City of Bradbury Community Wildfire Protection Plan

Prepared for:

City of Bradbury
600 Winston Avenue
Bradbury, California 91008

CONTACT:
Kevin Kearney
City Manager

August 2022

Prepared by:

DUDEK

MAIN OFFICE
605 THIRD STREET
ENCINITAS, CA 92024

CONTACTS:
Noah Stamm
Fire Protection Specialist III –
Fire Protection + Urban Forestry

Michael Huff
Discipline Director –
Fire Protection + Urban Forestry

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
ACWM	Los Angeles County Agriculture Weights and Measures
ADU	Accessory Dwelling Unit
AFD	Arcadia Fire Department
APD	Arcadia Police Department
AMSL	Above Mean Sea Level
ANF	Angeles National Forest
BMP	Best Management Practice
CAD	Computer Aided Dispatch
CAWC	California American Water Company
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Office of Emergency Services
CalTrans	California Department of Transportation
CARB	California Air Resource Board
CBC	California Building Code
CEQA	California Environmental Quality Act
CFC	California Fire Code
CHP	California Highway Patrol
City	City of Bradbury
CWPP	Community Wildfire Protection Plan
EPA	U.S. Environmental Protection Agency
FHSZ	Fire Hazard Severity Zone
FMZs	Fuel Modification Zones
FRAP	Fire and Resource Assessment Program
FSAS	Fire Station Alerting System
GIS	Geographic Information System
HFRA	Healthy Forest Restoration Act
HFHSZ	High Fire Hazard Severity Zone
ICS	Incident Command System
IFC	International Fire Code
JADU	Junior Accessory Dwelling Unit
LACoFD	Los Angeles County Fire Department
LACoSD	Los Angeles County Sheriff's Department
LRA	Local Responsibility Area
MFD	Monrovia Fire Department
MPD	Monrovia Police Department
RAWS	Remote Automated Weather Station
SCAQMD	South Coast Air Quality Management District
SRA	State Responsibility Area
USFS	United States Forest Service
VHFHSZ	Very High Fire Hazard Severity Zone
WUI	Wildland Urban Interface

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1 CWPP Authorization

The City of Bradbury CWPP was collaboratively developed. Interested parties, and local, state, and federal agencies managing land within or adjacent to the at-risk communities were consulted. This document identifies and prioritizes areas for hazardous fuel reduction treatments, provides recommendations for the types and methods of treatment that will protect the at-risk communities in the City, and recommends measures to reduce the ignitability of structures within the WUI areas. This CWPP is intended to better protect the community from the threat of wildfires by promoting community-level fuel reduction projects.

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

____

Bruce Lathrop, Mayor
City of Bradbury

____________________ 8-12-22

Kevin Kearney, City Manager
City of Bradbury

____________________ 8.5.22

Anthony C. Marrone, Acting Fire Chief
Los Angeles County Fire Department

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Date: 2022.08.12 09:32:23 -07'00'

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Robert Garcia, Angeles National Forest Fire Chief
U.S. Forest Service

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2 Executive Summary

The City of Bradbury (City) is proposing to implement a comprehensive, coordinated Community Wildfire Protection Plan (CWPP) to protect lives, property, and natural resources threatened by wildland fire. The City of Bradbury CWPP was developed by Dudek, with input from the Los Angeles County Fire Department (LACoFD), the United States Forest Service (USFS), and other Stakeholders. The recommendations and proposed Action Plan items within this CWPP are currently being collaborated with the City of Bradbury. Many of the recommendations and proposed Action Plan items are to be determined by the City, in collaboration with the cooperators/stakeholders, including the LACoFD and USFS. Implementation shall be determined by available budgets, Grants, and/or available resources.

Wildfires have and will continue to be a natural part of our ecosystem, however, as humans continue to expand into the Wildland-Urban Interface (WUI) areas and the reality of climate change fueled by drought and strong winds, wildfires will continue to grow and are become more destructive and less predictable. 2020 was a record-breaking wildfire season in the western United States with the cost exceeding billions of dollars in damage and suppression. 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 City is located approximately 23 miles northeast of downtown Los Angeles, adjacent to the San Gabriel Mountains in the Angeles National Forest (ANF), 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 and the LACoFD recognize the catastrophic impact of wildfire in the community and is committed to reducing hazards and risk through fire protection, fuel hazard reduction, public education, preparedness, and community involvement. In order to mitigate for 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 help accomplish these goals and provide recommendations.

Development of this CWPP included an assessment of wildfire hazard, which involved modeling potential fire behavior around the City under extreme wind and weather conditions, consistent with conditions experienced during a Santa Ana wind event. Other wildfire hazard variables were evaluated (terrain, weather, fuels, development patterns, fire department response, structure density, etc.) to identify the Very High Fire Hazard Areas adjacent to the City. City values potentially threatened by wildfire were also evaluated to understand the potential wildfire risk facing the City. The hazard assessment was used to evaluate the extent of the City's statutorily designated as a Very High Fire Hazard Severity Zone (VHFHSZ) by California Department of Forestry and Fire Protection (CAL FIRE) Fire and Resources Assessment Program (FRAP 2007).

The enactment of the 2003 Healthy Forest Restoration Act (HFRA) emphasized the need for federal agencies to work collaboratively with communities in the WUI in developing hazardous fuel reduction projects to reduce the risk from large-scale wildfire (Project Wildfire). The HFRA paved the way for communities to develop a compressive plan that would allow communities to develop and implement forest management and fuel reduction projects. This CWPP outlines a series of policies and action items which are intended to guide implementation of the CWPP. The policies and actions focus on codes and standards, funding, fire rehabilitation, evacuation, fire protection, vegetation/fuels management, and public education. Action items identify tasks to be implemented by the City and the LACoFD, and other responsible City Departments, to achieve the stated goal of protecting lives, property, and natural resources threatened by wildland fire. 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 San Gabriel Mountains, and the tasks and strategies to reduce the wildfire risk must also change. Although the HFRA doesn't provide a specific timeline to monitoring and updating the CWPP, 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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3 Introduction

The City of Bradbury is located in Los Angeles County along the northern fringe of the urbanized portion of the Los Angeles Basin at the base of the San Gabriel Mountains in the ANF. The City is bordered by the City of Monrovia to the west and north and the City of Duarte to the south and east. Royal Oaks Drive serves as the southern boundary of the City's corporate limits. Royal Oaks Drive parallels the I-210 Freeway, located approximately one mile south of the City; access to this major regional transportation corridor is available through Duarte via Buena Vista Street and Mountain Avenue. The City 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 the San Gabriel Mountains has been subject to numerous damaging wildland fires, is influenced by local extreme wind and weather conditions (including Santa Ana wind events), has 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. Although wildfires directly adjacent to the City have historically been relatively infrequent, the San Gabriel Mountains have a significant history of devastating and catastrophic wildland fires, including the 2009 Station Fire, which at the time was one of the 10 largest wildfires in California History, and the 2020 Bobcat Fire, currently one of Los Angeles County's largest wildfires. The 2009 Station Fire originated approximately 15 miles northwest of the City and burned over 160,000 acres, threatened over 12,000 structures in the Angeles National Forest, and resulted in two firefighter deaths. The 2020 Bobcat Fire initially spread south towards Bradbury, Sierra Madre, Monrovia, and Duarte, burning over 115,000 acres within the San Gabriel Mountains, injuring six, and threatening an estimated 6,000 structures, destroying 27 residences and damaging 28 more (CAL FIRE 2020).

As a key component of the Healthy Forest Restoration Act of 2003, a Community Wildfire Protection Plan (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 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. With the intent to reduce the wildfire threat to the City of Bradbury, the City applied for and received a Cal OES (California Offices of Emergency Services) grant in 2019 to fund the development of the CWPP. And in the winter of 2020, the City hired Dudek to develop the City's CWPP.

This CWPP was developed for the City of Bradbury with input and direction from stakeholders and the community. The purpose of this collaboratively prepared CWPP is to serve as a fire protection planning document that presents the City's physical characteristics, wildfire hazard, assets at risk from wildfire, vegetation/fuel management projects and specifications, and goals and action items intended to reduce wildfire risk in the City. The ultimate goal of this CWPP is to protect lives, property, and natural resources threatened by wildland fire.

3.1 Purpose and Need

The City recognizes the potential for significant loss of life, property, and natural resources from wildland fire and has a history of prioritizing development and implementation of a comprehensive wildland fire program. The purpose of the CWPP is to create a community-based plan that focuses on identifying and addressing local hazards and risks from wildfire, as well as identifying potential projects intended to mitigate such risks. The CWPP process is intended to provide the community 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 within the CWPP. Additionally, identifying values at risk of wildfire increases the community member's understanding of living within the wildland-urban interface and instills a sense of personal responsibility among residents to take preventive actions around their properties in regard to wildfire.

The planning outline in '*Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities' (Sponsored By:* Communities Committee, National Association of Counties, National Association of State Foresters, Society of American Foresters, and Western Governors' Association, March 2004) was referred to throughout the development of this CWPP. A CWPP determines what is a wildfire risk, provides a roadmap of actions for a community to address the wildfire threat, and at a minimum, addresses the three following central components:

1. Collaboration
2. Identifying and Prioritizing Fuel Reduction
3. Identifying and treatment of Structural Ignitability

A CWPP must be collaboratively developed by local and state officials to meaningfully involve non-governmental stakeholders in the CWPP's process. This CWPP development included development of a Public Outreach and Engagement Plan to guide community engagement and coordination with other key stakeholders throughout the development of the CWPP. The City's central engagement goal was to develop a CWPP that builds on input from key stakeholders, including community members, City departments, neighboring jurisdictions (e.g. Monrovia Fire Department), Cal Fire and Federal agencies that manage lands within the vicinity of the community (e.g. United States Forest Service (USFS). The next step in the CWPP process is to identify and prioritize areas for hazardous fuel reduction treatments by recommending types and methods of treatment that, if acted upon and carried out when the City is threatened by a wildfire, it will make a difference of how that wildfire threatens the community and reduces the overall risk to that community. And the last step of the CWPP is the Treatment of Structural Ignitability. This CWPP will recommend measures that homeowners and communities can take to reduce the ignitability of structures and ensure their structures can withstand a wildfire. Not only will this include providing defensible space around your structure, but with the research and data over the past 15 to 20 years on structural enhancements, modifications can be made to the structure that will reduce the structures likelihood of catching fire.

There are eight steps identified within the *Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities,* that were used as a guide in the completion of the CWPP. The eight steps are:

Step One: Convene the City's Decisionmakers.

The City of Bradbury CWPP developed an operating group that included representatives from the Los Angeles County Fire Department (LACoFD Deputy Forester) and the Angeles National Forest/United States Forest Service (USFS); the City of Bradbury; other stakeholders; members of the community; and other members of the public.

Step Two: Involve the State and Federal Agencies.

Step two recommends engaging with local representatives of the nearby USFS and other federal agencies interested in the development of the CWPP, to gain an understanding of their perspectives, information about current and future fuel reduction/natural resources planning efforts, and other information relevant to the CWPP planning process. Representatives from the Angeles National Forest Division of the USFS have been involved in throughout the process of this CWPP and will a great benefit for implementing fuel reduction priorities identified within the CWPP.

Step Three: Engage Interested People.

Throughout the early stages of the Bradbury CWPP, community engagement meetings were held in order to include resident's, the City's Public Safety Committee, and homeowner's associations (HOAs) within the City of Bradbury, as well as community members from adjacent communities at risk, local business members, City Council members, and other organizations and individuals. These meetings were to introduce interested people to the CWPP process and allow for input from a diverse range of interested people to ensure that the final CWPP encompasses all concerns and ideas.

Step Four: Establish a Community Base Map.

Based upon existing fire hazard severity zone maps and community boundaries, a community base map was created to identify the Very High Fire Hazard Severity Zone (VHFHSZ) and High Fire Hazard Severity Zone (HFHSZ) areas, as well as potential ember zone areas based upon the fire behavior modeling results within adjacent naturally vegetated areas of the San Gabriel Mountains. The base map provides the residents within the City and adjacent communities a baseline visual of the areas within the City that are of the highest concern regarding wildfire threats.

Step Five: Develop a Community Risk Assessment.

After review of available City information, including topography, vegetation types, and fire history, a City-wide wildfire risk assessment was conducted to document existing vegetative fuel hazards within and adjacent to the City and identify and determine the highest priority areas where fuel treatment would reduce wildfire risk to the City. In addition to an assessment of existing vegetation, existing infrastructure and the City's overall emergency preparedness was assessed.

Step Six: Establish Community Hazard Reduction Priorities and Recommendations to Reduce Structural Ignitability.

Based on the City-wide assessment, key objectives, and goals of the CWPP were developed and recommended action items were identified to be implemented by the City that serve to minimize wildfire impacts to the community. Future project and actions identified would need to be funded and approved by the City prior to implementation.

Step Seven: Develop an Action Plan and Assessment Strategy.

This CWPP includes an action plan that identifies roles and responsibilities, potential funding needs, and timetables for carrying out the highest priority projects. Additionally, it will be important to establish a schedule to ensure that the tasks and action plan continue to meet the needs of the community over the long term.

Step Eight: Finalize the Community Wildfire Protection Plan.

A draft of the City of Bradbury CWPP will be available for public review prior to final approval, in order to allow for the interested parties to provide comments and feedback. Once comments and feedback have been addressed and mutual agreement throughout all interested parties about all aspects of the CWPP has been achieved, finalization of the CWPP can occur.

The purpose of this CWPP is intended to provide a comprehensive, coordinated plan to mitigate the impact of wildland fire to the City. This CWPP evaluates the City's existing VHFZSZ Areas based on hazard and risk, identifies policies and actions to reduce the community's threat from wildland fire, and identifies and prioritizes vegetation management projects to reduce wildfire threat. Intended users of this CWPP include the LACoFD, the USFS – Angeles National Forest, all City Departments, the Public Safety Committee, the City Council-City Manager, and members of the public. The policies and actions outlined in Chapter 6 include those proposed for implementation under this CWPP.

3.2 The Development Team

This section lists the representatives or organizations either involved in the development of the CWPP or who provided information for the completion of this CWPP. The organization, roles, and responsibilities are indicated in Table 1.

Table 1. CWPP Development Key Stakeholders and Roles

CWPP Development Participant	Roles/Responsibilities
California Governor's Office of Emergency Services (Cal OES)	- Grant funding for CWPP - Provide general guidance as needed - Review and approve Final CWPP
City of Bradbury City Council - City Manager	- Provide general guidance as needed - Receive comments from the public on the CWPP - Approve Final CWPP
Los Angeles County Fire Department	- Provide guidance and support for the CWPP development - Participate in CWPP Working Group and Team Meetings
CWPP Development Team: • City Manager and City Management Analyst • City's Public Safety Committee • Los Angeles County Fire Department – Deputy Forester • Los Angeles County Office of Emergency Management • Los Angeles County Sheriff's Department • Los Angeles County Public Works	- Provide guidance and expertise for the CWPP - Coordinate with neighboring jurisdictions - Provide guidance on key stakeholders - Distribute media releases about the CWPP through City website - Conduct direct outreach as appropriate
Key Stakeholders: • LACoFD • USFS - Angeles National Forest • Neighboring Jurisdictions • Utility Companies • State Agencies • Elected Officials	- Provide insights on the intersection of cross-jurisdictional hazard areas - Collaborate on program and project development - Review CWPP drafts - Participate in public workshops, as appropriate
Stakeholders and Interested Parties including Communities Most Vulnerable to Wildfire Risk	- Attend stakeholder virtual workshops - Read electronic newsletters - Provide input on the CWPP
CWPP Consultant: Dudek	- Develop CWPP

Table 1. CWPP Development Key Stakeholders and Roles

CWPP Development Participant	Roles/Responsibilities
	- Facilitate virtual public meetings - Develop CWPP community survey

3.3 Community Involvement

3.3.1 Stakeholders

The City recognizes that implementation of the CWPP is not possible without the support of the people, businesses, and organizations that live and work in the City, especially in the City's VHFHSZ areas, as well as the many federal and local agencies that have jurisdiction in these areas. These are the stakeholders that are impacted by this plan and must share in the responsibility for protecting themselves and their community.

The roles of the LACoFD and USFS – Angeles National Forest are to assist in the development of the CWPP by helping identify wildland fire hazards and risks, recommend procedures and programs for City and private lands to minimize the threat of wildfire, educate the public about how to prepare and protect themselves from wildfire, enforce existing and new wildland fire codes to protect the public, and continue to develop partnerships and cooperation from other City departments, property owner groups, and individual property owners to effectively manage and respond to wildfire threat.

The role of stakeholders is to be aware of the hazards and risks that threaten their properties and safety, comply with wildland fire codes, formulate wildland fire evacuation plans, support neighborhood preparedness and community groups focused on wildland fire safety, and become part of the solution in mitigating the threat of wildfire that faces the City.

Since the creation and implementation of the LACoFD's 'Ready! Set! Go!' Wildfire Action Plan, residents living in the WUI and Very High/High Fire Hazard Areas throughout Los Angeles County, including those living in the City of Bradbury, have gained a greater understanding of the need to decrease the impact of wildfire and their personal responsibility in making that happen. Significant wildfires occurring near the City of Bradbury (including the 2002 Williams Fire, the 2014 Colby Fire, the 2016 Reservoir Fire, 2016 San Gabriel Complex Fire, and the most recent 2020 Bobcat Fire) have also increased public awareness of the wildfire threat facing the City. As a result, there has been a significant increase in public participation in wildland fire issues and public lobbying within City government to mitigate wildfire risk.

The LACoFD continues to work cooperatively with cities throughout Los Angeles County VHFHSZ areas to better plan, prepare, and reduce the potential hazards and risks associated with wildland fire. Federal, state, and other local fire agencies have also been working to develop community fire planning documents (for example, the Monrovia CWPP), coordinating with the City in a collaborative approach. The City and the LACoFD intend to continue these collaborative efforts.

Furthermore, members of the Fire Management Staff of the USFS - Angeles National Forest Division, are currently conducting hazardous fuel inventory data and fuel break research in areas of the Angeles National Forest adjacent to the City of Bradbury, which is crucial in decreasing the impact of wildfire to the City. The City and USFS – Angeles National Forest intend to continue looking for future opportunities to collaborate on potential Projects.

3.3.2 Public Outreach and Engagement Plan

During CWPP development, a Public Outreach and Engagement Plan was developed as a guide for engaging with members of the community and coordinating with other key stakeholders throughout the development of the CWPP. The City's central engagement goal was to develop a CWPP that builds on input from key stakeholders including:

- the communities most vulnerable to wildfire risk;
- City departments with a role in preventing and responding to the spread of wildfires into the community; and
- neighboring jurisdictions, including the Angeles National Forest

The plan outlined a tiered engagement strategy with different levels of engagement for each key stakeholder group. Different engagement opportunities were identified in the plan and included:

- **A CWPP section included on the City's website** (https://www.cityofbradbury.org/): The accessible website provides a central location for project information and is fully compliant with the Americans with Disabilities Act, Section 508 and WCAG 2.1AA requirements (which address web content accessibility). The site included meeting announcements, documents available for review, and a survey link for stakeholders to provide direct feedback. The website was updated throughout the CWPP development process and will function as the City's primary website for the final CWPP.
- **City of Bradbury Wildfire Protection Plan Survey**: A City CWPP survey page was created to gain an understanding of the community's wildland fire concerns and allow for stakeholders and interested people to provide feedback about their wildfire level of concern and actions they would like to have included in the CWPP to reduce the risk of wildfire (refer to Appendix A).
- **Public Zoom Meetings:** Public outreach meetings were held throughout the CWPP development phase. Two on-line public zoom meetings and one Public Safety Committee zoom meeting were held to obtain community feedback on the preliminary analysis and scoping of the CWPP, as identified below. Additional public meetings will be held at the City Council to provide updates on the development of the CWPP.

