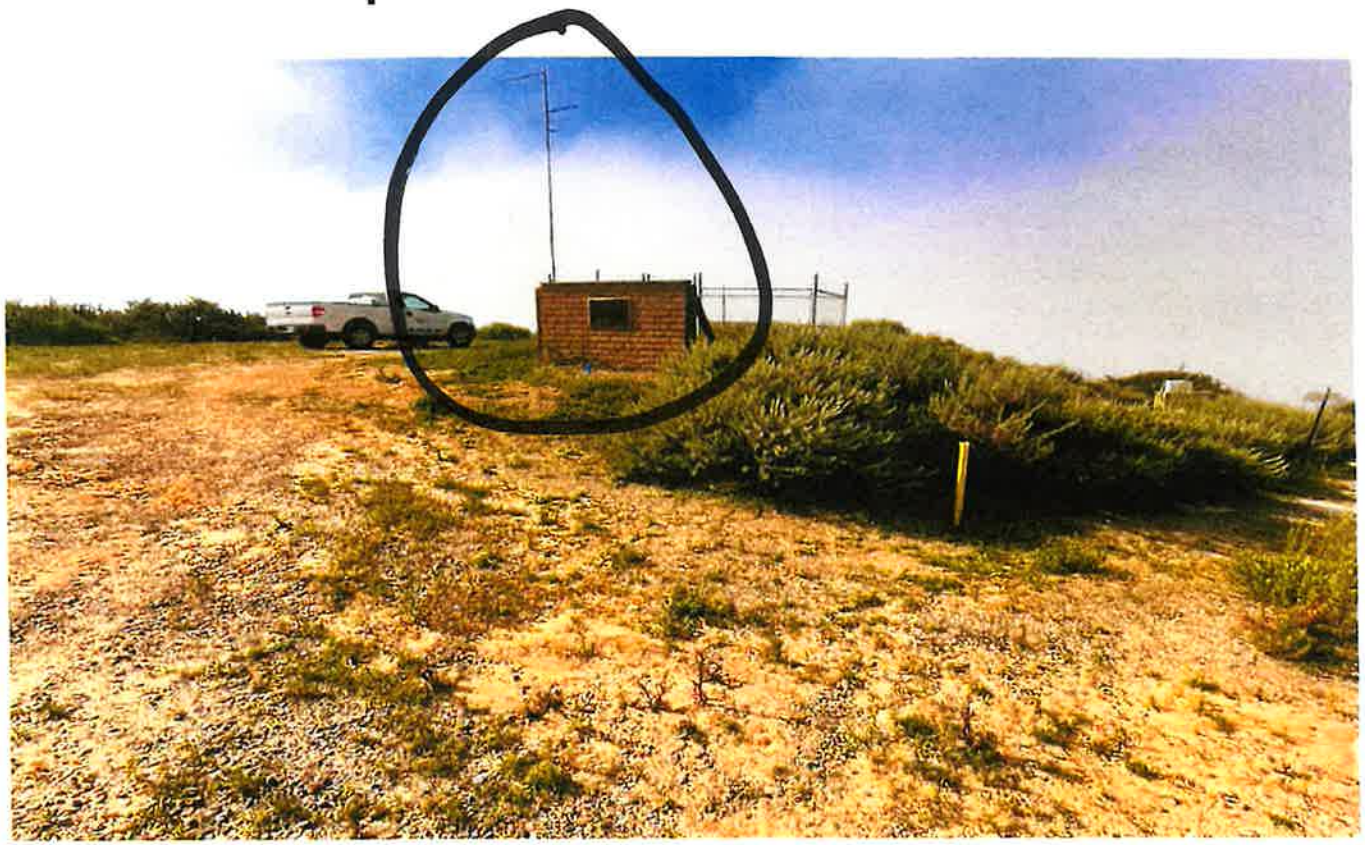
This site is located in the lower southeast corner of the property. The proposed location is depicted with the yellow pole in the picture.

The main advantage is that this site has clear sight lines to Emerald Bay.

There are several disadvantages to Option 1:

- It is at the lowest elevation of the three proposed sites (approximate 605 above sea level).
- Therefore, it would require the tallest pole due to the lower elevation of the site.
- Some native materials and plants would be disturbed in the construction at this site.
- This would be the most difficult site to maintain the pole and equipment.

Pole Location Option # 2



Pole Location Option # 2 - Discussion

The proposed site is located close to the existing telemetry equipment area and pole owned by LBCWD (in the northwest area of the buried reservoir).