3.3.3 Public Outreach Meetings

The following community meetings were held during the preparation of the CWPP in order to provide community members an opportunity to contribute to the CWPP process. Specifically, community input was sought to better understand the vulnerability of City residents, businesses, and resources to wildfire and to promote awareness of the City's wildland fire hazard and propose workable solutions to reduce the risk of wildfire. The meetings also provided a forum for the community to discuss how to best mitigate wildfire risk in the City. Two on-line webinar community zoom meetings and one Public Safety Committee zoom meeting were conducted during CWPP development, as identified below:

- **September 3, 2020:** On-line webinar — zoom meeting was designed to outline the CWPP development process and gather feedback on community priorities. This meeting was held via online webinar due to coronavirus (COVID-19) shelter-in-place orders in effect at the time.
- **November 12, 2020**: On-line webinar – zoom meeting was designed to update the Public Safety Committee on the hazard assessment that was conducted and outline the CWPP development process. This meeting was held via online webinar due to coronavirus (COVID-19) shelter-in-place orders in effect at the time.
- **January 13, 2021:** On-line Webinar—workshop to introduce the hazard assessment conducted for the CWPP and gather community and stakeholder feedback. This meeting was held via online webinar due to coronavirus (COVID-19) shelter-in-place orders in effect at the time.

3.4 Funding/Grant Management

Funding for the preparation of this CWPP was made available from a California Governor's Office of Emergency Services (Cal OES) Community Fire Prevention Grants. The grant period started on October 2019 and extends through August 2022. Grant management and reporting is being conducted by the City of Bradbury City Manager.

3.5 Signatories

The signatories for the City of Bradbury Community Wildfire Protection Plan include:

1. Local Government: Kevin Kearney, City Manager, City of Bradbury
2. Local Government: Bruce Lathrop, Mayor, City of Bradbury
3. Los Angeles County Fire Department: Michael Inman, Deputy Fire Chief
4. United States Forest Service, Angeles National Forest Division (USFS): Robert Garcia, Angeles National Forest Fire Chief

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4 Plan Area Description

Fire environments are dynamic systems and include many types of environmental factors and site characteristics. Fires can occur in any environment where conditions are conducive to ignition and fire movement. Areas of naturally vegetated open space are typically comprised of conditions that may be favorable to wildfire spread. The three major components of the fire environment are climate, topography, and vegetation (fuel). The state of each of these components and their interaction with each other determine the potential characteristics and behavior of a wildfire 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 fire resistive landscapes 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 City is necessary to understand the potential for wildfire within and around the City.

Wildfires are a regular and natural occurrence in most of California. However, the number of fires and acres burned annually has increased in recent years. These wildfires are mostly human-triggered, suggesting that the historic fire interval has been artificially affected across large areas. In addition, wildfire suppression efforts over the last several decades may have aided in the accumulation of fuels in some natural communities (Minnich 1983; Minnich and Chou 1997), resulting in larger and more intense wildfires. Large wildfires have had, and continue to have, a substantial and recurring role in California landscapes (Keeley and Fotheringham 2003), in part because (1) California landscapes become highly flammable each fall; (2) the climate in the region has been characterized by fire climatologists as the worst fire climate in the United States (Keeley 2004) with foehn winds[1] occurring during autumn after a 6-month drought period each year; and (3) ignitions via anthropogenic sources have increased or are increasing in many wildland or WUI areas.

4.1 City of Bradbury Location

The City of Bradbury is a small, residential/equestrian-oriented community located in Los Angeles County along the northern fringe of the urbanized portion of the Los Angeles basin at the base of the San Gabriel Mountains in the Angeles National Forest. The community encompasses 1.9 square miles, includes 3.2 miles of public streets and roads, and has an estimated population of just over 1,000 people. The City is bordered by the City of Monrovia to the west and north and the City of Duarte to the south and east. Royal Oaks Drive serves as the southern boundary of the City's corporate limits. Royal Oaks Drive parallels the I-210 Freeway, located approximately one mile south of the City; access to this major regional transportation corridor is available through Duarte via Buena Vista Street and Mountain Avenue (Figure 1, City of Bradbury Location Map and Figure 2, City of Bradbury Vicinity Map).

While many of the action items recommended in this CWPP focus on the VHFHSZ areas situated along the foothill communities within the City, this CWPP covers all portions of the City.

1 A type of dry, warm, down-slope wind that occurs on the lee (downwind side) of a mountain range. Locally, Sundowner winds would be considered foehn winds.

4.2 Fire Hazard Areas

4.2.1 State Fire Hazard Severity Zones

Fire Hazard Severity Zones (FHSZs) are “geographical areas designated pursuant to California Public Resources Code, Sections 4201 through 4204 and classified as Very High, High, or Moderate in State Responsibility Areas (SRA) or as Local Responsibility Area (LRA) VHFHSZ or non-VHFHSZ designated pursuant to California Government Code, Sections 51175 through 51189” (California Building Standards Commission 2016). The City of Bradbury’s VHFHSZ is a Local Agency VHFHSZ, as defined, and the City is considered an LRA. The LACoFD is the responsible agency for fire protection within the City’s VHFHSZ and follows the Cal Fire VHFHSZ designation. The City abuts lands where the responsibility for fire protection lies with the Federal or State of California (FRA or SRA). The City’s Local and Federal/State VHFHSZ is presented in Figure 3.

California Public Resources Code Sections 4201–4204 and Government Code Sections 51175–51189 direct CAL FIRE to map areas of significant fire hazards 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 (CAL FIRE 2020a). The model used to determine the extent of FHSZs is based on an analysis of potential fire behavior, fire probability predicated on the frequency of fire weather, ignition patterns, expected rate of spread, ember (brand) production, and past fire history (CAL FIRE 2020a). Structures built in FHSZs are subject to more stringent fire hardening requirements than those that are not.

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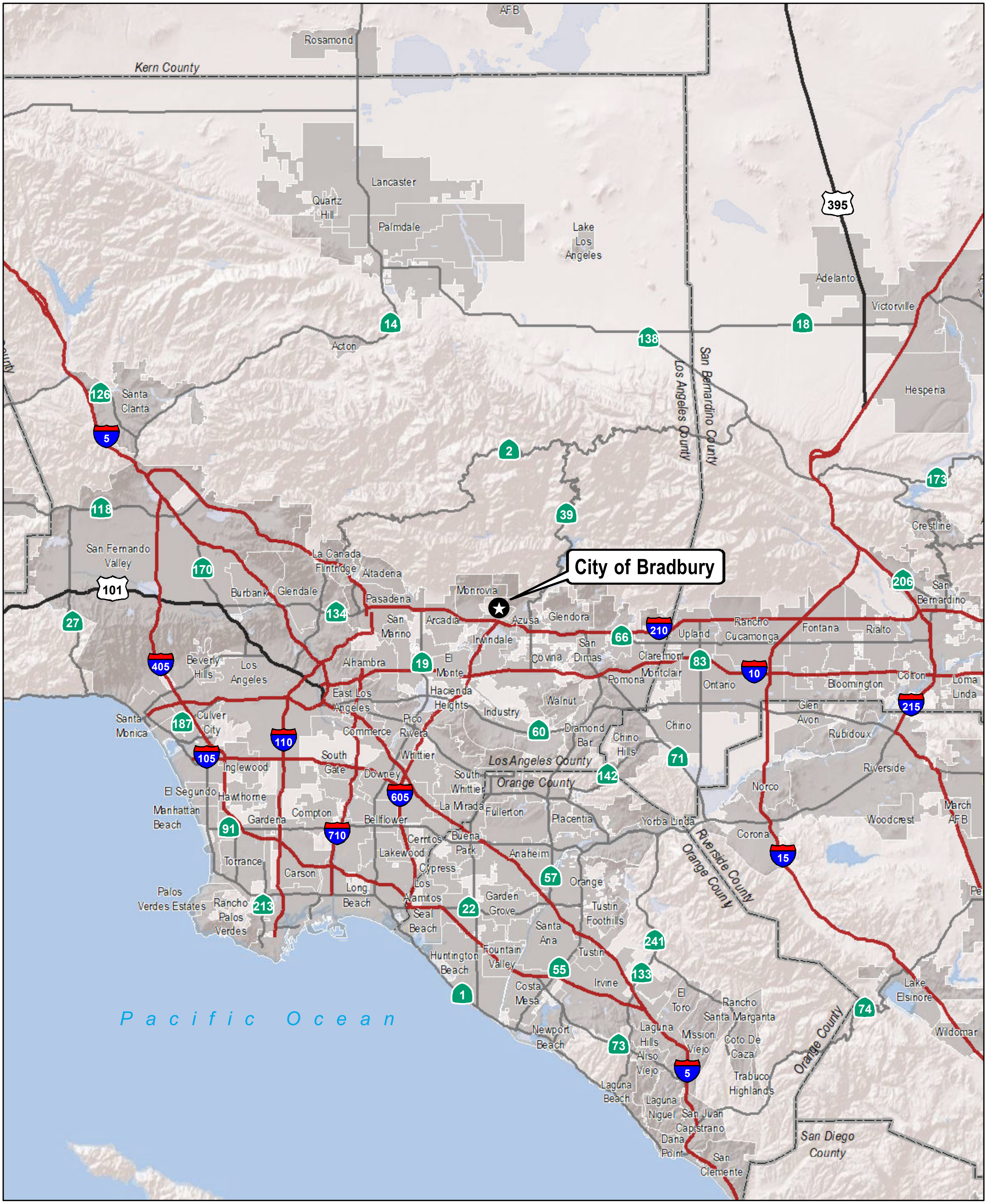

SOURCE: ESRI

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FIGURE 1

Regional Map

City of Bradbury Community Wildfire Protection Plan

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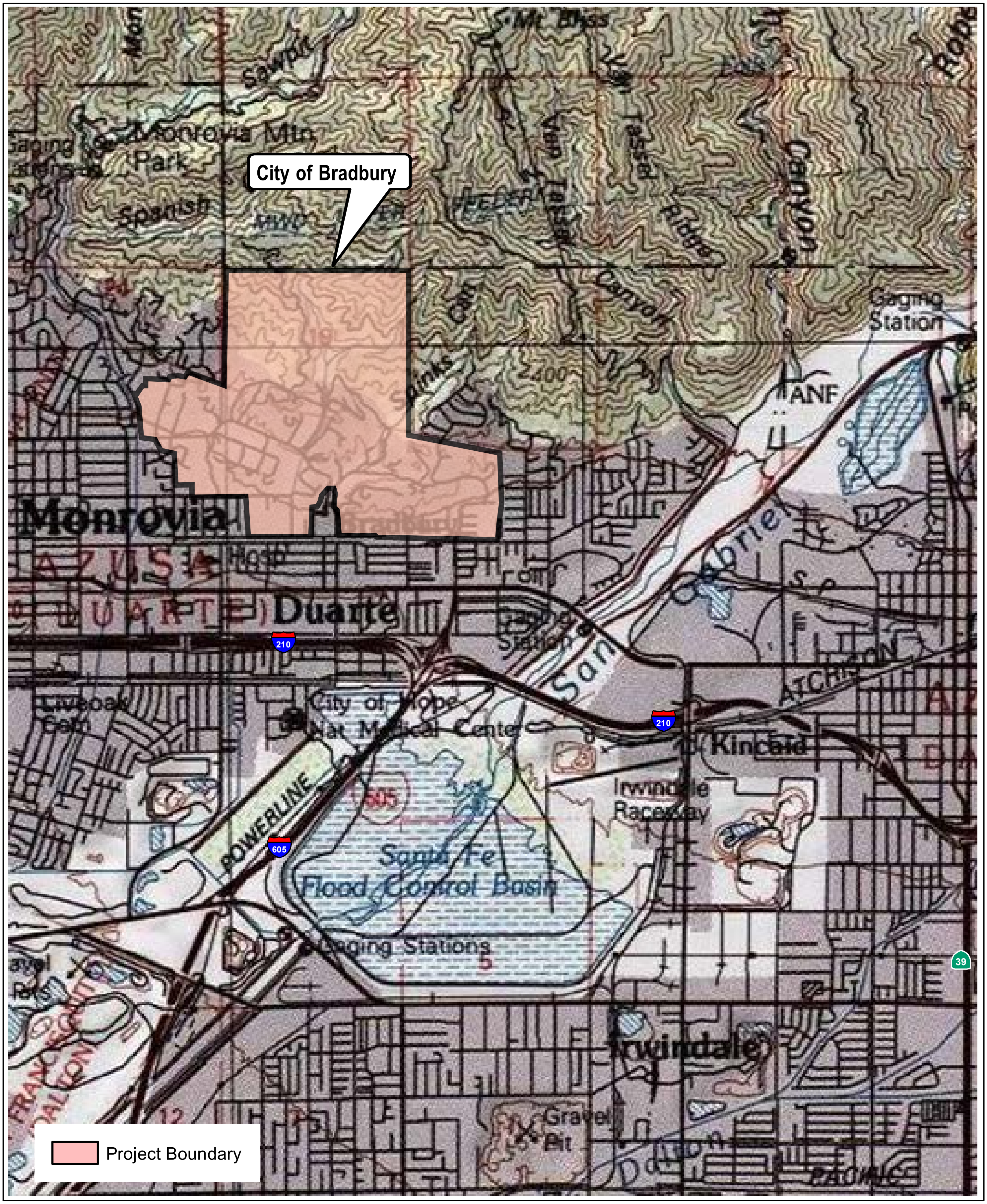

Document Path: Z:\Projects\j1244901\MAPDOC\MAPS\Community Wildfire Protection Plan\Fig 2 Vicinity.mxd

SOURCE: USGS 7.5 Minute Series, Azusa Quadrangle

DUDEK

0 1,800 3,600 Feet

FIGURE 2

Vicinity Map

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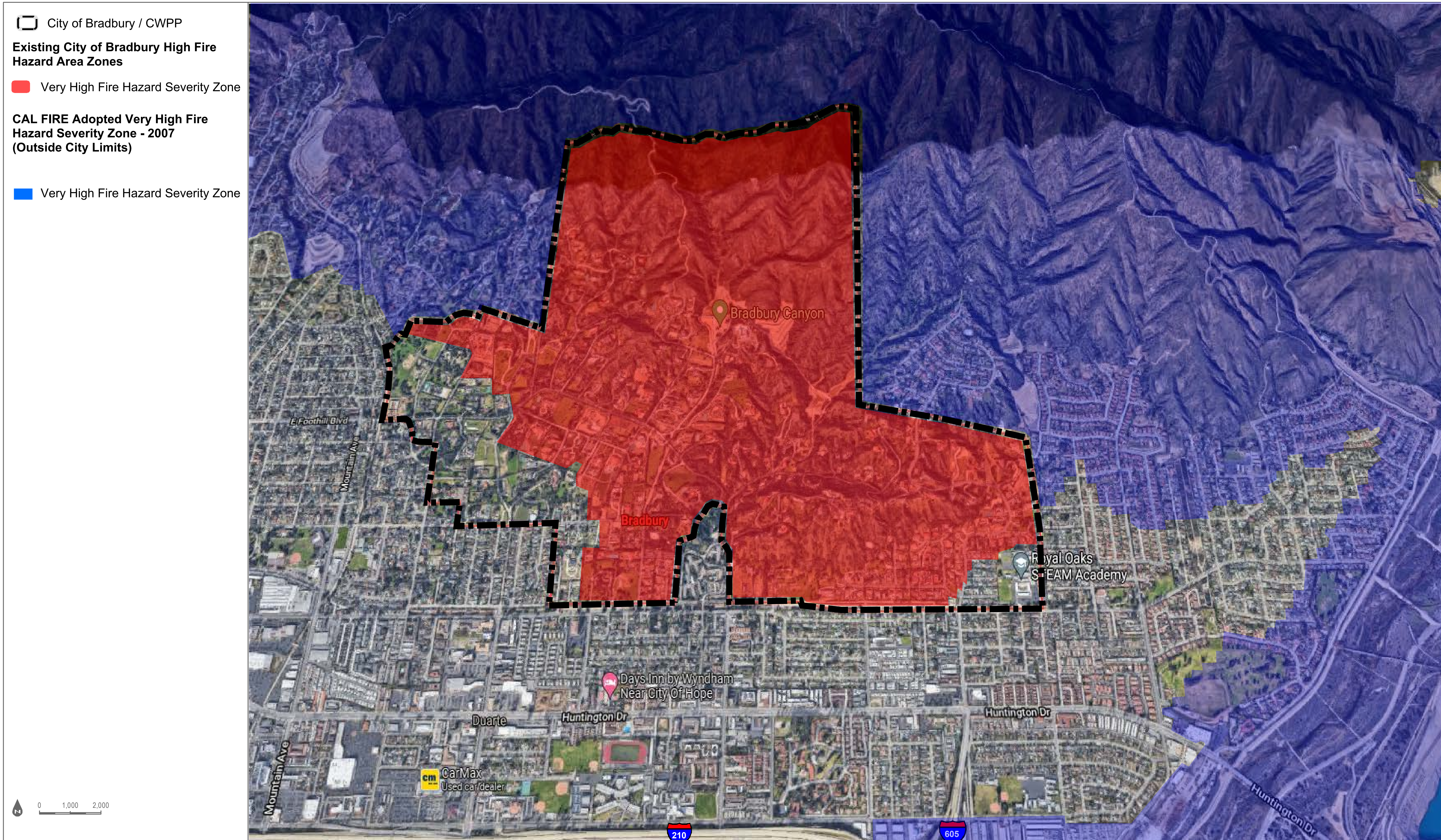

SOURCE: City of Bradbury, Los Angeles County Fire Department and CAL FIRE

CITY OF BRADBURY COMMUNITY WILDFIRE PROTECTION PLAN

DUDEK

FIGURE 3

Current High Fire Hazard Areas

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4.3 Climate

The City of Bradbury, like much of Southern California, is influenced by the Pacific Ocean and a seasonal, migratory subtropical high-pressure cell known as the "Pacific High." 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, easterly Santa Ana winds. The average annual high temperature calculated from January 1917 to June 2016 for the San Gabriel Canyon area is 78.2º Fahrenheit (ºF), with higher temperatures in summer and early fall (June through October) reaching up to an average of 91.7ºF. The average annual low temperature is 52.8°F and can reach an average low temperature of 47.2°F. The average annual precipitation for the area is 22.28 inches, with the most rainfall concentrated in December (3.49 inches), January (4.40 inches), February (5.06 inches), March (3.50 inches), and April (1.69 inches). Rainfall is much less during June (0.19 inches), July (0.04 inches), and August (0.11 inches) (Western Regional Climate Center, 2020).

From a regional perspective, the fire risk in southern California can be divided into three distinct "seasons" (Nichols et al. 2011, Baltar et al 2014). The first season, the most active season and covering the summer months, extends from late May to late September. This is followed by an intense fall season characterized by fewer but larger fires. This season begins late September and continues until early November. The remaining months, November to late May cover the mostly dormant, winter season. Mensing et al. (1999) and Keeley and Zedler (2009) found that large fires in the region consistently occur at the end of wet periods and the beginning of droughts. Live fuel moisture content, a measure of the relative mass of water and indicator of ignitability, for most vegetation in the San Gabriel Mountains of the ANF reaches the driest point in the late summer or early fall period. Seasonal drying of vegetation produces conditions that can result in fuel-driven wildfires and fire-associated climatic changes. This condition is referred to as a plume-dominated wildfire. Plume-dominated wildfires are fires where the energy produced by the fire, in conjunction with atmospheric instability, creates significant convective forces and increased wind speeds. Such fires are incredibly unpredictable, spread in various directions simultaneously, and exhibit extreme fire behavior.

Typically, the highest fire danger in southern California coincides with Santa Ana winds. The Santa Ana wind conditions are a reversal of the prevailing southwesterly winds that usually occur on a region-wide basis near the end of fire season during late summer and early fall. They are dry, warm winds that flow from the higher desert elevations in the east 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. Localized wind patterns on the Project Sites are strongly affected by both regional and local topography. The prevailing wind pattern is from the west (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 west–southwest (sea) and at night winds are from the northeast (land), averaging 2 miles per hour (mph). During the summer season, the diurnal winds may average slightly higher (approximately 15 mph) 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. The foothills adjacent to the City of Bradbury includes topography that would create unusual weather conditions; thus the City is subject to periodic extreme fire weather conditions that occur throughout foothill portions of Los Angeles County.

The fire season in the San Gabriel Mountain areas has historically occurred between June and October as the vegetation begins to dry out from regular, dry, offshore winds. The fire season would typically end in November with the onset of winter rainfall, cooler temperatures, and higher relative humidity, with fires less common from

December to April. However, climate change effects are extending fire season throughout the state, and the fire season in the Bradbury surrounding areas may ultimately be year-round. The greatest fire danger for this area coincides with the period when the Santa Ana winds are at their strongest.

Certain weather conditions can increase fire risk, resulting in the declaration of a Red Flag Warning. A Red Flag Warning is a forecast warning issued by the United States National Weather Service to inform area firefighting and land management agencies that conditions are ideal for wildland fire ignition and propagation. After drought conditions, and when humidity is very low, and especially when high or erratic winds which may include lightning are a factor, the Red Flag Warning becomes a critical statement for firefighting agencies, which often alter their staffing and equipment resources dramatically to accommodate the forecast risk (City of Bradbury). A Red Flag Warning is issued when their forecast includes any of the two following conditions:

- A sustained wind average 15 miles per hour (mph) or greater, and
- Relative humidity less than or equal to 25%, and
- 10-hour fuel moisture less than 8%.

To the public, a Red Flag Warning means high fire danger with increased probability of a quickly spreading vegetation fire within the area within 24 hours (City of Bradbury). The City is located in the Los Angeles County Mountains / Angeles National Forest Weather Zone (CAZ254). The City's webpage and Los Angeles County Emergency Response webpage identify policies and procedures to be followed by the LACoFD and Los Angeles County residents during Red Flag Warnings and High Risk Days and include monitoring weather conditions, notifying City Departments and the media, revoking burn permits, flying red flags at fire stations, and ensuring that staff and equipment are within the City should an event occur.

4.3.1 Climate Change

As noted above in the Executive Summary, California faces a dramatic increase in the number and severity of wildfires, with 10 of the most destructive fires occurring since 2015 (CAL FIRE 2019a). The state's major study on climate impacts, the Fourth Climate Assessment (OPR et al. 2019), projects that California's wildfire burn area is likely to increase by 77% by the end of the century. As identified in Governor Newsom's Strike Force report (State of California 2019), the growing risk of catastrophic wildfires has created an imperative for the state to act urgently and swiftly to expand fire prevention efforts. Current research has also identified that the frequency of autumn days with extreme fire weather has more than doubled in California since the early 1980s, a result of human-caused climate change. Such fire weather exhibits strong offshore winds (e.g., Santa Ana Winds) and is coincident with unusually dry vegetation resulting from warm conditions over the summer months prior to the onset of autumn precipitation (Goss et al. 2020).

Climate change is expected to make landscapes more susceptible to extreme wildfires by altering temperatures (Hayhoe et al. 2004) and the availability and aridity of fuels (Abatzoglou and Williams 2016). Anthropogenic climate change has emerged as a driver of increased fire activity, a trend that is expected to continue (Abatzoglou and Williams 2016). All analyses completed for fire occurrence and severity into the future predict more frequent fires, a greater number of fires, and higher fire severity under climate change scenarios (Fried et al. 2004; Lenihan 2008; Westerling et al. 2011; Westerling 2018).

A changing climate, combined with anthropogenic factors, has already contributed to more frequent and severe wildfires in the western United States (Abatzoglou and Williams 2016; Mann et al. 2016; Westerling 2016), with the number of human-caused fires being much higher in more populated regions of the state. Recently, the area burned by wildfires has increased consistent with increasing air temperatures (OEHHA 2018). Increased wildfire risk and severity are vulnerabilities that are anticipated throughout California (Westerling 2018; Krawchuk et al. 2009). Increased fire occurrence and severity under climate change would secondarily affect other areas of vulnerability, as noted below.

- **Increased Fire Risk:** Warmer air temperatures are expected to lengthen the fire season, drying out vegetation more quickly and increasing fire risk. Based on high- and low-emissions climate change scenarios, increases in the number of high-severity wildfires are anticipated (Westerling 2018). Multi-year severe drought is supported as a factor in increasing fire size and severity, as well as tree mortality (Crockett and Westerling 2018). On interannual and shorter time scales, climate variability affects the flammability of live and dead forest vegetation (Westerling 2016). Fire size in southern California and the Central Coast areas also increases with both air temperature in the month of ignition and with low precipitation in the preceding 12-month period (Westerling 2018). Additionally, the frequency of extreme fire weather in the fall months has increased over the past 40 years, a trend which is expected to continue under climate change models (Goss et al. 2020).
- **Greater Fuel Loads:** Years with widespread fires are historically preceded by wet years, which influence greater vegetation growth, especially in the understory. Highly flammable species, which often populate disturbed areas quickly, may have a competitive advantage over other species, typically resulting in a higher, more flammable fuel load. Drought may result in increased tree mortality, which contributes to higher fuel loading and wildfire size and severity (Crockett and Westerling 2018). Increasing fire size and severity and tree mortality are linked to increasing temperatures and aridity (Crockett and Westerling 2018). Increased prevalence of dead or desiccated fuels resulting from drought effects is conducive to crown fires, which require ladder fuels to move from volatile grasses to the less volatile mid-level forest to the dry and volatile canopy cover (Crockett and Westerling 2018). Increased fuel aridity contributes to larger forest areas experiencing increased periods of high fire potential (Abatzoglou and Williams 2016).
- **Ecological Impacts:** Increased fire severity is expected to amplify and accelerate the ecological impacts of climatic change. Drought years may increase the vulnerability of tree populations to insects and disease, and the lower occurrence of extended freezing periods in the winter would allow higher insect survivability. Climate-induced changes in fire behavior and frequency would influence species distribution, migration, and extinction (Flannigan 2000). Greater occurrence of fires increases the amount of carbon and particulates released into the atmosphere (Westerling 2008).
- **Social Impacts:** Increased expenditures for fire suppression are anticipated, and the amount of burned property (in total area and monetary value) in Southern California communities increases substantially under global climate models' high-emissions scenarios due to greater fire risk (Westerling and Bryant 2008; Levy 2018). In areas with the highest fire risk, wildfire insurance is estimated to see costs rise by 18% by 2055, and the number of properties insured lowered (Westerling 2018). Wildland fire smoke exposure is a growing risk to public health (Domitrovich et al. 2017). Secondary effects of increased fire, such as loss of recreational amenities, area closures, and excessive smoke, can have serious financial effects on regional business interests and local economies.

The management recommendations included in this CWPP include fuel management actions to reduce fuel loads, minimize ignitions, and reduce the potential for extreme fire behavior.

4.4 Topography

The City of Bradbury is located at the base of the San Gabriel Mountains in the ANF. The northern portion of the City is very steep, sloping from the northeast to the southwest. The southern portion of the City is fairly flat with some steep, rolling terrain sloping towards the south. Elevation within the City ranges from approximately 579 feet AMSL at the southern portion of the City to 1,800 feet AMSL at the highest point of the City to the north.

Topographic features that may present a fire spread facilitator are the slope and canyon alignments, which may serve to funnel or channel winds, thus increasing their velocity and potential for influencing wildfire behavior. From a regional perspective, the alignment of tributary canyons and dominant ridges are conducive to channeling and funneling wind, thereby increasing the potential for more extreme wildfire behavior in the region. Terrain affects wildfire movement and spread. Steep terrain typically results in faster upslope fire spread due to pre-heating 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 2.

The narrow drainage and sub-drainage topographic features of the San Gabriel Mountains have the capability to funnel winds, increase wind speeds, erratically alter wind direction, and facilitate fire spread and promote extreme fire behavior. This is especially true during Santa Ana wind events when strong northerly/northeasterly winds are aligned with the downslope direction of the canyons and watersheds of the San Gabriel Mountains. The topography of within and adjacent to Bradbury is, therefore, capable of producing wind conditions that promote extreme wildfire behavior.

Table 2. Effects of Topographic Features on Fire Behavior

Topographic Feature	Effect
Narrow Canyon	Surface winds follow canyon direction, which may differ from 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 not as susceptible to cross-canyon spotting except in high winds.
Box Canyon/ Chute	Air drawn in from canyon bottom; strong upslope drafts. No gaps or prominent saddles to let heated air escape. Fires starting at 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 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.

Table 2. Effects of Topographic Features on Fire Behavior

Topographic Feature	Effect
Saddle	Potential for rapid rates of fire spread; fires pushed 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; NFPA 2011.

4.5 Vegetation and Fuels

Vegetation types (fuels) present in the City and their contribution to fire hazard are summarized in this section. Hazardous fuels include live and dead vegetation that exists in a condition that readily ignites; transmits fire to adjacent structures or ground, surface, or overstory vegetation; and/or is capable of supporting extreme fire behavior.

4.5.1 Vegetative Fire Hazard

The following sections summarize vegetative fire hazard of dominant vegetation types that occur within and adjacent to the City. Hazardous fuels include live and dead vegetation that exists in a condition that readily ignites; transmits fire to adjacent structures or ground, surface, or overstory vegetation; and is capable of supporting extreme fire behavior. All vegetation burns; however, some plants exhibit characteristics that make them more flammable than others. Flammability can be defined as a combination of ignitability, combustibility, and sustainability. Ignitability is the ease of or the delay of ignition; combustibility is the rapidity with which a fire burns; and sustainability is a measure of how well a fire continues 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 retention of dead material) and physiological elements (e.g., volatile oils, resins, and moisture content) (Moritz and Svihra 1998; UCCE 2016; UCFPL 1997; White and Zipperer 2010). Plants that are less flammable have low surface-to-volume ratios, high moisture contents, and minimal dead material or debris. Examples of such plants include agave, oleander, and olive trees. More flammable species 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; UCFPL 1997; UCCE 2016; White and Zipperer 2010). Examples of such plants include pampas grass, juniper, and pine. Plant condition and maintenance is also an important factor in flammability potential. Some plants that have more flammable characteristics can become less flammable if well maintained and irrigated. Conversely, plants can be explosively flammable when poorly maintained, situated on south-facing slopes, in windy areas, or in poor soils (Moritz and Svihra 1998).

The LACoFD has developed a list of desirable plant species for use in the County's VHFHSZ Areas (Appendix B). These plants have the ability to store water in leaves or stems and withstand drought, produce limited dead and fine material, are prostrate or prone in form, have extensive root systems for controlling erosion, can withstand severe pruning, have high levels of salt or other compounds that contribute to fire resistance, have low levels of volatile oils or resins, and/or can resprout after a fire. The County has also adopted a list of plants that are prohibited in the County's VHFHSZ Areas. These plants are considered to be unacceptable in the landscape due to their flammable characteristics, which include large amounts of dead material retained within the plant, rough or peeling bark, production of profuse amounts of litter and the presence of volatile substances such as oils, resins, wax, and pitch. Certain native plants species contain these characteristics (e.g., sage, buckwheat, and coyote bush).

Insects, fungi, other microbes, and vertebrates are a natural component of California forests. Populations of pests are dynamic and fluctuate in response to climatic and environmental changes such as drought, stand density, fire, and other site disturbances. Healthy, vigorous trees are typically able to withstand pest attacks when pest populations are at low to moderate levels. When stressors exist in forests (e.g., overstocking, shading, drought), tree vigor is reduced, and tree susceptibility to pest attacks and infestations increases. Localized areas of infestations of pitch canker (*Fusarium circinatum*) and sudden oak death (*Phytophthora ramorum*) have been reported within Los Angeles County (Pitch Canker Task Force 2012; University of California 2004). Eucalyptus longhorned borer (*Phoracantha semipunctata* and *Phoracantha recurva*) has also been documented within the County (California Agriculture 1996). These diseases/pests can contribute to wildfire hazards by increasing dead surface fuel loads and hindering firefighting efforts.

4.5.2 Vegetation Types

The existing vegetation types present throughout the foothills of the San Gabriel Mountains adjacent to the City and their associated contribution to fire hazard. It should be noted that the majority of the City is considered as urban land cover. Urban land cover typically represents noncombustible types (e.g., pavement) or developed and maintained landscapes (e.g., buildings, turf in parks. Ornamental landscape vegetation also characterizes portions of areas considered as urban land cover. Such vegetation is a combination of native and introduced ground cover, grass, shrub, and tree species. Some ornamental vegetation may increase fire hazard due to plant composition and structure (as described above) and the lack of irrigation and maintenance.

To support the fire behavior modeling efforts conducted for this CWPP, the different vegetation types observed adjacent to the City were classified into the aforementioned numeric fuel models. As is customary for this type of analysis, the terrain and fuels directly adjacent to the property are used for determining flame lengths and fire spread. It is these fuels that would have the potential to affect the project's structures from a radiant and convective heat perspective as well as from direct flame impingement.

Vegetation types were derived from a site visit that was conducted on by a Dudek Fire Protection Planner. Based on the site visit numerous vegetation communities and land cover types exist, including Broom baccharis scrub, mafic chaparral, southern willow scrub (disturbed and undisturbed), southern mixed chaparral, coastal sage scrub, coast live oak and western sycamore riparian forests with non-native chaparral and shrub understory. Mature tree canopies for coast live oak trees (*Quercus agrifolia)* and western sycamore trees (*Platanus racemosa*) are assumed to have a canopy base height ranging from 35 to 45 feet off the ground. Canopy bulk density, the weight of canopy fuels per cubic foot of volume, is assumed to be the maximum allowable value in BehavePlus to represent broadleaf trees which, given canopy density and leaf size, have more weight per area than conifer trees (the standard for this value input in BehavePlus (Heinsch and Andrews 2010)). Foliar moisture, the moisture content of canopy foliage, is assumed to be 100%, a reasonable estimate in lieu of site-specific data (Scott and Reinhardt 2001).

Variations in vegetative cover type and species composition have a direct effect on fire behavior. Some plant communities and their associated plant species have increased flammability based on plant physiology (resin content), biological function (flowering, retention of dead plant material), physical structure (bark thickness, leaf size, branching patterns), and overall fuel loading. For example, the native shrub species that compose the coastal sage scrub and mixed chaparral plant communities on site are considered to exhibit higher potential hazard (higher intensity heat and flame length) than grass dominated plant communities (fast moving, but lower intensity) if ignition occurred. The corresponding fuel models for each of these vegetation types are designed to capture these differences. Additionally, vegetative cover influences fire suppression efforts through its effect on fire behavior. For example, while fires burning in grasslands may exhibit lower flame lengths and heat outputs than those burning in native shrub habitats, fire spread rates in grasslands are often more rapid.

As described, vegetation plays a significant role in fire behavior, and is an important component to the fire behavior models discussed in this CWPP. A critical factor to consider is the dynamic nature of vegetation communities. Fire presence and absence at varying cycles or regimes disrupts plant succession, setting plant communities to an earlier state where less fuel is present for a period of time as the plant community begins its succession again. In summary, high-frequency fires tend to convert shrublands to grasslands or maintain grasslands, and fire exclusion tends to convert grasslands to shrublands over time as shrubs sprout back or establish and are not disturbed by repeated fires. In general, biomass and associated fuel loading will increase over time, assuming that disturbance (e.g., fire, grazing, or farming) or fuel reduction efforts are not diligently implemented, which would not occur on this site due to the funded maintenance entity.

4.5.2.1 Grass/Herbaceous

Grass/herbaceous fuels in and adjacent to the City are represented by the California annual grassland vegetation type and are found throughout the foothills along the City's northern boundary. Grassland types may include scattered and widely spaced trees and/or shrubs, although grasses are the dominant cover type. Grasses are fine fuels that are loosely compacted with a low fuel load.[2] Grasses have a high surface area-to-volume ratio, requiring less heat to remove fuel moisture and raise fuel to ignition temperature. They are also subject to early seasonal drying in late spring and early summer. Live fuel moisture content in grasses typically reaches its low point in early summer, and grasses begin to cure soon after. Due to these characteristics, grasses have potential for a high rate of spread, rapid ignition, and facilitation of extreme fire behavior. Grasses are the vegetation type in and adjacent to the City with one of the highest risks for wildfire ignition. Their low overall fuel loads typically result in faster moving fires with lower flame lengths and heat output. Untreated grasses can help spread fire into other adjacent surface fuel types (e.g., shrubs) or facilitate surface to crown fire[3] transition where they exist beneath tree canopies.

4.5.2.2 Brush/Scrub

Brush/scrub fuels in the City are represented by the chaparral and coastal sage scrub vegetation types. Brush/ scrub types may include scattered and widely spaced trees, small patches of grass/herbaceous vegetation, or grass herbaceous vegetation occurring beneath shrub canopies, although shrubs are the dominant cover type. Chaparral and coastal sage scrub vegetation types are found throughout the foothills of the San Gabriel Mountains and within the ANF along the City's northern boundary.

Chaparral and coastal sage scrub are considered moderately fine fuels that are loosely compacted. Chaparral has a high fuel load, and coastal sage scrub has a moderate fuel load. Both types have high surface area-to-volume ratios, requiring less heat to remove fuel moisture and raise fuel to ignition temperature. Both are subject to early seasonal drying in the late spring and early summer, but do not fully cure in the way that grasses do. The live fuel moisture content reaches its

2 The amount of available and potentially combustible material, usually expressed as tons/acre (NWCG 2020).
3 A crown fire is a forest fire that advances often at great speed from tree top to tree top.

low point in the late summer and early fall months. Dead fuels consist mainly of 1-hour and 10-hour fuel sizes, or twigs and small stems ranging from 0.25 inches to 1 inch in diameter. Chaparral and coastal sage scrub have the potential for a high rate of spread, rapid ignition, and extreme fire behavior. Chaparral also has a high content of volatile organic compounds, which also contributes to extreme fire behavior potential.

4.5.2.3 Tree/Woodland

Tree/woodland fuels in the City are represented by the coast live oak woodland, western sycamore, pine woodlands, and riparian woodland vegetation types. Also, eucalyptus is included in this section due to its existence in and adjacent to the City. Tree/woodland types may also include scattered shrubs or shrub groupings, small patches of grass/ herbaceous vegetation, or shrub and grass herbaceous vegetation occurring beneath tree canopies, although trees are the dominant cover type. Oak woodlands are found in the City's drainages and canyons throughout the foothill areas.