The disadvantage for this site is that it is near the entrance to the site and reservoir from the access road. This may compromise access to the telemetry equipment.

The advantage is that it is within the current cleared reservoir property and would not disturb existing native plants and materials.

Option Pole Location #3



Pole location Option # 3 - Discussion

This proposed location is in the upper northwest corner of the Sweany Reservoir property.

There are several advantages to this Optional site:

- It is located within the area previously utilized for the construction of the reservoir.
- There are very few native plants or other vegetation in this area.
- It would not impact the reservoir structure, nor would it compromise the reservoir operation.
- It has the highest elevation (approximate elevation of 617 feet above sea level)
- This would potentially lower the required height of the pole from 70 feet to 50-60 feet.
- It has good access – no structures are in the way
- The disadvantage is its location near communication's equipment (not associated with the LBCWD).

Pole and Equipment



- Additions or modifications can be made to top or exterior of equipment to California State Park specifications to reduce likelihood of use by raptors.
- LBCWD equipment would be placed lower on same pole.
- Existing LBCWD pole would be removed.

IN SUMMARY

In summary, the District is recommending that Site No. 3 is the most feasible and viable for the new emergency pole/siren.

- The emergency siren will provide critical early warnings to residents of Emerald Bay in addition to residents of Irvine Cove and guests at Crystal Cove State Park.
- The emergency siren could save lives in future wildland fires.
- The recommended location at the Sweany Reservoir site was determined by experts to be the optimal location to notify the largest number of residents of an imminent threat.
- The recommended location at the Sweany Reservoir would allow easy access for installation and servicing over existing roads and easement.
- EBSD recommends Pole Location #3. This would allow adequate siren broadcasting while reducing the proposed height above ground to 50 feet.
- The emergency siren would not result in any significant compromise of undisturbed habitat.
- The recommended location would house both the emergency siren and the Laguna Beach County Water District telemetry equipment on one pole.

Google Maps Emerald Bay



Appendix I1

Citygate – Initial Wildfire Preparedness Taskforce Report

CITYGATE
ASSOCIATES

600 COOLIDGE DRIVE, SUITE 150 ▪ FOLSOM, CA 95630 ▪ PH (916) 458-5100 ▪ FX (916) 983-2090

March 3, 2025

EMERALD BAY - WILDFIRE PREPAREDNESS TASK FORCE - INITIAL IDEAS/SUGGESTIONS

For the following Items list begun by the Emerald Bay working group, Citygate and OCFA have used the following colors in the headings to quickly indicate opinions and how each topic will be handled in a briefing PowerPoint to the community committee.

Legend for the Following Categories:

Orange – Citygate and OCFA align and suggest on-going efforts

Red – OCFA does not support or based on current understanding is a last priority, requiring research

No Color – OCFA does not have a position based on what they can offer or enforce. Citygate finds the topic an obvious consideration and many should be resolved in a revised CWPP.

A. *Citygate Listening Topics in Discussion with OCFA*
   a. Emphasis on Vegetation Management/Defensible Space
   b. Review the density and final size of the newer Cypress Trees – 1600 Block
   c. Current environmental regulations will not allow burning of thistle
   d. Turnover of homeowners since '93
   e. Jan '25 OCFA did present to some of the homeowners
   f. Understand all options for a dual water supply
   g. Underground power lines behind Emerald Bay – due to voltage and regional transmission needs OCFA believes it very expensive and or there is no option for undergrounding
   h. If one or more homes are destroyed for any reason, current building codes will not allow rebuilding to prior less hardened designs
   i. An updated CWPP based on fire behavior modeling will be most beneficial and would be needed when talking with State and OC Parks

B. Citygate Overall Priorities
   a. Execute the basics really, really well, avoid hi-tech and or high maintenance costs
      i. Fuel control
      ii. Structure and yard hardening
      iii. Community notification systems
      iv. Evacuation plan and practice
   b. Don't pause on current active, and funded efforts this Spring
   c. Conduct an Updated CWPP Plan