Coast Live Oak Woodland

Oak stands are composed of fuel structures ranging from fine to heavy. In closed canopy stands, a sparse understory of grass, leaves, twigs, branches, and bark litter may be present. In open stands, understory may include grass, shrubs, leaves, twigs, branches, and bark litter. Fuel buildup typically occurs very slowly in oak woodland stands in California (USFS 2020a), and litter forms a thick, compacted mat resulting in very low surface fuel loads. In closed-canopy oak woodlands, understory fuel loads are low. The reduction of fire as an ecosystem process in oak woodlands, however, allows for an accumulation of fuels that had previously been consumed during regular, low-intensity fires. This can cause a build-up of woody vegetation in the understory, including significant increases in dead and down woody material and ladder fuels connecting ground vegetation to tree canopies. As a result, some oak woodlands are more susceptible to severe, crown-consuming fires (McCreary 2004).

Oak trees 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 2020a). Oaks also do not spread fire crown-to-crown readily like many conifers. Oak woodland litter does little to facilitate fire spread as it has a low surface area-to-volume ratio and requires high heat levels to remove fuel moisture and raise fuel to ignition temperature. Oak woodland litter is subject to seasonal drying in the late summer and early fall months, but fog drip, solar shading, and the windbreak provided by oak canopies can sustain high fuel moisture content in the summer when fog is present. 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.

Dead fuels consist of 1-hour (litter and duff < 0.25 inches in diameter), 10-hour (twigs and small stems 0.25 inches to 1 inch in diameter), 100-hour (branches 1 inch to 3 inches in diameter), and 1,000-hour (large stems and branches > 3 inches in diameter) sizes. Oak woodlands are mostly lacking in features that promote fire spread, but weather and topography have a strong influence on fire behavior. Given extreme fire weather and steep terrain, oak woodlands have the potential for a moderate rate of spread, torching and crown fire, and extreme fire behavior, especially those with higher surface fuel loads and ladder fuels. Fire behavior in oak woodlands and forests is typically much less intense than wildfires burning in chaparral and coastal scrub communities. Low, compacted leaf litter understory, canopy shading of ground fuels, and wind velocity reduction from tree canopies significantly reduces the intensity and spread rates of surface fires in oak woodlands. Transition from ground to canopy fire increases fire intensity, spotting, and tree mortality potential.

Riparian Woodland

Riparian woodlands are concentrated within the drainages of the San Gabriel Mountains and have a low fire hazard as their high moisture levels limit ignition potential and minimize the potential for wildfire spread. The vegetation within riparian woodlands responds slowly to changes in temperature and moisture, and significant surface shading from tree canopies limits fuel moisture loss. Surface fuels are relatively low in riparian woodlands; however, storm-related high-water streamflow can deposit debris and contribute to fuel buildup as it dries out later in the season. During severe weather conditions, high fuel loads can result in high intensity burning.

Eucalyptus

Eucalyptus stands are composed of fuel structures ranging from fine to heavy, and may include an understory of grass; brush; eucalyptus seedlings, saplings, and small trees; and eucalyptus leaf, twig, branch, and bark litter. Eucalyptus litter is generally moderately compacted with heavy to very heavy fuel loads; fuel loads in eucalyptus stands can reach between 45 and 100 tons per acre (Agee et al. 1973). Fuel buildup in eucalyptus stands is very rapid, exceeding that of other tree species, and its litter (dead leaves and debris) is especially flammable (Agee et al. 1973; NPS 2006; Wolf and DiTomaso 2016). Fuel reduction programs in eucalyptus stands are typically recommended to maintain low fuel load levels (USFS 2020b).

The leaves of many eucalyptus tree species may be moderately resistant to combustion under some circumstances (Dickinson and Kirkpatrick 1985); however, these trees are considered highly flammable as the bark catches fire readily, and deciduous bark streamers and lichen epiphytes tend to carry fire into the canopy, which tends to produce embers that can be carried by strong winds. These flying embers are carried downwind and result in the development of spot fires that have ignited in receptive fuel beds in advance of the fire's leading edge (Ashton 1981; USFS 2020b). Peeling bark is typical of many other eucalyptus species and contributes to ground-based fuels (litter) when it falls. Peeling bark is also retained for a period of time on tree trunks, where it can facilitate ground to canopy fire transition (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.

Like chaparral, eucalyptus also has a higher content of volatile organic compounds. Eucalyptus leaves produce a volatile (Gabbert 2014), highly combustible oil, and flammable gasses may be released from trees at very high temperatures, further increasing fire hazard (Gross 2013). The live fuel moisture content reaches its low point in the late summer and early fall months. Dead fuels consist of 1-hour (litter and duff < 0.25 inches in diameter), 10-hour (twigs and small stems 0.25 inches to 1 inch in diameter), 100-hour (branches 1 inch to 3 inches in diameter), and 1,000-hour (large stems and branches > 3 inches in diameter) sizes. Features that promote fire spread include heavy litter fall, flammable oils in the foliage, and open crowns bearing pendulous (i.e., downward-hanging) branches, which encourage maximum updraft (USFS 2020b). Given average weather conditions and terrain, eucalyptus has potential for a high rate of spread, torching and crown fire, and extreme fire behavior.

4.5.3 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 2020).

- **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 2020).
- **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 fire encompasses 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).

Another component of fire behavior is spotting, the transfer of firebrands (embers) ahead of a fire front, which can ignite smaller vegetation fires (NWCG 2020). These smaller fires can burn independently or merge with the primary fire. Spotting can also result in structural ignitions when transported embers reach a receptive fuel bed (e.g., combustible roofing), especially in wind-driven fires, such as those occurring during the Santa Ana wind events in the San Gabriel Mountains. Structure fires, as well as vegetation-fueled fires, can generate firebrands. Additionally, landscape features like ridges can dramatically affect fire behavior by changing prevailing wind patterns, funneling air, and increasing wind speeds, thereby intensifying fire behavior.

Each of the fire types mentioned above may occur within or adjacent to the City, depending on site-specific conditions. Fire behavior is how a wildland fire reacts to weather, fuels, and topography. The difficulty of controlling and suppressing a wildfire is typically determined by fire behavior characteristics, such as rate-of-spread, fireline intensity, torching, crowning, spotting, fire persistence, and resistance to control (NWCG 2020). Extreme fire behavior is that which precludes methods of direct control (e.g., flame lengths 8 feet and greater), behaves unpredictably and erratically, and typically involves high spread rates, crowning and spotting, the presence of fire whirls, and a strong convective column (NWCG 2017).

Fire behavior characteristics are an essential component in understanding fire risk and fire agency response capabilities. 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). While 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 fire variable (Rothermel 1993). Fireline intensity is a measure of heat output from the flaming front and also affects the potential for a surface fire to transition to a crown fire. The information in Table 3 presents an interpretation of flame length and its relationship to fire suppression efforts.

Table 3. Fire Suppression Interpretation

Flame Length	Fireline Intensity	Interpretations
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 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 head of fire are ineffective.

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

4.6 Fire History and Ignitions

Fire history is an important component of fire planning and can provide an understanding of fire frequency, fire type and behavior, most vulnerable community areas, and significant ignition sources, amongst others. One important use for this information is as a tool for pre-planning. It is advantageous to know which areas may have burned recently and therefore may provide a tactical defense position, what type of fire burned in the area, and how a fire may spread. Fire history represented in this CWPP uses the CAL FIRE - Fire and Resource Assessment Program (FRAP) database. FRAP summarizes fire perimeter data dating to the late 1800s, but which is incomplete due to the fact that it only includes fires over 10 acres in size and has incomplete perimeter data, especially for the first half of the 20th century (Syphard and Keeley 2016). However, the data does provide a summary of recorded fires and can be used to show whether large fires have occurred in the area, which indicates whether they may be possible in the future.

According to available data from the CAL FIRE in the FRAP database[4], approximately ninety-three (93) fires have burned within the San Gabriel Mountains of the Angeles National Forest within 5-miles of the City of Bradbury since the beginning of the historical fire data record. The topography, vegetation, and climatic conditions in the foothills above the City combine to create a unique situation capable of supporting large-scale, high-intensity, and sometimes damaging wildfires. Recorded wildfires within 5 miles range from 10.1 acres to 114,963 acres (2020 Bobcat Fire) and the average fire size is approximately 1,546 acres (not including the 2020 Bobcat Fire or fires smaller than 10 acres). The 2020 Bobcat Fire is the most recent fire, which occurred directly north of the City. Two fires have burned within the northern portion of the City. LACoFD may have data regarding smaller fires (less than 10 acres) that have occurred on the site that have not been included herein. Fire history for the general vicinity of the City is illustrated in the map in Table 4 and graphically presented in Figure 4.

4 Based on polygon GIS data from CAL FIRE's FRAP, which includes data from CAL FIRE, USDA Forest Service Region 5, BLM, NPS, Contract Counties and other agencies. The data set is a comprehensive fire perimeter GIS layer for public and private lands throughout the state and covers fires 10 acres and greater between 1878–2018.

Table 4. Fire History within Five Miles of the City of Bradbury

Fire Year*	Fire Name	Interval (years)	Total Area Burned (acres)
1900	Big Fire	N/A	16,960
1909	Un-named	9	19
1909	Un-named	0	20
1909	Un-named	0	104
1910	Un-named	1	81
1910	Un-named	0	19
1910	Un-named	0	27
1911	Un-named	1	15,096
1912	Un-named	1	32
1915	Un-named	3	15,096
1916	Duarte	1	179
1917	Hastings Ranch	1	350
1918	Fish Canyon	1	51
1923	Un-named	5	119
1924	Monrovia CC	1	57
1924	San Gabriel	0	43,050
1928	Bradbury No. 62	4	227
1928	Marlborough	0	73
1928	Brush Flat No. 12	0	241
1928	Un-named	0	86
1929	Rock Pit No. 46	1	145
1932	Tunnel Fire	3	31
1937	Fralich	5	38
1942	Hiyon #135	5	184
1943	Azusa Fire No. 42	1	188
1946	Beatty No. 209	3	159
1947	Azusa Fire No. 112	1	351
1950	Un-named	3	18
1952	Arcadia	2	10
1952	Baird Fire	0	138
1952	Spinks	0	179
1953	Un-named	1	95
1953	Monrovia Peak Fire	0	14,061
1953	Maddock	0	558
1954	Monrovia Peak No. 2	1	13,870
1957	Gale Fire	3	24,708
1957	Morris	0	2,788
1958	Un-named	1	66
1958	Un-named	0	13,943
1959	Un-named	1	118
1961	Un-named	2	257

Table 4. Fire History within Five Miles of the City of Bradbury

Fire Year*	Fire Name	Interval (years)	Total Area Burned (acres)
1961	Un-named	0	922
1962	Un-named	1	861
1962	Norumbega Fire	0	15
1965	Un-named	3	23
1968	Canyon Inn Fire	3	19,055
1968	Newman Fire	0	67
1968	Un-named	0	47
1968	Un-named	0	26
1969	Un-named	1	51
1969	Un-named	0	11
1969	Bole Fire	0	715
1970	Un-named	1	10
1975	Lannen Fire	5	160
1975	Star Pine Fire	0	115
1978	Mountain Trail Fire	3	1,295
1979	Silver Fish Fire	1	153
1980	Stable Fire	1	6,048
1982	Un-named	2	29
1988	Un-named	6	28
1993	Kinneloa Fire	5	5,454
1994	Old San Gabriel Canyon Rd.	1	3
1996	Reservoir	2	1,465
1997	Canyon II Fire	1	3,825
1997	Roberts	0	10
1998	Foothill	1	11
1999	Santa Anita	1	750
2002	Santa Anita II	2	28
2002	Williams	0	38,119
2008	Santa Anita	6	558
2009	Morris	1	2,237
2012	Reservoir	3	10
2013	Madre	1	209
2013	Shooting	0	11
2014	Colby Fire	1	1,951
2016	Reservior Fire	2	1,146
2016	Fish Fire	0	4,246
2020	Bobcat Fire	4	114,963

1 *CAL FIRE FRAP 2020

Nearly all significant wildfires have burned in the months of July, September, or October. This timeframe coincides with the end of the dry summer season, where vegetation has lower fuel moistures, and Santa Ana winds are prominent. While not all the fires shown in Table 4 were associated with Santa Ana winds, the largest and most damaging fires have occurred during such winds.

Based on an analysis of this fire history data set, specifically the years in which the fires burned, the average interval between wildfires within 5 miles of the City was calculated to be one year with intervals ranging between 0 (multiple fires in the same year) to 6 years. Based on this analysis, it is expected that there will be wildland fires within 5 miles of the City at least every six (6) years and on average, every 1.25 years, as observed in the fire history record. The proximity of the City to large expanses of open space to the north, northwest, and northeast and the terrain within the San Gabriel Mountains, including multiple sub-drainages and canyons, has the potential to funnel Santa Ana winds, thereby increasing local wind speeds and increasing wildfire hazard in the vicinity of the City.

4.7 Development Patterns

Nearly the entirety of the City of Bradbury's land area is designated and zoned for Agricultural residential land uses. This is reflected in the pattern of development and land use within the City's VHFHSZ area, which creates conditions that can be described as either a WUI or a wildland-urban intermix (Intermix). The WUI are areas where structures and other human development meets or intermingles with undeveloped wildland or vegetation fuels. This area typically consists of residential and commercial areas near or along foothills, such as found in Bradbury. Intermix areas predominately consist of low-to-medium density housing units and structures more closely interwoven with vegetative fuels that are capable of propagating fire. This condition exists throughout the Bradbury Estates, Woodlyn Lane community, and the remainder of the Bradbury community areas. where steep terrain and sensitive habitat prevents more dense development. Challenges with developments in WUI areas include narrow roads, long driveways, dead-end roads, steep slopes, and dense vegetation. Emergency response and evacuation from WUI areas during emergencies can also be hindered by these factors.

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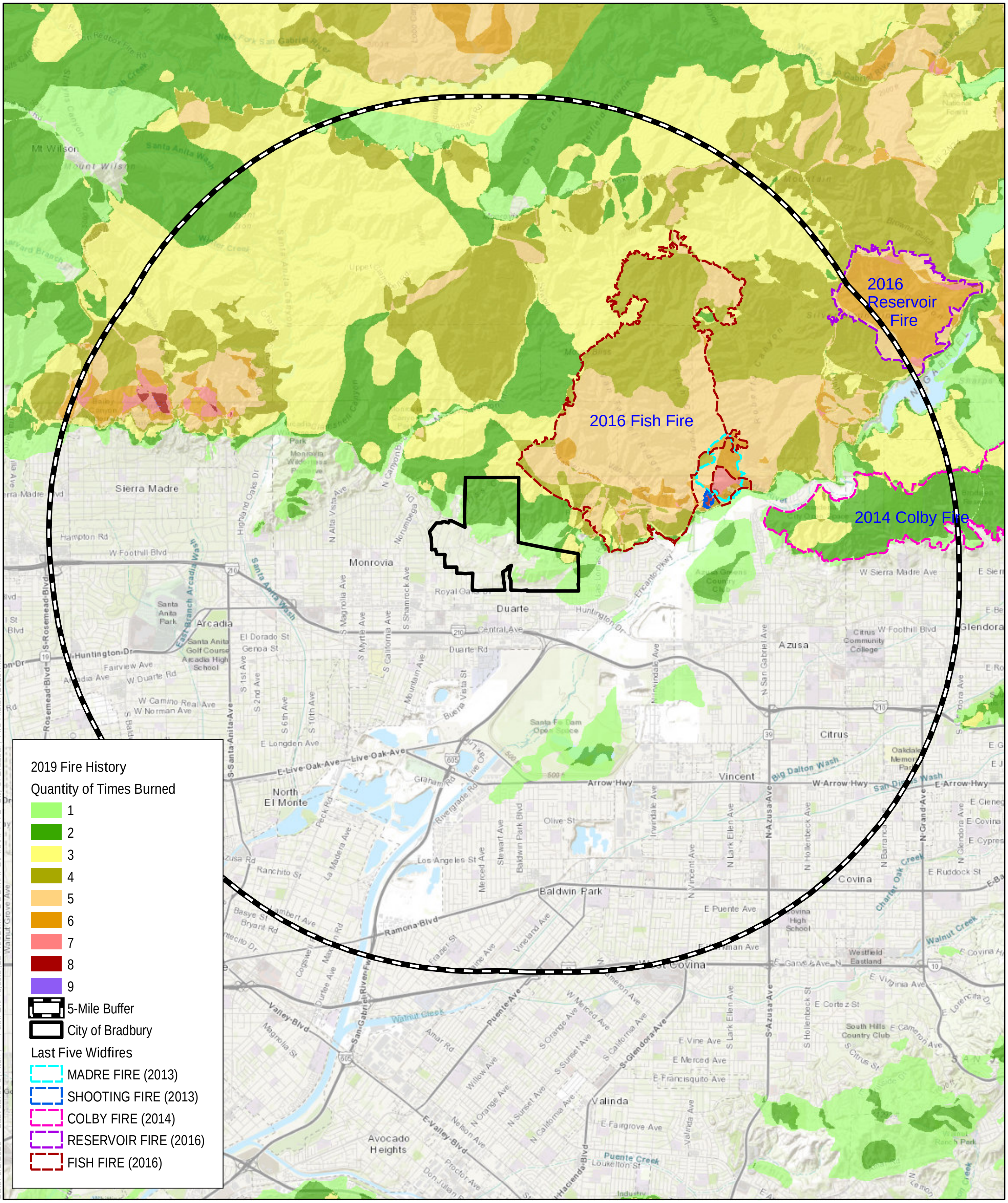

SOURCE: BASE-ESRI; FIRE DATA-CALFIRE 2019

DUDEK

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Figure 4

Fire History Map

City of Bradbury Community Wildfire Protection Plan

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4.8 Existing Hazard Abatement/Fuels Treatment

4.8.1 LACoFD Defensible Space and Vegetation Management

An important component of a fire protection system for a City is the provision for fire resistant landscapes and modified vegetation buffers. Defensible space Fuel Modification Zone (FMZs) 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 the WUI exposed structures.

As noted above, the City is exposed to naturally vegetated open space areas to the north, as well as being adjacent to residential communities to the west, east, and south. Based on the modeled extreme weather flame lengths within the naturally vegetated coastal scrub and chaparral fuels within the San Gabriel Mountains of the ANF, average wildfire flame lengths are projected to be approximately 40 to 45 feet high. The fire behavior modeling system used to predict these flame lengths was not intended to determine sufficient FMZs widths, but it does provide the average predicted length of the flames, which is a key element for determining “defensible space” distances for providing firefighters with room to work and minimizing structure ignition. Although Defensible Space is very important for setting back structures from adjacent unmaintained fuels, the highest concern is considered to be from firebrands or embers as a principal ignition factor.

4.8.1.1 Los Angeles County Fuel Modification Zone Standards

A FMZ is a strip of land where combustible vegetation has been removed and/or modified and partially or totally replaced with more adequately spaced, drought-tolerant, fire resistant plants in order to provide a reasonable level of protection to structures from wildland fire. Los Angeles County Fire Code (Title 32, Fire, Section 4908) is consistent with the 2019 California Fire Code (Section 4907 — Defensible Space), Government Code 51175 – 51189, and Public Resources Code 4291, which require that fuel modification zones be provided around every building that is designed primarily for human habitation or use within a VHFHSZ. Fuel modification consists of at least 100 feet, measured in a horizontal plane, from the exterior façade of all structures towards the undeveloped areas. A typical landscape/fuel modification installation per the County’s Fire Code consists of a 30-foot-wide Zone A and a 70-foot-wide Zone B for a total of 100[5] feet in width. An additional 100-foot-wide Zone C may be required for the areas adjacent to natural-vegetated, open space areas.

Zone A – From structure outward to minimum 30 feet

Zone A is an irrigated, limited planting area measured from the outermost edge of the structure or appendage outward to 30 feet (horizontal distance), or to the property line for perimeter lots adjacent to native vegetation.

[5] In accordance with section 325.2.2 of the Los Angeles County Fire Code, Clearance of Brush and Vegetation Growth “Extra Hazard”, it may be determined by the fire official that some sites pose an extra hazard. In such cases, Fuel Modification Zones may exceed 100 feet but not exceed 200 feet from structures.

1. Zone A should be planted with plants from Appendix B: Acceptable Plant List by FMZ. Plant selection for Zone A should consist of small herbaceous or succulent plants less than two to three feet in height or regularly irrigated and mowed lawns.

2. Plants identified as "Target" or undesirable plants (See Appendix C: Fuel Modification Zone Undesirable Plant List) by LACoFD shall not be planted within Zone A.

3. Trees should be spaced to allow a minimum 10-foot canopy clearance at full maturity to the structure.

4. Inorganic mulches, such as gravel, shall be used within 12 inches of the structure.

5. A 5-foot wide pathway shall be provided around and abutting any structures for firefighter access.

Zone B – From outer edge of Zone A to 100 feet from structure

Zone B is the area (may be irrigated or not irrigated) measured horizontally from the outer edge of Zone A to 100 feet from the structure or property line, whichever is first.

1. Zone B can be planted with slightly higher plant density than Zone A as long as landscape does not create any horizontal or vertical fuel ladders (e.g., fuel which can spread fire from ground to trees).
   Exception: Screen plantings are permissible if used to hide unsightly views.

2. Trees found in Appendix B can be planted, if they are Zone B appropriate and the tree canopies at maturity are not continuous.

3. Plants identified as "Target" or undesirable plants (See Appendix C) by LACoFD shall not be planted within Zone B.

4. Avoid planting woody plant species taller than 3 feet in height at maturity directly underneath any tree canopy.

5. Zone B may not be landscaped, but it is still subject to brush clearance standards (https://www.fire.lacounty.gov/forestry-division/fire-hazard-reduction-programs/)

Zone C – Thinning Zone (from outer edge of Zone B to 200 feet from structure)

Zone C is considered a thinning zone and is any FMZ greater than 100 feet from structures. When provided, either by conditions of a development, voluntary by the property owner, or required by the LACoFD, this zone is more of a progressive thinning zone to lessen spread of fire as it approaches the primary FMZ adjacent to structures. The amount of fuel reduction and removal should take into consideration the type and density of fuels, aspect, topography, weather patterns, and fire history. Thinning of less than 50 percent of the existing condition may be acceptable where erosion is of high concern, but the average cover throughout the Zone C will be reduced by 50 percent, resulting in approximately 50 percent ground cover by plant canopy.

4.8.2 LACoFD Vegetation Management Program

The LACoFD created the Vegetation Management Program in 1979 to develop strategies for responding to the growing fire hazard problem throughout Los Angeles County. The Vegetation Management Program includes an ongoing effort to analyze the history and effects of wildland fires in Los Angeles County, as well development of fuel management projects with stakeholders, including cities, community groups, and other agencies; experimentation with various methods of reducing or removing fuels in fire prone areas, as well as environmental impacts and effects of these practices. Many homes have been lost due to unmanaged vegetation around them. Vegetation can be modified and managed, but as long as people choose to live in wildland areas, the threat of major catastrophe exists. Vegetation management, related to wildland fire, refers to the total or partial removal of high fire hazard grasses, shrubs, or trees. In addition to fire hazard reduction, vegetation management has other benefits, including increased water yields, improved habitat for wildlife, reduction of invasive exotic plant species, and open access for recreational purposes (LACoFD, Fire Hazard Reduction[6]).

4.8.3 Neighboring Jurisdictions Establishment and Maintenance of Defensible Space

Mutual vegetation management is essential for fire prevention and fire management. Both the Monrovia Fire Department (MFD) and the Arcadia Fire Department (AFD) have brush clearance and fuel mitigation strategies independent of LACoFD, to reduce the potential or slow the progress of wildfires. These programs include fuel reduction through identified structural hardening (i.e., defensible spaces) and emergency preparedness. The LACoFD coordinates vegetation management efforts with the MFD and AFD in areas adjacent to the City, where feasible.

Additionally, the Fire Management Staff of the USFS - Angeles National Forest Division, are currently conducting hazardous fuel inventory data and fuel break research in areas of the Angeles National Forest adjacent to the City of Bradbury, which is crucial in decreasing the impact of wildfire to the City. The City and USFS – Angeles National Forest intend to continue looking for future opportunities to collaborate on potential Projects.

4.9 Evacuation

The City of Bradbury presents unique challenges for evacuation due to the speed and intensity at which wildfires occur as well as the high variability in transportation systems in the City, notably throughout the City's VHFHSZ Areas. Factors associated with evacuation, such as human behavior, population density, overloaded transportation routes, visitors, vulnerable populations, as well as the evacuation of pets and large animals, make the task of any evacuation more complex. Any combination of these factors may significantly increase the amount of time it takes to execute an evacuation. As a result, the decision by property owners and agencies to evacuate is often made quickly.

Evacuation during a wildfire in the City of Bradbury is not necessarily directed by the LACoFD, except in specific areas where fire personnel may enact evacuations on-scene. The Los Angeles County Sheriff's Department (LACoSD), Monrovia Police Department (MPD), Arcadia Police Department (APD), and other cooperating law enforcement agencies have the primary responsibility for evacuations. These agencies work closely within the Unified Incident Command System (ICS) with the County Office of Emergency Services and responding fire department personnel who assess fire behavior and spread, which should ultimately guide evacuation decisions. To that end, the LACoSD and Department of Public Works, Los Angeles County, have worked with a County Task Force to address wildland fire evacuation planning for cities throughout Los Angeles, including Bradbury. The task

[6] https://fire.lacounty.gov/fire-hazard-reduction-programs/#1566334036482-7a650ced-8cf5

force also received input from the Arcadia Police Department (APD), Monrovia Police Department (MPD), California Highway Patrol (CHP), the California Department of Transportation (CalTrans), as well as various property owners' associations throughout the Los Angeles area.

In 2008, the LACoSD along with the LACoFD, reviewed the evacuation routes throughout the City; these evacuation routes include:

- From the Estates: Exit out of the Deodar Main or Barranca Road. If possible, have incoming horse trailers stage on Lemon, and walk the horses down Barranca Road.
- From Woodlyn Lane: Exit towards Royal Oaks Drive North. If route is not accessible, exit towards Mount Olive Drive.
- From the East: The east end of the City exits down Mount Olive Drive from all feeder streets.

A map of the City's Emergency Evacuation Plan is presented in Figure 5.

4.9.1 Post Emergency Evacuation Community Repopulation

Once a wildfire has burned through an area, the damage to homes and infrastructure is usually unknown and there are many dangers to the homeowners wanting to return home days or sometimes weeks later that could remain, including downed trees and powerlines, unsafe roofs and exterior areas of a home, small ground hotspots or smoldering stumps, smoke and ash in the area that could irritate eyes and lungs, and even unsuspected wildlife in the area. Repopulation to an area would occur after an order is issued and once the law enforcement officers (LACoFD and LACoSD) allow for residents to return home. Fire jurisdictions, including the LACoFD, understand that evacuation orders cause additional unwanted stress and concerns to those who are eager to return home, however, it's important to understand that incident commanders are continuously evaluating the area for both fire and infrastructure conditions so that residents can return home as soon as possible and as safe as possible. According to a LACoFD Repopulation General Information sheet, before an evacuation order can be lifted, several factors are taken into consideration by the incident commander and law enforcement, including the amount of personnel still working in an area and the type of work being performed, public access conditions (damage to the road or downed trees blocking the road), damage to utility infrastructure that must be repaired prior to repopulation (power lines in the road or replacing downed power poles), or public health considerations (unhealth smoke and ash that remains). When repopulation begins to occur after evacuation orders have been lifted, repopulating in segments not only allows law enforcement and fire agencies to get some residents home as quickly as possible, but also reduces the impact on law enforcement checking for identification when areas are reopened to residents only. See Appendix D, Los Angeles County Fire Department Repopulation General Information Sheet for additional repopulation information.

As an area is being repopulated, it's extremely important to be aware of the hazardous environment and know what to look for when an evacuation order has been lifted. The California Department of Forestry and Fire Protection (Cal Fire) has additional information about returning home from a wildfire (Cal Fire, 2019 - After a Wildfire - Ready for Wildfire), including:

- Keep an eye out and be mindful of people working in the area, including road crews, firefighters, and other personnel and law enforcement workers.

- Watch for trees, brush, and rocks that may have been weakened or loosened by a wildfire.
- Be aware of debris or damage to roads or driveways, slowing traffic flow and reducing traffic lanes due to repairs and firefighting operations.
- Use extreme caution around trees, power poles, and other tall objects or structures that may have been weakened by a wildfire.
- Check for the smell of gas and use a battery-powered flashlight to inspect a damaged home.
- Check the ground for hot spots, smoldering stumps, and vegetation.
- Check the roof and exterior areas for sparks or embers.
- Check the attic and other areas throughout the home for hidden burning sparks or embers.
- Check for fire damage to the home, turn off all appliances and make sure the meter is not damaged before turning on the main circuit breaker.
- Do not drink water from the faucet until emergency officials say it's okay, as water supply systems can be damaged and become polluted during wildfires.
- Wildfires leave behind a lot of ash that can irritate eyes, nose, or skin and cause coughing; protect yourself against ash by wearing a mask to help you breath in dust from ash, wearing goggles to protect your eyes, and wearing gloves, long-sleeved shirts, long pants, and shoes and socks to protect your skin.

4.10 Water Supply

Water systems that supply adequate quantity, pressure, and duration are essential to structure protection. Without adequate water supply the ability to safely protect structures and suppress fires is compromised. The Fire Department Water Supply and Fire Hydrant standards (City Municipal Code, Chapter 8, Section 17.08.010) outline the City's water supply requirements. (Appendix E). The Public Works Department has developed an extensive water distribution system that consists of many components including reservoirs, pump stations, pressure zones, water mains, and fire hydrants. Fire hydrants (with fire flow ratings) and water reservoirs important for fire suppression were identified during development of the 2004 Wildland Fire Plan.

The City of Bradbury's domestic water service is owned and operated by the California American Water Company (CAWC), within the Los Angeles County Service Area of Duarte. The locations of City's existing fire hydrants are presented in Figure 6.

4.11 Communications

Radio communications systems are critical to fire department response capabilities and the life safety of firefighters and the public depends on reliable, functional communication tools that work in harsh environments. Radios are the lifeline that connect firefighters to command and outside assistance and serve as a critical tool for communicating site information accurately and efficiently. The County of Los Angeles operates an 800 MHz, trunked simulcast radio system. With the exception of the LACoFD and the LACoSD, all Los Angeles County departments participate. To communicate with LACoFD and LACoSD, there exists a bridging interface. In the event of a declared emergency Los Angeles County departments can communicate with each other and free up other communication channels.

The LACoFD currently provides fire protection and life safety services to more than 4 million residents, with a service area spanning 2,300 square miles to 60 cities and nearly 400,000 incidents annually. With rapid response from 177 County fire stations, LACoFD's Fire Station Alerting System (FSAS) serves as the central communication technology for getting first responders out the door quickly (RadioMobile, 2021). The LACoFD improved the performance and flexibility of their FSAS with new technology. The Departments old FSAS was a system compiled of relays, batteries, inverters, and a commercial public address system. The dispatch alerts were previously received via two-tone signals through the radio system that triggered the process of turning on station lights, generating a series of alert tones, and finally turning on the speaker so the voice dispatch could be heard.

The Department's communication system components are aging and were in need of an upgrade system, so the Department turned to collaboration with a new FSAS, based on modern technology, which would improve the response times and can be customized to meet the need of each fire station individually. With the new FSAS, the Computer Aided Dispatch (CAD) system would send a dispatch that is immediately converted to a signal by IQ FSAS and routed to the appropriate station(s)via the County's Land Mobile Radio (LMR) network. Some key features of the IQ FSAS include fully programmable and customizable lights and tones (RadioMobile, 2021).

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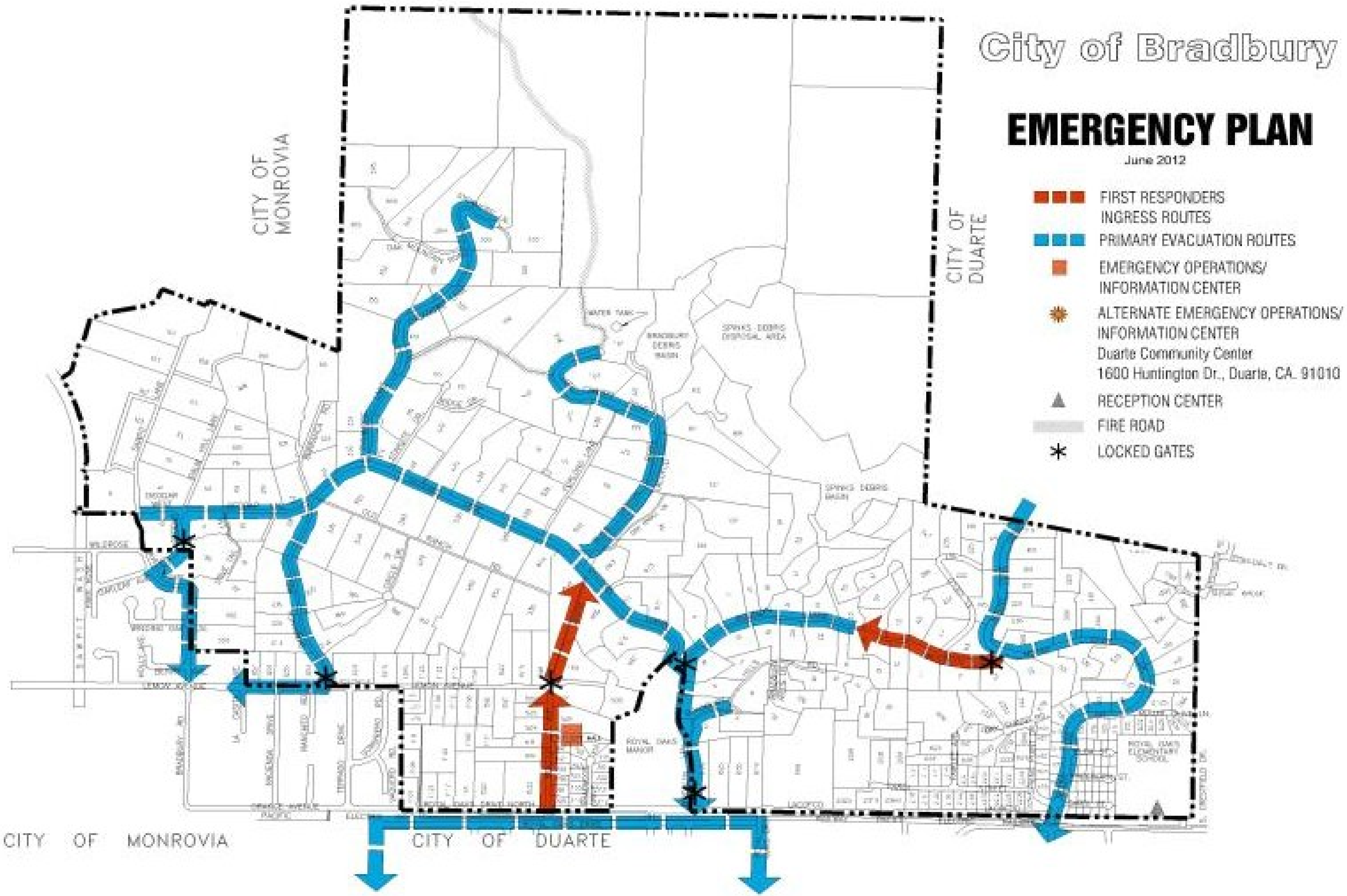

SOURCE: City of Bradbury, 2020

FIGURE 5
City of Bradbury Evacuation Routes

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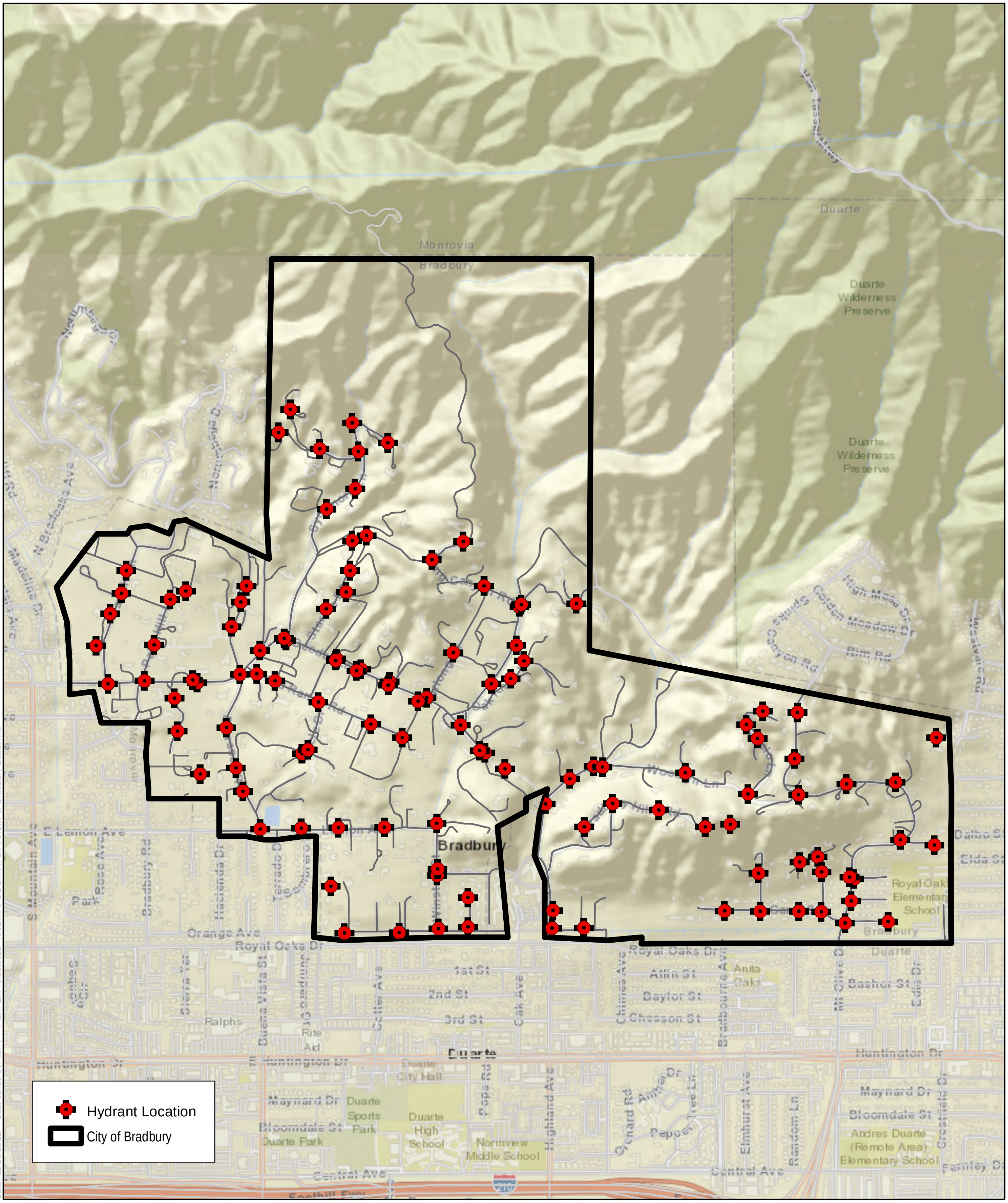

Date: 11/10/2021 - Last saved by: lterry - Path: Z:\Projects\j12449\01\MAPDOC\MAPS\Fire\City of Bradbury Base.mxd

SOURCE: BASE-ESRI

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0 750 1,500 Feet

Figure 6

City of Bradbury Fire Hydrant Locations

City of Bradbury Community Wildfire Protection Plan

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5 Planning and Regulatory Environment

The following section provides an analysis of the City of Bradbury in terms of current LACoFD Fire Service capabilities and resources to provide Fire Protection and Emergency Services, as well as existing codes and standards relevant to wildfire protection and fuels management to the City. The analysis that follows examines the ability of the existing LACoFD fire stations to adequately serve the Community. Response times were evaluated.