Fuel Mitigation

1. **Conduct more aggressive interior fuel modification**[1]
    a. Survey property lines in Canyon to help clearly identify Association v Homeowner property
        - *Mike Dunbar received quote from Toal - $40k, awaiting additional quotes*
    b. Conduct Phase 1 of fuel modification in the Canyon to create clear fire break on the interior – concentrate on removal of trees at end of 1400 block, and ground cutting vegetation from 1100 block down to the pool/canyon road, and the same for the opposite side of the canyon
        - *Toni Hughes, Mike Dunbar, Cisco Farias met with David's Tree Service to walk the area, before meeting with OCFA Senior Fire Inspector/Community Wildfire Mitigation Jon Lim and other personnel on January 27, 2025, to discuss the areas of planned trimming and they agreed with the plan of action, noting that they usually run into issues with the area of the canyon which belongs to individual members but extends beyond the 100' of defensible space requirement. The Board approved Dave's Tree Service proposal to move forward immediately with the canyon vegetation management. Work started 2/20/25.*
        - *Consider need for wattles and jute netting*
    c. Conduct Phase 2 of fuel modification, including opposite the office and all other areas, including extensive trimming of all palm trees, as suggested by OCFA
        - *Maintenance staff have started removal/trimming of the slope opposite the office*
        - *Citygate and OCFA recommend removal of the Palm Trees*
    d. Conduct any additional fuel modification requirements, after typical annual meeting with OCFA in March and prepare annual bid package and award work to be performed earlier this year in May
        - *Met with Dudek 2/18/25 to begin fuel mod bid package prep*
    e. Increase fuel modification to twice a year moving forward. OCFA can assist with twice a year walking inspections
        - *Discussed with Noah Stamm, Dudek 2/18/25 the possibility of typical fuel mod annually in May and then any additional needed trimming or just clean up in Nov prior to the rains – would depend on potential additional growth*
    f. Consideration of removal of 1600 block Eucalyptus or Extensive Trimming
        - *OCFA evaluated the Eucalyptus trees after the Emerald Fire and noted that they acted as a "baseball mitt" for embers. OCFA can't mandate the removal of healthy trees. Chief Summers emailed to confirm the same but noted it is the community's choice whether to remove them.*

[1] Fuel modification is a specific description of vegetation management. Any work done outside the Bay and on the interior slopes should be considered vegetation management or defensible space. Only four parcels have true fuel modification.

- *Citygate is of the opinion they should be removed given location at slope edge and annual maintenance effort and will speak to OCFA re their thoughts.* After discussion, OCFA agrees with slope stability evaluation prior to removal of trees and should include the planting of the Cypress in the same area
- HOA Consideration of conducting a controlled burn area – not needed pending an update CWPP. Second AQMD issues all burn permits for any reason, countywide and they do not allow these types of burns.

Current OCFA Program Elements

Annually - Pre-walk with Emerald Bay and third party consultant to go over what vegetation removal is to happen outside of Emerald Bay property line (State and OC Parks land and interior canyon).

Once Emerald Bay completes discussed work, verification inspection occurs.

Every home interior of PCH OCFA completes an annual defensible space inspection.

2. Increase exterior fuel modification zone

a. Conduct meeting with State Parks and OC Parks re extending fuel modification zone beyond existing 170' to 500'. Second, locally sourced cactus and oak replacement plantings would be required. Conduct a CWPP before continuing this path.
   - *Mike Dunbar, Toni & Cisco met with both on February 5, 2025 – they asked for scientific reasoning for 500'. They will speak to management & told Mike to add the request to this year's fuel mod permit.*

b. Legal Counsel to send letters to State and OC Parks requesting additional clearance
   - *Letters have been drafted but seek independent fire modelling analysis so can reference supporting documentation for 500'*

c. Install more opuntia and oak trees as fire mitigating measures within the OC/State Parks if acceptable *'A low hanging fruit task'*
   - *State/OC Parks were enthused by the prospect of planting more opuntia and will work with us on this*
   - *OCFA has noted that grants are available for entities to apply for – consider teaming up with the City again to apply for grant*

3. Encourage more aggressive vegetation management of homeowners

a. Send a vegetation management letter to all residents to encourage aggressive action and pre-education ahead of OCFA's vegetation inspections in March
   - *Letter went out in 2/7/25 mailing*

b. Target communication to residents with most concerning vegetation in canyon areas

- *Emails were sent x 3 from 2/11/25 to canyon homeowners about piggy-backing onto the Association efforts, Staff and vendor have met with 530, 532, 529, 518, 1133, 1227 the week of 2/17/25 – positive responses & requests for proposals*

c. Work with OCFA in annual residential vegetation management notices in attempts for quicker compliance – encourage Members to address vegetation in immediate zone (0-5') and determine ways to address privacy hedges etc. Coordinate inspections by notifying residents so OCFA can obtain access to inspect and make their recommendations/requirements – watch out for updated Fire Severity Zone Map (3/17/25) with updated requirements

d. Determine if any rule changes can be made to require greater vegetation management, specifically in relation to immediate zone, trees touching eaves, privacy hedges

   a. Landscape design criteria can be enforced to a higher standard than current code requirements through the landscape design committee. OCFA can assist.