5.1 Fire Protection

The Project is located within the LACoFD jurisdictional response area. Regionally, LACoFD provides fire, emergency medical, and rescue services from 177 stations. The Department serves over 4 million residents throughout 60 cities and all unincorporated portions of Los Angeles County. The City lies within the East Operations Bureau, Division 2. Fire Station 44 would provide initial response; however, Stations 29, 32, and 48 within LACoFD's Division 2, and Station 169 within LACoFD's Division 9 are available to service the City, if needed. Figure 7 illustrates the station locations and Table 5 provides a summary of the LACoFD fire and medical delivery system for Fire Stations 29, 32, 44, 48, and 169.

Table 5. Closest Los Angeles County Fire Department Responding Stations Summary

Station	Location	Equipment	Staffing
Station 29	14334 Los Angeles Street, Baldwin Park, California, 91706	- (1) Paramedic Engine Company - (1) Paramedic Squad Truck - (1) Quint [1]	- 3-Person Engine company - 2-Person Paramedic Squad - 4-Person Quint
Station 32	605 North Angeleno Avenue, Azusa, California, 91702	- (1) Paramedic Engine Company - (1) Paramedic Squad Truck	- 4-Person Engine Company - 2 Person Paramedic Squad
Station 44	1105 Highland Avenue, Duarte, California, 91010	- (1) Paramedic Engine Company - (1) Assessment Engine Company	- 3-Person Engine Company - 4-Person Assessment Engine Company[2]
Station 48	15546 Arrow Highway, Irwindale, California, 91706	- (1) Engine Company	- 4-Person Engine Company
Station 169	5112 North Peck Road, El Monte, California, 91732	- (1) Engine Company	- 3-Person Engine Company

1. A quintuple combination pumper or "quint" is a fire-service apparatus that serves the dual purpose of an engine and a ladder truck.
2. An assessment engine company is an engine company with some limited paramedic capabilities.

The department is largely staffed and equipped for structural fire protection; however, its Forestry Fuel Modification and Fire Prevention Division Units focus on educating the community about the benefits of proper safety practices. These Department Units including full-time staffing of wildland fire experts, development of codes and standards for vegetation management and structural protection in the County's Very High Fire Hazard Severity Zone Areas, implementation of vegetation management projects and a defensible space inspection program, and working with the community to increase resilience in the event of a wildland fire. The LACoFD recognizes that wildland fire throughout the cities they serve is inevitable.

The City of Bradbury, along with the help of the LACoFD also recognizes the need to maintain a long-range wildland fire plan to reduce the catastrophic effects of wildfire. Without this plan, the ability to prioritize, fund, and implement projects and programs to minimize the impact of wildfire in the community would be jeopardized.

5.1.1 LACoFD's Fire Protection Philosophy

5.1.1.1 Public and Firefighter Safety

The mission of the LACoFD is to protect lives, the environment, and property by providing prompt, skillful, and cost-effective fire protection and life safety services. Protecting lives continues to be the number one priority in the Fire Chief's fire protection philosophy and strategic plan, as nearly 84% of the Department's emergency calls are medically related. However, addressing societal challenges through Countywide initiatives and partnerships, supporting community resilience by implementing environmental initiatives, catastrophic preparedness, and public education programs, and building tomorrow's fire department will help fulfill the LACoFD's vision of being an exemplary organization acclaimed for their national reputation, regional strength, and hometown attentiveness (Los Angeles County Fire Department 2017-2021 Strategic Plan). The LACoFD's mission and vision statements, Standard Operating Procedures, training, fire protection, and fire prevention activities all support this priority.

5.1.1.2 Protection of Structures

The protection of structures is another top priority of the LACoFD. The ability to protect structures during a wildfire is complex. The majority of the structures throughout the City were developed before the adoption of building and fire codes that required noncombustible roofing and building materials, adequate fire department access, and meet water supply standards in the VHFHSZ areas. These existing nonconforming structures are at greater risk of loss than structures that meet current building, access, and water standards and limit the ability of the LACoFD to provide adequate structure protection. Added to the complexity is the number of homes (both existing conforming and non-conforming structures) that do not have adequate defensible space or vegetation clearance around structures and along driveways and roadways. The LACoFD's Fire Prevention Division's mission is to educate the community about the benefits of proper safety practices and to identify and eliminate all types of hazardous conditions that pose a threat to life, property, and the environment (Los Angeles County Fire Department Overview, May 2021).

5.1.1.3 Protection of the Environment and Natural Resources

Another top priority for the LACoFD is to protect the environment and natural resources. The Forestry Division of the LACoFD is comprised of environmental professionals who deliver high quality fire prevention services to homeowners and public agency stakeholders and assist Emergency Operations with logistical support. The Forestry

Division is made up of three sections, including Brush Clearance Section, Natural Resources Section, and Forestry Operations Section, whose overall responsibilities include forest and natural resource management, fire prevention, environmental review, pre-fire planning, and public education. Fire suppression and fire prevention strategies and procedures attempt to balance the need for wildland fire safety and protection of resources. The complexity of protecting lives and property, along with natural resources, is a reality for the LACoFD.

The first of the three Sections is the Brush Clearance Section oversees inspection, abatement, and enforcement of brush clearance Fire Codes, reviews, and approves fuel modification plans, and assists homeowners in maintaining "Defensible Space."

Second, the Natural Resources Section reviews environmental documents for the Fire Department, ensuring compliance with the California Environmental Quality Act (CEQA), and monitors the implementation of the County of Los Angeles Oak Tree Ordinance. The Natural Resources Section is also responsible for bi-monthly live fuel moisture sampling of fire-prone plants and supports monitoring and mitigation of invasive insect species. It also completes the annual review, revision, and implementation of the Fire Department's Strategic Fire Plan, designed to minimize cost and losses from wildland fires by utilizing geographic information system software to identify high-hazard/high-value areas and communities at risk.

Thirdly, the Forestry Operations Section specializes in the propagation and distribution of native trees and shrubs to assist area residents with erosion control, slope stabilization, and wind breaks. Other services include conservation education, nursery tours, fire prevention consultations, hazard tree assessments, landscape design and installation on Fire Department facilities, pest assessment and control, and tree planting and maintenance projects throughout the County (Los Angeles County Fire Department Overview, May 2021).

The chaparral vegetation types within the surrounding areas of the City has adapted over millions of years with fire as a natural part of its ecosystem. Current and past fire exclusion and suppression policies have resulted in large accumulations of flammable vegetation on hillsides of the San Gabriel Mountains. When these areas burn under wildfire conditions, they result in intense fire behavior and increase the potential for resource damage. The City along with the LACoFD realize the best way to provide wildland fire protection and to protect natural resources is to implement a Community Wildfire Protection Plan that develops policies and actions to reduce accumulations of vegetation, and enhance natural resources and reduce their vulnerability to wildfire.

5.1.2 Fire Protection Partnerships and Mutual Aid Agreements

Like most California communities and jurisdictions, the LACoFD relies on mutual aid resources to augment firefighting resources if a wildfire or other emergency situation occurs through Appendix J – California Master Mutual Aid Agreement found in the Los Angeles County OA Emergency Response Plan. No community has the resources sufficient to cope with all emergencies for which the potential exists. In times of large scale wildfires and disasters, the City of Bradbury relies on the LACoFD and neighboring agencies within Area D, including the AFD and MFD, to provide equipment and personnel for fire suppression, prevention, and investigation of wildfires. Likewise, when called upon, LACoFD provides the same assistance to outside agencies in need.

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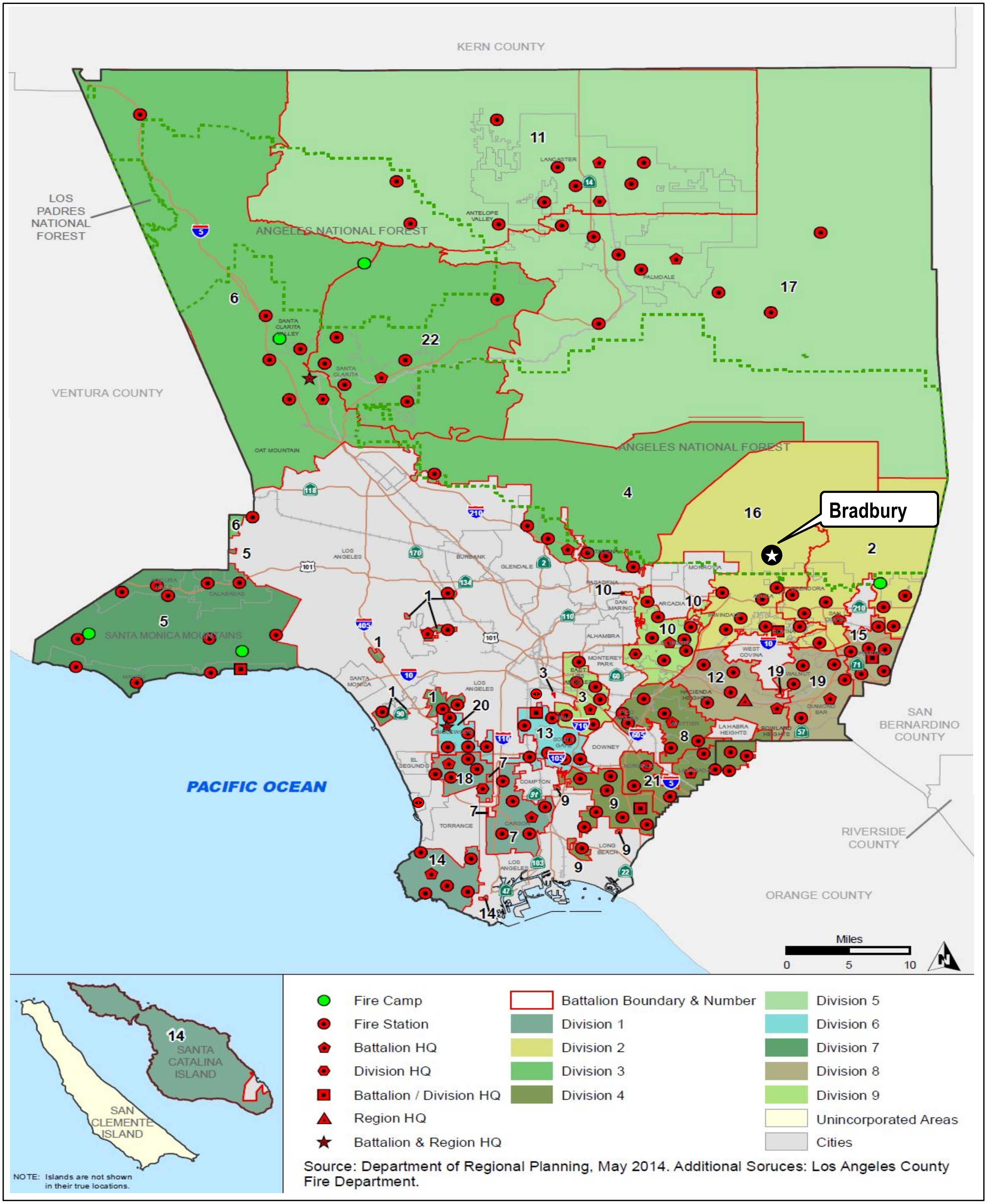

SOURCE: Los Angeles County Fire Department, 2020

DUDEK

Figure 6

Los Angeles County Fire Department Battalions and Stations Map

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5.2 City of Bradbury Codes and Standards

5.2.1 Los Angeles County Fire Code

Through Title 32 of the 2020 Los Angeles County Fire Code, as amended, and adopting by reference the 2019 edition of the California Fire Code (CFC). Title 32 is hereafter referred to as the Los Angeles County Fire Code or "Fire Code". The 2019 edition of the CFC is based on the model International Fire Code (IFC), as published by the International Code Council (2016 Edition),[7] and all standards and secondary codes referenced in said codes, as defined in City of Bradbury Municipal Code Title IV, Chapter 3, Section 4.03.010 through 4.03.030.

Section 325 of the Los Angeles Fire Code outlines Clearance of Brush and Vegetative Growth. Specifically, Section 325.2.1 states:

> 'Persons owning, leasing, controlling, operating or maintaining any building, structure, or apiary upon or adjoining any mountainous-, or forest-, or brush-covered land or land covered with flammable growth, and person owning, leasing or controlling land adjacent to such structures, shall at all times:
>
> 1. Place or store firewood, manure, compost, and other combustible materials a minimum of 30 feet (9.14 m) from any building, structure, or apiary.
>
> 2. Maintain around and adjacent to such building, structure, or apiary an effective fire protection or firebreak made by removing and clearing away, for a distance of not less than 30 feet (9.14 m) on each side thereof, all flammable vegetation or other combustible growth. This includes ornamental plants and trees known to be flammable, including but not limited to acacia, cedar, cypress, eucalyptus, juniper, pine, and pampas grass.
>
> Exceptions:
>
> 1. Ornamental plants and trees that are individually planted, spaced, and maintained in such a manner that they do not form a means of transmitting fire from native growth to the structure.
>
> 2. Cultivated ground cover such as green grass, ivy, succulents, or similar plants provided that they are maintained in a condition that does not form a means of transmitting fire from native growth to the structure.
>
> 3. When the fire code official or Commissioner finds that because of extra hazardous conditions, a firebreak of only 30 feet (9.14 m) around such building, structure, or apiary is not sufficient to provide reasonable fire safety, the person owning, leasing, controlling, operating, or maintaining the building, structure, or apiary shall maintain around or adjacent to any building, structure, or apiary an additional fire protection or firebreak made by removing all brush, flammable vegetation, or combustible growth located from 30 to 100 feet (9.14 to 30.48 m) from such building, structure, or apiary, as may be required by the fire code official or Commissioner. Grass and other vegetation located more than 30 feet (9.14 m) from such

7 This includes Chapters 1 through 80, and Appendices B, BB, C, CC, and D; the 2016 California Fire Code (Title 24, Part 9 of the California Code of Regulations).

building, structure, or apiary and less than 18 inches (45.72 cm) in height above the ground, may be maintained where necessary to stabilize the soil and prevent erosion.

4. That portion of any tree which extends within 10 feet (3.05 m) of the outlet of any chimney shall be removed.
5. Maintain any tree adjacent to or overhanging any building, structure, or apiary free of dead wood.
6. Maintain the roof of any building, structure or apiary free of leaves, needles, or other dead vegetative growth.
7. Nothing contained in this section shall be construed to require any person to maintain any clearing on land where such person does not have the legal right to maintain such clearing, nor shall any provision of this ordinance be construed to require any person to enter upon or to damage property of another without the consent of the owner thereof.

Section 325.2.2 of the Fire Code outlines Extra Hazards and states:

> 'The governing body finds that in many cases because of extra hazardous situations, a firebreak around buildings, structures, or apiaries of only 30 feet (9.14 m) is not sufficient and that a firebreak of 50 feet (15.24 m) or more may be necessary. If the fire code official or Commissioner finds that because of the location of any building, structure, or apiary and because of other conditions, a 30-foot (9.14-m) firebreak around such building, structure, or apiary as required by Section 325.2.1, is not sufficient, the fire code official or Commissioner may notify all owners of the properties affected that they must clear all flammable vegetation and other combustible growth or reduce the amount of fuel content for a distance greater than 30 feet (9.14 m), but not to exceed 200 feet (60.96 m).'

Section 4907.1 of the Fire Code outlines defensible space requirements in the throughout the County and within the City of Bradbury. Section 4907.1 states:

> 'Defensible space will be maintained around all buildings and structures in State Responsibility Areas (SRA) as required in Public Resources Code 429- and "SRA Fire Safe Regulations" California Code of Regulations, Title 14, Division 1.5, Chapter 7, Subchapter 2, Section 1270.

Buildings and structures within the VHFHSZs of a Local Responsibility Areas (LRA) shall maintain defensible space as outlined in Government Code 51175-51189, Chapter 3 of this code and any local ordinance of the authority having jurisdiction.'

5.2.2 City's Building Code

The City's Building Codes (Municipal Code Title XVII, Chapter 1, Section 17.01.101) adopts Title 26, Building Code, of Los Angeles County Code, adopting the California Building Code (CBC), 2016 Edition (Part 2 of Title 24 of California Code of Regulations), based on the model International Building Code and others (e.g., California Mechanical Code, Plumbing Code, Electrical Code, and Residential Code) by reference, subject to the amendments specified in Sections 17.02.010 through 17.08.010. Structural fire protection standards are addressed in the building codes and address structural hardening requirements for buildings located within a VHFHSZ area as defined by the LACoFD and consistent with Chapter 7A of the CBC. Structural hardening requirements address roofing, exterior coverings, decking materials, windows and doors, eaves, and vents, among others. The intent of these requirements is to minimize the potential for structural ignition through radiant or convective heat exposure or ember intrusion.

5.2.3 City of Bradbury's General Plan

The City of Bradbury's General Plan - 2012-2030 Update, is a long-range policy document designed to guide future conservation, enhancement, and development in the City. It defines the framework by which the City's environmental and economic resources are managed. The General Plan establishes goals, policies, and implementation measures to guide development and sustainability, and address issues related to the health, safety and welfare of its current and future citizens. The following elements of the City's General Plan include goals, policies, and implementation measures that address the impacts of wildland fires.

- **Land Use Element:** Contains goals, policies, and implementation actions related to land use, growth management, community design, and neighborhoods.
- **Environmental Resources Element:** Establishes goals and policies that specifically address hillside protection and conservation of open space, discourage development in high fire areas, and limit development on steep slopes.
- **Safety Element:** Contains goals and policies to reduce the potential risk of death, injuries, property damage, and economic and social dislocation resulting from large-scale hazards.

City of Bradbury General Plan policies applicable to wildfire are included in Appendix F.

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6 Wildfire Hazard Assessment

The wildfire hazard assessment conducted in support of this CWPP involved an evaluation of field conditions, processing and analyzing spatial datasets in a geographic information system (GIS), conducting GIS-based modeling to identify areas that may be subject to extreme fire behavior, and analyzing existing plans and data sets related to wildfire hazard. The assessment effort is presented in the following sections and was used to inform proposed modifications to the City's VHFHSZ Area.

6.1 Assessment Methods

6.1.1 Field Evaluations

Field assessments were conducted by Dudek and City of Bradbury staff in March 2020 and again in December 2020, in order to evaluate existing fuel load conditions, to gain an understanding of general fire hazard conditions in and around the City, and to better understand current vegetation management practices being conducted by the LACoFD and other agencies (MFD and AFD) within and adjacent to the City. During field assessments, site conditions were documented via photographs and, in some cases, noted on digital or hard-copy field maps.