4. **Ensure vegetation management of neighboring residents, i.e. City of Laguna Beach, Irvine Cove, and Smithcliffs residents who back onto Emerald Bay residents**

   a. Work with the City of Laguna Beach to get compliance on vegetation management from LB neighbors who back up on to Emerald Bay residents

      - *Susan Thomas discussed this with LB Mayor, and he asked for the information from the homeowner who complained about this at the Town Hall (Dr. Eftimie, 570 EB) so he could turn it over to the Laguna Beach Fire Department for enforcement. I contacted Dr. Eftimie to request confirmation of the offending LB resident and he plans to contact his neighbor again first to try and obtain compliance before turning it over to the City*

   b. Work with Irvine Cove on vegetation management

      - *Staff followed up with Kelly Shaw, Irvine Cove's GM, to have their culvert behind the 900 block cleaned of debris – this was done immediately. Additional follow up was done to ask for clearing of the overhanging vegetation – need to contact the EB residents about this too.*

   c. Work with Smithcliffs on vegetation management

5. **Consider other measures, such as anti-arson patrol units**

   a. OCFA can assist in connecting you with OC Fire Watch groups

Property/Home Hardening

OCFA can assist in outreach to homeowners with RSG messaging in a town hall setting and individual home assessments

1. **Ensure all Association buildings are properly hardened[2]**

[2] Confirm that properly hardened means to Chapter 7A of Building Code or 337 of the Residential Code?

a. Meet with OCFA for inspection of properties
    - *Staff met with OCFA on January 30, 2025, to inspect all the buildings and surrounding vegetation – has recommendations to action*
b. Take action to upgrade properties/address surrounding vegetation based on OCFA advice
    - *Staff have already met with vendors to obtain quotes for a new roof for the maintenance building ($21k) and new tough sheds to replace the old shed due to the cost to repair roof($12.5k)*

2. Incentivize Members to harden their homes and create improved defensible space/vegetation management

a. Consider changes to the Architectural Regulations to require increased fire protection (e.g. creating a Landscape setback of 5 ft minimum from the home and property line that will have planted no higher than 18"; Replacement of roofing with Class A fire rated materials; Replacement of wood siding with fire rated/ cementitious material
b. Consider waiving architectural, construction, and parking pass fees for any appropriate fire-related improvements – determine what these might be to avoid abuse of the system/rules (e.g. if member adds on additional remodel or property improvements this will void the waivers); spell out what would constitute an administrative review
c. Determine what rule changes may need to be made & implement according to hearing process

3. Investigate the possibility of undergrounding the power lines or coating them

a. Coordinate with the City of Laguna Beach and Irvine Cove to join forces
    - *EBSD Vice-President, Susan Thomas, has already spoken with LB Mayor Alex Rounaghi who expressed an interest in working together – he plans to approach Southern California Edison, the County, and Parks.*
    - *Scott Swensen met with Irvine Cove Board President, Steve Gordon, and Susan Thomas – Steve thinks OC Transportation may sell bonds to fund the cost.*
    - OCFA believes Extremely expensive and may not be possible. Long-term research.
b. Set up a meeting with SCE, OC & State Parks

4. Consideration of power outage preparations

a. Install emergency generator for Community Center
    - *EBSD awaiting County permit to finish generator installation*
b. Consider making exceptions to Architectural Regulations for noise mitigation measures for emergency generators

C. Fire Fighting

1. Determine sufficiency of reservoirs and if any further improvements can be made

a. Confirm and monitor reservoir levels
   - *EBSD GM, Mike Dunbar, met with LBWD on January 30, 2025, to confirm levels and monitoring access – can get weekly updates*

b. Consider the development of a reservoir (or Heli-hydrant) on Emerald Bay owned lot – next to 1133 EB.
   a. OCFA finds the need for input from Air Operations for feasibility with limited water and power lines may need to rethink.

2. Evaluate and improve EB fire hydrant capabilities

a. Evaluate/improve Canyon fire hydrant *(it is the only direct fed hydrant from the Zitnik Reservoir on Old Hill side and if fire is coming down the Canyon, firefighters will avoid tactical firefighting in the Canyon and go into structure protection mode – how can we still make use of that valuable hydrant?)* – investigate/purchase a fire hose which can be attached to the canyon fire hydrant and extend out of the canyon so it can be still utilized to fill fire trucks
   - *Mike Dunbar sent "Bulk 4" x 1,000' double jacket fire hose" to Dave Skarman for review ($11.3k)*
   - OCFA - If you want to run a hose above ground, why not run it underground with proper signage on the hydrant and education of operations that there is an independent water source?

b. Determine if any other hydrants can be directly fed from the Zitnik Reservoir
   - *Consider adding hydrants at the 1229 EB cul-de-sac, 557 EB cul-de-sac, and 530 EB cul-de-sac, directly fed from Zitnik – estimated cost of $125-$200k.*

c. Consider any opportunities for additional fire hydrants in the community, including Heli hydrants *see above note from OCFA for Air Operations determination*
   - *LB County Water has added a heli hydrant at the Zitnik Reservoir and is investigating adding one at Sweeny Reservoir.*
   - *Consider EB lot at end of 1133 EB*

3. Consider/Install water cannon/irrigation system

a. Determine what irrigation/pump system is needed around the perimeter of the Bay & how it could be installed and operated
   - OCFA - If consideration is given, it is a very low priority as someone would have to stay behind and doing so goes against normal passive evacuate recommendations
   - *Staff met with MinuteMan Plumbing on January 28, 2025, to discuss the installation of a water irrigation/cannon system on the interior side of the canyon fence, running up both sides of the canyon and eventually around the full*

perimeter, to be operated remotely. Mike Dunbar is meeting with the EBSD Engineer to plan the system to aid MinuteMan in putting a proposal together (4" galvanized pipe along perimeter, connected to 8" transmission main from the Zitnik Reservoir; water cannons capable of shooting water out 400' placed in several locations) – estimated cost of $200-300k. Consider if this will deplete firefighting water resources – can the pool water be used?

b. Evaluate pool fire pumps for EB pool & likelihood of use
    - *Stewart noted that this would be extremely unlikely, especially since a diesel pump could have issues operating in heavy smoke/ember conditions*
    - OCFA- if piping and valve could be provided to the fire hydrant at lower elevation, this may provide additional water to local station.

c. Consider other related water pumping systems and potential use of Pacific Ocean

4. Utilization of fire retardant (Phos-Chek)

- OCFA - Further evaluation and proving to assure no environmental concerns

a. Spray fire retardant around interior (and exterior?) perimeter to create additional fire break. Consider if it's needed along PCH for evacuation
    a. OCFA - Evaluation of roadside hardening on PCH related to vegetation
    - *Perimeter Solutions provides fire retardant and phos-chek to fire agencies - it can be sprayed and lasts up to six months or up to a half inch of rain, is non-toxic, biodegradable, and colorless/odorless. It's approved by US Forestry and CAL FIRE and acts as a fertilizer so it won't kill the vegetation, but it will turn it temporarily brown. They do it for other cities/communities - see attachment 7 for information on Phos-chek*
    - *An initial intro virtual meeting was held on January 27, 2025; an onsite meeting is scheduled for February 4, 2025, for Perimeter Solutions to visit and assess the community and determine the preventative measures, including the coverage level needed and manpower to do so. They noted that it could also be pumped into a perimeter sprinkler system.*
    - *Stewart Gary noted that the San Diego County is investigating another product – a new chemical for multi-month brush pretreatment.*

b. Consider providing residents with "Ember Blitz"
    a. OCFA - Additional education needed to anyone that would utilize instead of evacuation as that is still a priority
    - *Cannister which attaches to a garden hose and a bottle of Phos-Chek to spray eaves, etc. Can be used as another protective measure if wildfire is coming and there is time*

5. Consideration of private firefighters

6. Consideration of an Emerald Bay helipad

7. Consideration of water tankers or/and tank farms

8. Investigate modifications to existing canyon fire camera/siren

- *LB have added AI to their cameras which can detect brush density*
- *Investigate SensoRy AI – new technology being developed in collaboration with OCFA*

D. Education

1. Consider outreach to other Wildfire Preparedness Consultant Experts

a. Engage wildfire consultants
   - *Mike D rec'd proposal from Citygate Associates for consulting services – they are already working with OCFA. The EBSD approved their proposal, and they will be joining us for our Task Force meetings.*

b. Consider applying for the Community Planning Assistance for Wildfires (CPAW) program
   - *(CPAW) provides communities with land use planning solutions, communications assistance, and customized research to better understand and manage wildfire-prone areas and reduce risks: https://cpaw.headwaterseconomics.org/what-we-do/*

2. Educate residents on Town Hall topics for those who did not attend

a. Send separate eblasts on the different topics
   - *Several eblasts have been sent from Scott S. re wildfire mitigation efforts & encouraging homeowners to book OCFA home assessment*

b. Send a letter to residents with a summary of tips

3. Establish Red Flag/High Wind communication and enforcement protocol

a. Evaluate/improve messaging with additional instruction?
b. Enforce closure of fire pits during these conditions
c. Consider parking enforcement on these days

OCFA - Like LA city no parking on red flag days or only in designated locations

OCFA - Evaluate if the previous station 11 siren is still available. Education on what the siren means.