6.1.2 GIS Analysis

Development of this CWPP included analysis and processing of various GIS datasets (in ArcGIS, version 10.7.1) for variables influencing wildfire hazard in the City. The following datasets were analyzed:

- Fire history
- Boundaries (VHFHSZ, High Fire Hazard Area, City Boundary, Parcels)
- Vegetation
- Terrain
- Roads
- Structure locations
- Fire station locations
- Evacuation blocks and routes
- Water Infrastructure

6.1.2.1 Structure Density

Individual building footprint data (2000 and 2010 US Census) was used to determine the proximity of structures to other structures. The 2010 Census identified a total of 400 dwelling units in the City of Bradbury. As of 2018, the Department of Finance identified a total of 409 housing units in Bradbury, all of which consist of single-family dwellings, either primary or second units on the same parcel of land. The City does not have group quarters or institutional facilities. The structure density is 204.2 structures per square mile which is considered low. Of the occupied units, 307 (86.7%) were owner-occupied and 47 (13.3%) were rented. The homeowner vacancy rate was 1.0%; the rental vacancy rate was 7.8%.

There are two primary concerns for structure ignition: (1) radiant and/or convective heat and (2) burning embers (National Fire Protection Association Standard 1144, Insurance Institute for Business and Home Safety, etc.). Burning embers have been a focus of building code updates for at least the last decade, and new structures in the WUI built to these codes have proven to be very ignition resistant. Likewise, radiant and convective heat impacts on structures have been minimized through the inclusion of structural hardening requirements included in Chapter 7A of the California Building Code, such as those for roofs, exterior walls, windows, and doors. However, in communities, or portions thereof, where structures are older and do not include ignition-resistant improvements (such as those identified in Chapter 7A), radiant heat from burning vegetation or adjacent structures is a primary concern. Areas with higher structure density (buildings are closer together) are therefore at greater risk of burning due to radiant heat exposure. The effect of radiant heat during wind-driven fires has been well documented (Cohen and Saveland 1997). Wind and slope can significantly increase the radiant heat exposure to surrounding structures. The type of building construction and the amount and kind of vegetation between structures also play a role in the ability of a structure to withstand radiant heat exposure.

The proximity of structures also limits the ability of property owners to maintain a minimum of 30 feet of defensible space between structures. The lack of defensible space inhibits firefighters from being able to safely maneuver around structures to provide protection.

6.1.2.2 LACoFD's Call Volume and Travel Times

Road network and fire station location data were used to evaluate the amount of travel time necessary to reach an individual parcel from existing fire station locations. Fire stations used in the analysis included LACoFD Fire Stations 29, 32, 44, 48, and 169, with Station 44 providing the initial response.

The closest existing fire station to the City of Bradbury is Station 44 located at 1105 Highland Avenue, Duarte, California, which includes a three (3)-person Engine Company staffed with a Captain, a Firefighter Specialist, and a Firefighter, and a four (4)-person Assessment Engine Company[8] with a Captain, a Firefighter Specialist, a Firefighter/Paramedic, and a Firefighter, 24-hours per day/seven days a week. Station 32, located at 605 North Angeleno Avenue, Azusa, California, is the next closest station, which includes a four (4)-person Paramedic Engine Company staffed with a Captain, a Firefighter Specialist, a Firefighter/Paramedic, and a Firefighter, and a two (2)-person Paramedic Squad truck with two (2) Firefighter/Paramedics, 24-hours per day/seven days per week

Additionally, Station 29 located at 14334 Los Angeles Street, Baldwin Park, California, Station 48 located at 15546 Arrow Highway, Irwindale, California, and Station 169 located at 5112 North Peck Road, El Monte, California could

[8] As Assessment Engine Company, is an engine company with some limited paramedic capabilities.

provide an effective firefighting force for the Chadwick Ranch Estates Project. Station 29 houses a three (3)-person Paramedic Engine Company, a four (4)-person Quint Company, and a tow (2)-person Paramedic Squad truck; Station 48 staffs a four (4)-person Engine Company; and Station 169 staffs a three (3)-person Engine Company.

The LACoFD documented 398,981 total incidents for 2019[9] generated by a County-wide service area total population of approximately 4,096,325 persons in 60 cities and all unincorporated communities within Los Angeles County (revised from LACoFD 2019). The County's per capita annual call volume is approximately 97 calls per 1,000 persons. The resulting per capita call volume is 0.097. It is estimated that the City of Bradbury has a total population of 1,069 persons[10].

6.1.2.3 Response Capability Impact Assessment

As presented in Table 6, using 2019 call volume data (Bagwell, pers. Email comm. 2020a), Engines 29, 32, 48, 169, 244, and Assessment Engine 44, the six closest Engines[11], ran calls in 2019, averaging 11, 8, 3, 4, 6, 3, and 7 calls per day, respectively. Quint 29, and Squads 29 and 32 with larger response jurisdictions ran 5, 15, and 14 calls per day, respectively.

Table 6. LACoFD 2019 Call Volume Totals for Closest Fire Stations

Response Jurisdiction	*Engine 29*	*Quint 29*	*Squad 29*	*Engine 32*	*Squad 32*	*Assess. Engine 44*	*Engine 244*	*Engine 48*	*Engine 169*
Fire	180	214	74	140	58	103	129	131	149
Medical Aid (EMS)	3,442	1,094	5,316	2,670	5,088	2,099	546	1,146	1,750
Other	429	309	142	347	128	328	280	334	349
Annual Total Response	**4,051**	**1,617**	**5,532**	**3,157**	**5,274**	**2,530**	**955**	**1,611**	**2,248**
Total Calls Per Day	**11**	**5**	**15**	**8**	**14**	**7**	**3**	**4**	**6**

Source: LACoFD Planning Division

The available firefighting and emergency medical resources in the vicinity of the City of Bradbury include an assortment of fire apparatus and equipment considered fully capable of responding to the type of fires and emergency medical calls potentially occurring within the City. For perspective, Assessment Engine 44 and Engine 244 ran 7 and 3 calls per day (Refer to Table 6 above). A busy suburban fire station would run 10 or more calls per day. An average station runs about 5 calls per day.

Land use in the City of Bradbury vicinity area varies greatly from urbanized and suburban clusters to vast rural areas. LACoFD's response time targets (Bagwell, pers. Email comm. 2020b) by land use type are:

- 5 minutes or less for urban areas
- 8 minutes or less for suburban areas

[9] https://fire.lacounty.gov/wp-content/uploads/2020/06/2019-Statistical-Summary-May-2020.pdf
[10] https://www.scag.ca.gov/Documents/Bradbury.pdf
[11] Engines 29, 32, and Assessment Engine are Paramedic Engines

- 12 minutes or less for rural areas

In an effort to understand fire department response capabilities, an analysis of the travel-time response coverage from the closest, existing station (Fire Station 44) was conducted. This response time analysis was conducted using travel distances that were derived from Google road data and Project development plan data. Travel times were calculated applying the distance at speed limit formula[12] (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH) as well as the nationally recognized Insurance Services Office (ISO) Public Protection Classification Program's Response Time Standard formula (T=0.65 + 1.7 D, where T= time and D = distance) for comparison. The ISO response travel time formula discounts speed for intersections, vehicle deceleration and acceleration, and does not include turnout time. Tables 7 and 8 present tabular results of the emergency response time analysis using the distance at speed formula and the ISO formula, respectively.

Table 7. City of Bradbury Emergency Response Analysis using Speed Limit Formula

LACoFD Station Nos.	Travel Distance to Furthest Point of the City[1]	Travel Time to Furthest Point of the City	Maximum Travel Distance[2]	Maximum Travel Time[2]	Total Response Time[3]
29	6.9 miles	11 minutes 48 seconds	7.4 miles	12 minutes 40 seconds	14 minutes 40 seconds
32	6.5 miles	11 minutes 10 seconds	7.0 miles	12 minutes	14 minutes
44	2.8 miles	4 minutes 47 seconds	3.3 miles	5 minutes 36 seconds	7 minutes 36 seconds
48	6.8 miles	11 minutes 36 seconds	7.3 miles	12 minutes 30 seconds	14 minutes 30 seconds
169	6.0 miles	10 minutes 16 seconds	6.6 miles	11 minutes 19 seconds	13 minutes 19 seconds

Notes:

1. Assumes travel distance and time to the furthest point of the City off Bliss Canyon Road from fire station, and application of the distance at speed limit formula (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH), a 35 mph travel speed, and does not include turnout time.
2. Assumes travel distance and time to the furthest point of the City from fire station, and application of the distance at speed limit formula (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH), a 35 mph travel speed, and does not include turnout time.
3. Emergency response time target thresholds include travel time to furthest point of the City from fire station, and application of the distance at speed limit formula (T=(D/S) * 60, where T=time, D=distance in miles, and S=speed in MPH) a 35 mph travel speed along with dispatch and turnout time, which can add an additional two minutes to travel time.

[12] Using the speed limit of 35 MPH.

Table 8. City of Bradbury Emergency Response Analysis using ISO Formula

LACoFD Station Nos.	Travel Distance to Furthest Point of the City[1]	Travel Time to Furthest Point of the City[1]	Maximum Travel Distance[2]	Maximum Travel Time[2]	Total Response Time[3]
29	6.9 miles	12 minutes 23 seconds	7.4 miles	13 minutes 15 seconds	15 minutes 15 seconds
32	6.5 miles	11 minutes 42 seconds	7.0 miles	12 minutes 31 seconds	14 minutes 31 seconds
44	2.8 miles	5 minutes 25 seconds	3.3 miles	6 minutes 15 seconds	8 minutes 15 seconds
48	6.8 miles	12 minutes 13 seconds	7.3 miles	13 minutes 02 seconds	15 minutes 02 seconds
169	6.0 miles	10 minutes 48 seconds	6.6 miles	11 minutes 48 seconds	13 minutes 48 seconds

Notes:

1. Assumes travel distance and time to the furthest point of the City off Bliss Canyon Road from fire station, and application of the ISO formula, T=0.65+1.7(Distance), a 35 mph travel speed, and does not include turnout time.
2. Assumes travel distance and time to the furthest point of the City from fire station, and application of the ISO formula, T=0.65+1.7(Distance), a 35 mph travel speed, and does not include turnout time.
3. Emergency response time target thresholds include travel time to furthest point of the City from fire station, and application of the ISO formula, T=0.65+1.7(Distance), a 35 mph travel speed along with dispatch and turnout time, which can add an additional two minutes to travel time.

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6.1.3 Fire Behavior Modeling

Modeling of potential fire behavior was also conducted to support development of this CWPP. Specifically, both the BehavePlus and FlamMap software packages were used to identify portions of the City that may be subject to extreme fire behavior, considering weather, fuels, and terrain variables.

6.1.3.1 BehavePlus Fire Behavior Analysis

Fire behavior modeling has been used by researchers for approximately 50+ years to predict how a fire will move through a given landscape (Linn 2003). The models have had varied complexities and applications throughout the years. One model has become the most widely used as the industry standard for predicting fire behavior on a given landscape. That model, known as "BEHAVE", was developed by the U. S. Government (USDA Forest Service, Rocky Mountain Research Station) and has been in use since 1984. Since that time, it has undergone continued research, improvements, and refinement. The current version, BehavePlus 6.0, includes the latest updates incorporating years of research and testing. Numerous studies have been completed testing the validity of the fire behavior models' ability to predict fire behavior given site specific inputs. One of the most successful ways the model has been improved has been through post-wildfire modeling (Brown 1972, Lawson 1972, Sneeuwjagt and Frandsen 1977, Andrews 1980, Brown 1982, Rothermel and Rinehart 1983, Bushey 1985, McAlpine and Xanthopoulos 1989, Grabner, et. al. 1994, Marsden-Smedley and Catchpole 1995, Grabner 1996, Alexander 1998, Grabner et al. 2001, Arca et al. 2005). In this type of study, BehavePlus is used to model fire behavior based on pre-fire conditions in an area that recently burned. Real-world fire behavior, documented during the wildfire, can then be compared to the prediction results of Behave and refinements to the fuel models incorporated, retested, and so on.

Fire behavior modeling conducted within the adjacent naturally vegetated hillsides of the San Gabriel Mountains includes a relatively high-level of detail and analysis which results in reasonably accurate representations of how wildfire may move through available fuels on and adjacent the property. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. To objectively predict flame lengths, spread rates, and Fireline intensities, this analysis incorporated predominant fuel characteristics, slope percentages, and representative fuel models observed adjacent to the City. The BehavePlus fire behavior modeling system was used to analyze anticipated fire behavior within and adjacent to key areas just outside of the City. Predicting wildland fire behavior is not an exact science. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather and the limits of weather forecasting. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire prevention planning information. To be used effectively, the basic assumptions and limitations of BehavePlus must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuels less than one-quarter inch in diameter. These are the fine fuels that carry fire. Fuels greater than one inch have little effect while fuels greater than three inches have no effect on fire behavior.
- Second, the model bases calculations and descriptions on a wildfire spreading through surface fuels that are within six feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.

- Third, the software assumes that weather and topography are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
- Fourth, the BehavePlus fire behavior computer modeling system was not intended for determining sufficient fuel modification zone/defensible space widths. However, it does provide the average length of the flames, which is a key element for determining "defensible space" distances for minimizing structure ignition.

Although BehavePlus has some limitations, it can still provide valuable fire behavior predictions which can be used as a tool in the decision-making process. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur throughout the San Gabriel Mountains. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven fuel characteristics help define the 13 standard fire behavior fuel models[13] and the five custom fuel models developed for Southern California[14]. According to the model classifications, fuel models used in BehavePlus have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface to volume ratio. Observation of the fuels in the field (on site) determines which fuel models should be applied in BehavePlus. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models and the custom Southern California fuel models:

- Grasses — Fuel Models 1 through 3
- Brush — Fuel Models 4 through 7, SCAL 14 through 18
- Timber — Fuel Models 8 through 10
- Logging Slash — Fuel Models 11 through 13

In addition, the aforementioned fuel characteristics were utilized in the recent development of 40 new fire behavior fuel models[15] developed for use in BehavePlus modeling efforts. These new models attempt to improve the accuracy of the standard 13 fuel models outside of severe fire season conditions, and to allow for the simulation of fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the new 40 fuel models:

13 Anderson, Hal E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. USDA Forest Service Gen. Tech. Report INT-122. Intermountain Forest and Range Experiment Station, Ogden, UT.

14 Weise, D.R. and J. Regelbrugge. 1997. Recent chaparral fuel modeling efforts. Prescribed Fire and Effects Research Unit, Riverside Fire Laboratory, Pacific Southwest Research Station. 5p.

15 Scott, Joe H. and Robert E. Burgan. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

- Non-Burnable Models NB1, NB2, NB3, NB8, NB9
- Grass Models GR1 through GR9
- Grass-shrub Models GS1 through GS4
- Shrub Models SH1 through SH9
- Timber-understory Models TU1 through TU5
- Timber litter Models TL1 through TL9
- Slash blowdown Models SB1 through SB4

BehavePlus software was used in the development of this CWPP in order to evaluate potential fire behavior for the City. Existing site conditions were evaluated, and local weather data was incorporated into the BehavePlus modeling runs. A detailed discussion of the BehavePlus modeling process conducted for this CWPP is presented in Appendix G and a map depicting the run locations for the fire behavior modeling effort is presented in Figure 8.

6.1.3.2 FlamMap Fire Behavior Analysis

In addition to the BehavePlus software package, FlamMap was used as well. FlamMap (version 5.0.3) is a GIS-driven computer program that incorporates fuels, weather, and topography data in generating static fire behavior outputs, including values associated with flame length and crown fire activity, among others (Finney et al. 2015). It is a flexible system that can be adapted to a variety of specific wildland fire planning and management needs. The calculations that come from FlamMap are based on the BehavePlus fire modeling system algorithms but result in geographically distinct datasets based on GIS inputs. FlamMap model outputs allow wildland resource managers to evaluate anticipated fire behavior, which provides important insight about the characteristics of wildfire spread within management areas. Each of the input variables used in FlamMap remain constant at each location, meaning that the input variables are applied consistently to each grid cell and the fire behavior at one grid cell does not impact that at a neighboring grid cell. Essentially, the model presents a “snapshot” in time and does not account for temporal changes in fire behavior or the movement of fire across the landscape. As such, the results of the models contained in this CWPP are best used as valuable information sources and tools to identify high hazard areas and prioritize fuel treatments based on potential risk rather than used as a forecast tool of an exact representation of how a fire would behave in the City.

The following are the basic assumptions and limitations of FlamMap:

- The model output files describe fire behavior only in the flaming front. The primary driving forces in the predictive calculations are the dead fuels less than 0.25 inches in diameter. These are the fine fuels that carry fire. Fuels greater than 1 inch in diameter have little effect in carrying fire, and fuels greater than 3 inches in diameter have no effect. While not contributing to the fire behavior calculation, larger fuels (1-inch and greater) are consumed by the fire and are components of the fuels being consumed. For example, the smaller portions (e.g., leaves, twigs, peeling bark) of a chaparral shrub will combust readily and affect fire behavior, while larger portions (e.g., trunk, main branches) do not affect fire behavior but are part of the overall fuel load and will combust after the flaming front has passed.

- The model bases calculations and descriptions on a wildfire spreading through surface fuels that are within 6 feet of the ground and contiguous to the ground. Surface fuels are classified as grass, brush, litter, or slash, which are general categories that are assigned to different vegetation types.
- The software assumes that fuel moisture conditions are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel must be carefully considered to obtain useful predictions.
- WindNinja software (version 2.1.0), which is incorporated into FlamMap, allows for the generation and incorporation of gridded wind data in the FlamMap simulation. This approach is preferable as it allows the model to account for the effect of terrain on wind speed and direction at different locations throughout the modeling area, rather than relying on one single input value applied to the entire modeling area (e.g., the entire City).

FlamMap was used to model flame length, crown fire activity, and spot fire potential for an area encompassing the entire City plus a buffer of approximately 5 miles. A detailed discussion of the FlamMap modeling process conducted for this CWPP is presented in Appendix G. A map depicting flame length outputs from the fire behavior modeling effort is presented in Figure 9.

The results presented in Figure 9 and discussed in Appendix H depict values based on inputs to the FlamMap software and are not intended to capture changing fire behavior as it moves across a landscape. For planning purposes, extreme fire behavior (e.g., that occurring during periods of low humidity and high, Santa Ana winds) is the most useful information for identifying high-hazard areas and prioritizing vegetation management activities. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

6.2 Hazard Assessment Results

The results presented in Table 9 depict values based on inputs to the BehavePlus software and are not intended to capture changing fire behavior as it moves across a landscape. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis. For planning purposes, the averaged worst-case fire behavior is the most useful information for conservative fuel modification design. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

Based on the BehavePlus analysis, worst-case fire behavior is expected in untreated, surface shrub and chaparral fuels northeast of the City under Peak weather conditions (represented by Fall Weather, Scenario 3). The fire is anticipated to be a wind-driven fire from the north/northeast during the fall. Under such conditions, expected surface flame lengths reach 42 feet with wind speeds of 50+ mph. Under this scenario, fireline intensities reach 18,499 BTU/feet/second with fast spread rates of 6.2 mph and could have a spotting distance up to 2.3 miles away.