If Emerald Bay can provide location for a camera and related logistics and access, OCFA will research installation of camera for Alert California.

d. Consider no construction on these days
e. Consider locking the wilderness gate on these days
f. Add red flags to other gates, including wilderness gate 13

4. Educate residents based on insurance renewal information

a. Liaise with EBCA insurance broker, Brown & Brown, and resident volunteer, Steve Friedman regarding insurance requirements

5. Document all Wildfire Preparedness improvements and make accessible to Members for use with insurance renewals

a. Maintain a working document which can be accessed via CondoControl

E. Evacuation

1. Installation of an emergency siren

a. EBSD to secure land lease and obtain approval from State Parks
   - *EBSD meeting with State Parks w/o 2/10/25*

2. Consider efficacy of emergency communication

a. Investigate if EBCA emergency numbers can be rebranded, i.e. CondoControl
b. Consider AM radio
c. Investigate Wi-Fi back-up
   - *Starlink is $500 p/m to give all resident access*

3. Evaluate emergency ingress/egress

a. Work with LBPD and OCSD to obtain evacuation plans – do they have contraflow procedure?
   - *Staff obtained Laguna Beach evacuation plan, in addition to KLD Engineering Study Wildfire Egress Study which indicates that the evacuation time estimate (ETE) benefit does not outweigh the danger and effort required to implement it*

b. Consider ability for fire truck access on all streets and need for additional red curbs
c. Work with Parking Ad-Hoc Subcommittee to evaluate ways to mitigate the number of vehicles parked on-street
d. Consider providing giving residents near gate 8 a key to open the fire gate
   - *Gate 5 was repaired, making it easier to open*

4. Evaluate how to further aid ease of evacuation

a. Ensure protocol of providing emergency services with "Requires Assistance" list to ensure those residents are evacuated should staff not get to them first
b. Investigate an emergency animal collection service, as suggested at the Town Hall
c. OCFA - Establish locations for kennels that block leaders could remove animals while others are at work or away from home?

F. Post-Fire Preparation

1. Investigate measures the Association would need to take post-wildfire destruction

a. Determine Association's responsibility post-wildfire in terms of allowing residents back into the community and hiring demolition/removal of hazardous waste - In coordination with the Federal, State and County regulating agencies

2. Prepare a home replacement plan in event of destructive wildfire

a. Consider if new regulations are required to address home reconstruction in event of a disaster, e.g. *If a homeowner rebuilds their home to the prior approved plan, they will receive one round of review to verify the plans match and the project gets noticed. Project will have a reduced or waiver of review fees* - consider expeditated measures which do not compromise the rules

OCFA - Reconstruction will not be allowed to prior approved plans. All building will be required to be constructed at current adopted state and county Uniform Building and Fire codes

Appendix I2

Citygate – Community Wildfire Mitigation Planning Briefing Report

CITYGATE
ASSOCIATES



Community Wildfire Mitigation Planning

TASK FORCE BRIEFING

Emerald Bay Service District / Homeowners Assoc.

March 27, 2025

Work Completed Since Last Task Force Meeting

- Citygate reviewed the draft Task Force Action Plan ideas
- Citygate worked with OCFA to understand what has been occurring to date
- Citygate and OCFA discussed the draft Task Force Action Plan and suggested this joint briefing to your staff as a next step
- CSD staff are receiving proposals for the Community Wildfire Protection Plan (CWPP) work by March 27

Citygate's Overall Priorities

- Execute the basics and passive activities
  - Avoid high-tech and high maintenance cost items until the basics are solid
  - Don't fund expensive items without engineering for fit and life cycle maintenance costs
- Work the basics all in parallel
  - Fuel management and modification
  - Structure and homeowner yard hardening
  - Community notification systems
  - Evacuation plan with annual real-time practice

Citygate's Recommendations Up Front

- Continue with active, funded efforts this spring
- Conduct an updated CWPP, to include a fire behavior model that provides a current best practices foundation for an actionable multi-year strategic plan that drives internal and external partners activities
- Practice the evacuation plan this spring
- Increase the tempo of communications to homeowners
- Use OCFA when meeting with other agencies

Fuel Mitigation

Vegetation Management Framework

- Vegetation Management
  - Defensible space (100 feet or to property line) PRC 4291
  - Fuel modification (condition to build)
    - Currently five addresses have a fuel modification plan
- Conceptual management plan after the 1993 fire

Current OCFA Program Elements

- Annual pre-walk with Emerald Bay and third-party consultant to go over what vegetation removal is to happen outside of Emerald Bay property line (State and OC Parks land and interior canyon)
- Once Emerald Bay completes discussed work, verification inspection occurs
- OCFA completes an annual defensible space inspection for every home within PCH
- OCFA can assist with walking inspections twice per year

Private Property Process

- Immediate Zone (0–5 feet)
  - AB 3074
- Real estate disclosure
  - AB 38
- Send a vegetation management letter to all residents to encourage aggressive action and education ahead of OCFA's vegetation inspections in March
- Target communication to residents with most concerning vegetation in canyon areas

Private Property Process (cont.)

- Work with OCFA on annual residential vegetation management notices in attempts for quicker compliance; encourage members to address vegetation in immediate zone (0–5 feet) and determine ways to address privacy hedges, etc.; coordinate inspections by notifying residents so OCFA can obtain access to inspect and make their recommendations/requirements; SRA maps have been out since April 2024
- Determine if any rule changes can be made to require greater vegetation management, specifically in relation to immediate zone, trees touching eaves, and privacy hedges

Current Vegetation Management Program

- Survey property lines in canyon to help clearly identify Association vs homeowner property
  - What if private lot is outside of the 100-foot PRC requirement?
  - Maintain buffer twice per year
    - Light flashy fuels
    - Heavy fuels
- Work with the City of Laguna Beach to get compliance on vegetation management from neighbors backing to Emerald Bay lots; also include Irvine Cove
- Conduct Phase 1 vegetation management – What does a twice-per-year plan look like?
- Look at roadside thinning / vegetation reduction on PCH

Task Force Vegetation Management Projects

- Conduct Phase 1 of fuel modification in the canyon – Planning underway
- Conduct Phase 2 of fuel modification, including opposite the office and all other areas, as well as extensive trimming of all palm trees – OCFA recommended, Citygate supports
- Increase fuel modification to twice per year – OCFA can assist with twice-per-year walking inspections
- Consider removing 1600 block eucalyptus, or extensive trimming
  - OCFA can't mandate; it's a community choice
  - Citygate is concerned three ways: unnecessary fuel hazard, increasing maintenance costs, proximity to powerlines and edge of slope; Citygate recommends consulting an arborist (not tree trimmer) and soils engineer for review, or to just remove them
  - Include the cypress trees below on the slope in the review as they will mature; trees, slope, and power lines are not a positive mix
- HOA consideration of conducting a controlled burn area – Not possible pending an updated CWPP; AQMD issues all burn permits Countywide and the criteria do not fit your local conditions

Exterior to Community Options – CWPP Driven

- Conduct meeting with State Parks and OC Parks about the request to extend the fuel modification zone – Suggest tabling it pending the new fire behavior model completed early in the CWPP process
- Move forward on installing more opuntia and oak trees as fire mitigating measures within State Parks and OC Parks
- *State Parks and OC Parks were enthused by the prospect of planting more opuntia and will work with Emerald Bay*
- *OCFA knows that grants become available; consider teaming up with the City and Irvine Cove again to apply for grant*

Increase Homeowner Vegetation Management

- Watch out for the updated CAL Fire Severity Zone Map (April) with new requirements
- Landscape design criteria can be enforced to a higher standard than current code requirements through the Architectural Committee; *OCFA can assist*
- OCFA can assist in connecting you with OC Fire Watch group for dangerous practices/arson observation

Building and Landscape Hardening

Building Hardening

- Ensure all Association buildings have properly hardened vents, eaves, and roofs (direct flame versus ember intrusion)
  - Pool building
  - Maintenance
  - Community center
- OCFA can assist in outreach to homeowners with RSG messaging in a town hall setting and individual home assessments
- Confirm that properly hardened materials meet Chapter 7A of Building Code, or 337 of the Residential Code

Private Homes & Powerline Considerations

- Incentivize members to harden their homes and create improved defensible space / vegetation management
  - Change architectural regulations
  - Determine what rules need to be revised to allow this
- Transmission lines behind Emerald Bay are 66kV according to CPUC
  - Undergrounding has been done elsewhere, but is *very* expensive
  - Terrain would be an issue; engineering and installing barriers
- Local area lines inside the property are likely 3-phase, 12kV
- Open and maintain the discussion with SCE and the Countywide CWPP work on undergrounding
  - As underground funding allows, advocate for priority need

Generator & Battery Considerations

- Install emergency generator for Community Center
  - Generator installation to be complete by April
- Consider making exceptions to architectural regulations for noise mitigation measures for emergency generators
  - Coordinate with County as needed
- Is community-wide battery/microgrid storage possible?
  - Would SCE pilot something?

Firefighting Enhancements

Water Supply Improvements

- Evaluate/improve canyon fire hydrant
  - Is the canyon fire hydrant the only direct fed hydrant from the Zitnik Reservoir on Old Hill side?
  - If fire is coming down the canyon, firefighters will avoid tactical firefighting in the Canyon and go into structure protection mode; how can that valuable hydrant be used?
  - Consider underground line from hydrant to main road with signage on the new hydrant
- Investigate/purchase a fire hose which can be attached to the canyon fire hydrant and extend out of the canyon so it can be still utilized to fill fire trucks
  - A lot of questions, expensive to maintain, last choice if permanent line is not feasible
    - Who is going to connect
    - Fire Department access / fire damage

Consider/Install Water Cannon / Irrigation System

- Always first go with passive protections
- Maintenance effort, cost, back-up power, smoke conditions
- *Who stays behind to monitor?*
- Evaluate pool fire pumps for Emerald Bay pool and likelihood of use
  - Is there enough elevation from the pool to the access road to fill engines (connect drainpipe from the pool to the pre-plumbed fire hydrant with clear signage)

Utilization of Fire Retardant (Phos-Chek)

- Spray fire retardant around interior (and exterior?) perimeter to create additional fire break
  - Consider if it is needed along PCH for evacuation
  - This has been used before/elsewhere
- Consider providing residents with "Ember Blitz" or similar; still need to evacuate early
- Monitor development of new chemicals; insist on health research, not sales pitch
- Consider the development of a heli-hydrant on lot next to 1133 EB
  - OCFA Air Operations finds 1133 EB not feasible due to flying issues to overcome; Laguna Beach Water District built one on boat spur just south of Emerald Bay
  - Laguna Beach has one at Zitnik Reservoir and is considering Sweany

Evacuation

Evacuation – Education

- Everything the Task Force has talked about creates a positive approach if completed
- Continue educating on "Ready – Set – Go"
  - Due to area challenges, consider an early warning in which, at "Set," those capable or needing assistance go at that point
- Investigate modifications to existing canyon fire camera/siren
  - *Laguna Beach have added AI to their cameras which can detect brush density*
  - *Investigate SensoRy AI: New technology being developed in collaboration with OCFA*; early detection camera with AI looking up Emerald Canyon; connects to ALERTCalifornia
- Complete siren research and site options with both State and OC Parks

Evacuation (cont.)

- Depth of alert: Consider dual, if not triple layers – public cell, siren, AM radio
- As a last resort, use hi-tech such as WiFi or Starlink
- Citygate Reviewed the Laguna Beach City study and does not agree that extraordinary evacuation procedures are not “cost effective”

Evacuation (cont.)

- Review fire truck access on all streets, additional red curbs, and restricting street parking on Red Flag Warning days
- Keep the "requires assistance" lists updated
- Consider pet programs, block leaders, and temporary kennels
- Keep up annual drills

Post-Fire Recovery Planning

Recovery Planning

- IF there is a next time:
  - Visitation and repopulation will be slow
  - Stay-behinds will not be able to come/go and resupply
- Plan the Association's role for input into repopulation incident command decisions, now a multi-agency event
- Understand the newer regulations on hazardous waste removal
- Reconstruction will not be allowed to prior-approved plans; they will be required to meet current adopted State and County building and Fire Codes
- Educate the homeowners: "Protect what you have." The replacement neighborhood may not be the same

Next Steps

- Prioritize staff time to complete what is funded and staffed *now*
- Increase coordination with OCFA; they will help
- Prioritize research efforts to achieve the possible before the complicated
- Improve and reinforce "Ready – Set – Go"
  - Fuel management
  - Education
  - Evacuation alert and drills
- Then work on adjunct water and firefighting