Table 9: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions

Fire Scenario	Flame Length[1] (feet)	Spread Rate[1] (mph[5])	Fireline Intensity[1] (Btu/ft/s)	Spot Fire[1] (miles)	Surface Fire to Tree Crown Fire	Tree Crown Fire Rate of Spread (mph)	Crown Fire Flame Length (feet)
Scenario 1: 38% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub[2,3] (Sh4)	10.9'	0.9	1,013	0.5	Crowning[4]	0.8	110.8'
Sagebrush scrub (Sh5)	19.5'	1.5	3,599	0.7	No	N/A	N/A
Scenario 2: 43% slope; Fall Offshore, Extreme Winds (97th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	12.8' (23.5')[6]	1.1 (4.2)	1,453 (5,471)	0.5 (1.5)	Crowning	1.0 (4.1)	133.1'
Sagebrush scrub (Sh5)	25.0' (41.8')	2.1 (6.4)	6,184 (18,966)	0.8 (2.3)	No	N/A	N/A
Scenario 3: 20% slope; Fall, Offshore, Extreme Winds (97th percentile)							
Sagebrush scrub (Sh5)	24.0' (41.3')	1.9 (6.2)	5,697 (18,499)	0.8 (2.3)	No	N/A	N/A
Scenario 4: 18% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	10.5'	0.8	933	0.4	Crowning	0.8	110.8'
Sagebrush scrub (Sh5)	18.8'	1.4	3,328	0.6	No	N/A	N/A

Note:

1. Wind-driven surface fire.
2. Riparian overstory torching increases fire intensity. Modeling included canopy fuel over Sh4, which represents surface fuels beneath the tree canopies.
3. A surface fire in the mixed sycamore riparian forest would transition into the tree canopies generating flame lengths higher than the average tree height (25 feet). Viable airborne embers could be carried downwind for approximately 1.0 mile and ignite receptive fuels.
4. Crowning= fire is spreading through the overstory crowns.
5. MPH=miles per hour.
6. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph.

The following describes the fire behavior variables (Heisch and Andrews 2010) as presented in Table 9:

Surface Fire:

- Flame Length (feet): The flame length 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.
- Fireline Intensity (Btu/ft/s): Fireline intensity is the heat energy release per unit time from a one-foot-wide section of the fuel bed extending from the front to the rear of the flaming zone. Fireline intensity is a function of rate of spread and heat per unit area and is directly related to flame length. Fireline intensity and the flame length are related to the heat felt by a person standing next to the flames.

- Surface Rate of Spread (mph): Surface rate of spread is the "speed" the fire travels through the surface fuels. Surface fuels include the litter, grass, brush and other dead and live vegetation within about 6 feet of the ground.

Crown Fire:

- Transition to Crown Fire: Indicates whether conditions for transition from surface to crown fire are likely. Calculation depends on the transition ratio. If the transition ratio is greater than or equal to 1, then transition to crown fire is Yes. If the transition ratio is less than 1, then transition to crown fire is No.
- Crown Fire Rate of Spread (mph): The forward spread rate of a crown fire. It is the overall spread for a sustained run over several hours. The spread rate includes the effects of spotting. It is calculated from 20-ft wind speed and surface fuel moisture values. It does not consider a description of the overstory.
- Fire Type: Fire type is one of the following four types: surface (understory fire), torching (passive crown fire; surface fire with occasional torching trees), conditional crown (active crown fire possible if the fire transitions to the overstory), and crowning (active crown fire; fire spreading through the overstory crowns). Dependent on the variables: transition to crown fire and active crown fire.

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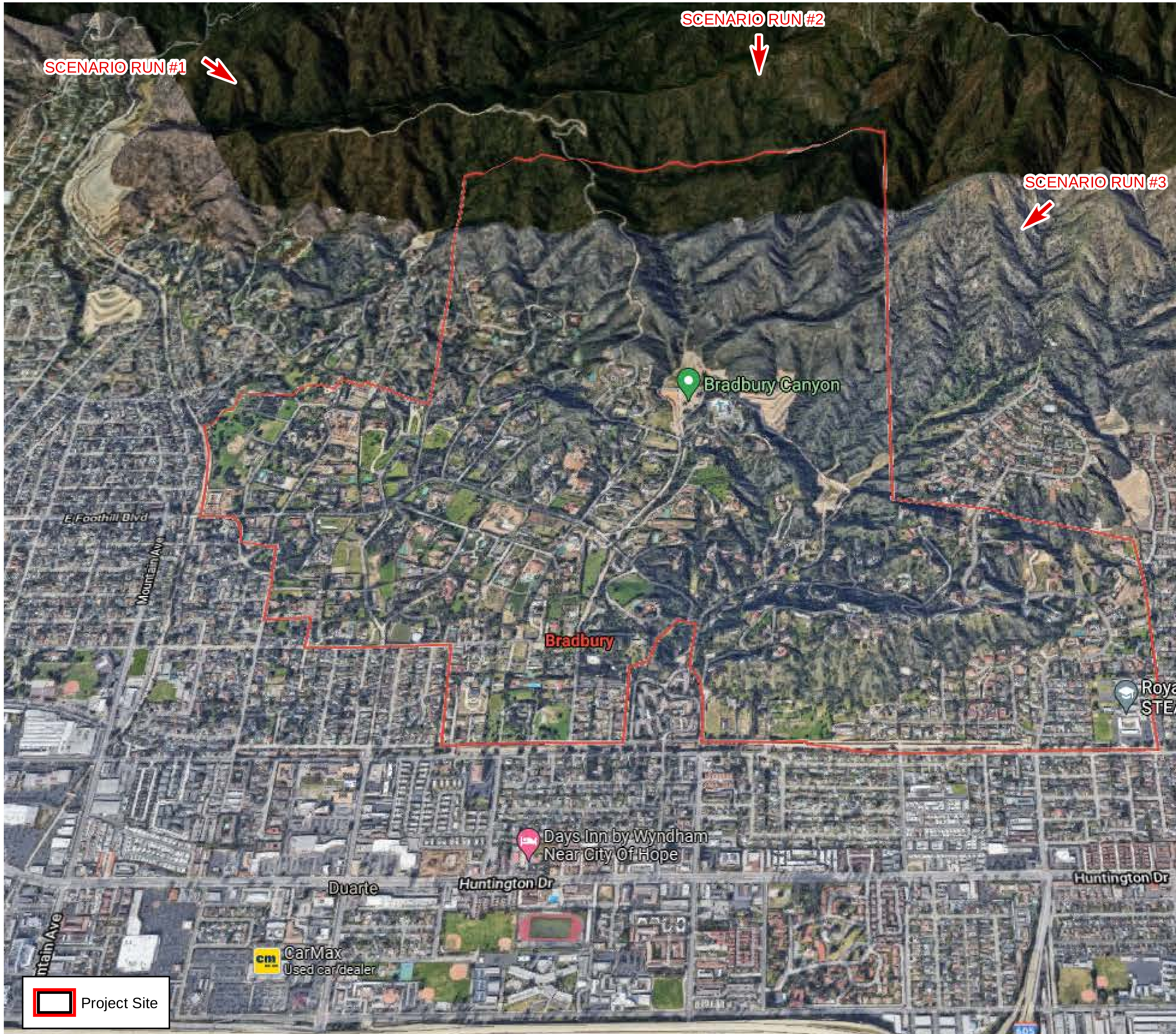

Table G-1: Existing Fuel Model Characteristics

Fuel Model	Description	Location	Fuel Bed Depth (Feet)
Sh4	Riparian Habitat (Timber Shrub)	Riverbed that runs near the base of the San Gabriel Mountains, north of the City of Bradbury	>8.0 ft.
Sh5	High Load, Dry Climate Shrub	Scrub and chaparral naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury.	>4.0 ft.
Gs2	Moderate load, Dry Climate Grass-Shrub	Scrub and grasses naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury.	<3.0 ft.
FM4	Chaparral	Chaparral fuel model naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury	>6.0 ft.

Table G-2: Variables Used for Fire Behavior Modeling

Model Variable	Summer Weather (50th Percentile)	Peak Weather (97th Percentile)
Fuel Models	FM4, Gs2, Sh4 and Sh5	FM4, Gs2, Sh4, and Sh5
1 h fuel moisture	5%	2%
10 h fuel moisture	6%	3%
100 h fuel moisture	9%	5%
Live herbaceous moisture	39%	30%
Live woody moisture	78%	60%
20 ft. wind speed	19 mph (sustained winds)	18 mph (sustained winds); wind gusts of 50 mph
Wind Directions from north (degrees)	200 and 290	0 and 80
Wind adjustment factor	0.4	0.4
Slope (uphill)	18 to 38%	20 to 45%

Table G-3: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions

Fire Scenario	Flame Length[1] (feet)	Spread Rate[1] (mph[5])	Fireline Intensity[1] (Btu/ft/s)	Spot Fire[1] (miles)	Surface Fire to Tree Crown Fire	Tree Crown Fire Rate of Spread (mph)	Crown Fire Flame Length (feet)
Scenario 1: 38% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub[2,3] (Sh4)	10.9'	0.9	1,013	0.5	Crowning [4]	0.8	110.8'
Sagebrush scrub (Sh5)	19.5'	1.5	3,599	0.7	Crowning [4]	0.8	116.3
Moderate load grass-shrub (Gs2)	7.8'	2.3	9,509	0.4	Crowning [4]	0.8	109.0
Chaparral (FM 4)	30.4'	0.7	500	1.0	Crowning [4]	0.8	123.2
Scenario 2: 43% slope; Fall Offshore, Extreme Winds (97th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	12.8' (23.5')[6]	1.1 (4.2)	1,453 (5,471)	0.5 (1.5)	Crowning [4]	1.0 (4.1)	133.1'
Sagebrush scrub (Sh5)	25.0' (41.8')	2.1 (6.4)	6,184 (18,966)	0.8 (2.3)	Crowning [4]	1.0 (4.1)	141.6'
Moderate load grass-shrub (Gs2)	10.1' (19.1')	1.0 (3.9)	870 (3,450)	0.4 (1.4)	Crowning [4]	1.0 (4.1)	131.0'
Chaparral (FM 4)	38.1' (70.4')	3.1 (11.9)	15,517 (58,853)	1.1 (3.3)	Crowning [4]	1.0 (4.1)	151.3'
Scenario 3: 20% slope; Fall, Offshore, Extreme Winds (97th percentile)							
Sagebrush scrub (Sh5)	24.0' (41.3')	1.9 (6.2)	5,697 (18,499)	0.8 (2.3)	No	N/A	N/A
Moderate load grass-shrub (Gs2)	9.7' (18.9')	0.9 (3.8)	797 (3,380)	0.4 (1.3)	No	N/A	N/A
Chaparral (FM 4)	36.5' (69.6')	2.9 (11.6)	14,172 (57,575)	1.1 (3.3)	No	N/A	N/A

Note:

1. Wind-driven surface fire.
2. Riparian overstory torching increases fire intensity. Modeling included canopy fuel over Sh4, which represents surface fuels beneath the tree canopies.
3. A surface fire in the mixed sycamore riparian forest would transition into the tree canopies generating flame lengths higher than the average tree height (25 feet). Viable airborne embers could be carried downwind for approximately 1.0 mile and ignite receptive fuels.
4. Crowning= fire is spreading through the overstory crowns.
5. MPH=miles per hour
6. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph

SOURCE: AERIAL-BING MAPPING SERVICE 2019

DUDEK 0 500 1000 2000 Feet

FIGURE 8
BehavePlus Analysis Map
City of Bradbury Community Wildfire Protection Plan

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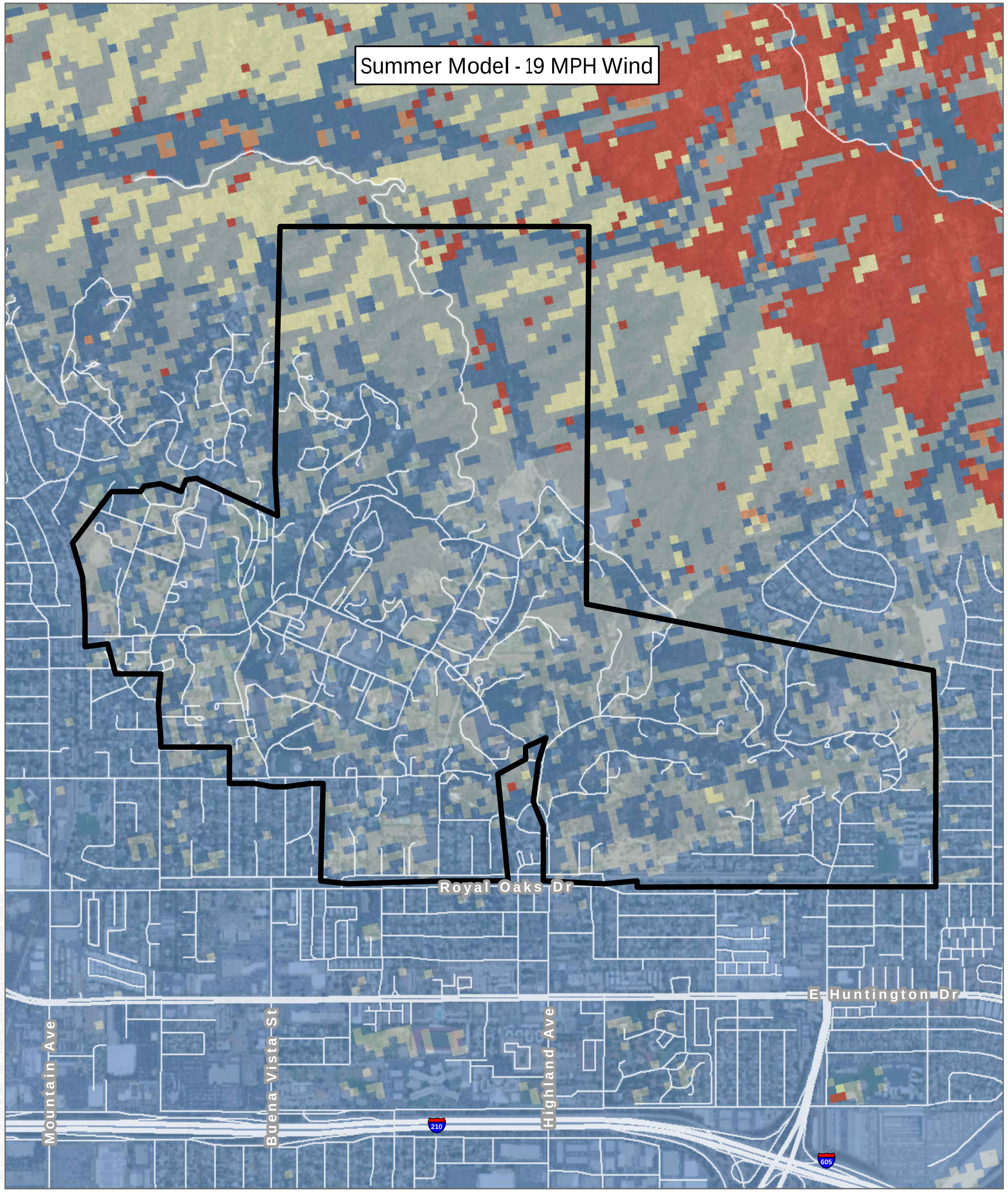

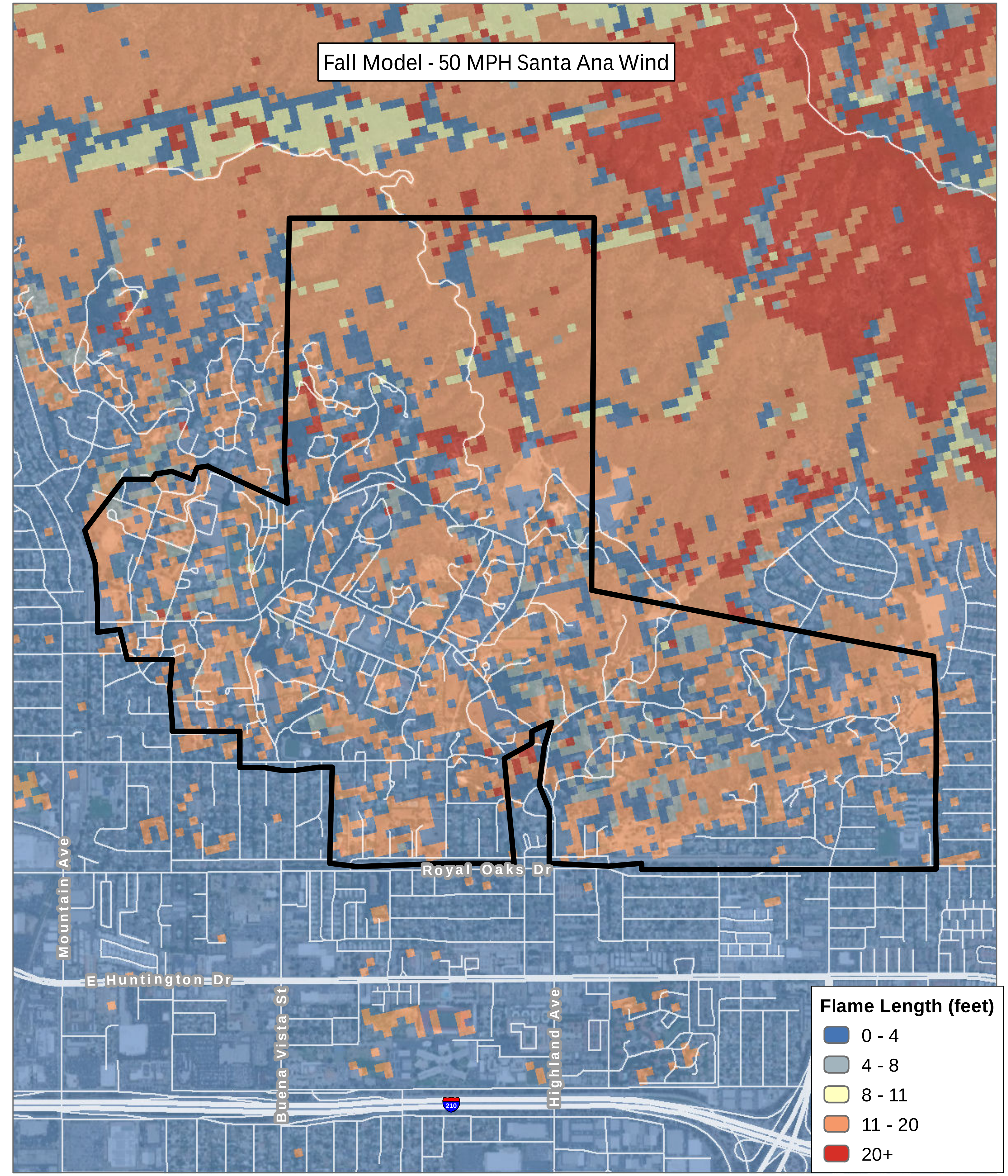

SOURCE: BASE-BING MAPPING SERVICE

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Figure 9

City of Bradbury FlamMap Exhibit

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7 Values at Risk

7.1 At-Risk Community

The Healthy Forest Restoration Act of 2003 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 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 communities. These high-risk communities identified within the WUI were published in the Federal Register in 2001 and include those communities neighboring federal lands. The City of Bradbury is identified as a Community at Risk in the Federal Register.

7.2 Values at Risk

Values threatened by wildfire include life, property, and natural and economic resources. The LACoFD's mission statement is (Los Angeles County Fire Department 2020):

> "The mission of the Los Angeles County Fire Department is to protect lives, the environment, and property by providing prompt, skillful and cost-effective fire protection, and life safety services."

The lives and property threatened by wildfire are of paramount importance. However, natural resource and economic values threatened by wildfire are also significant. A major wildfire affecting the City would potentially result in the loss of biological, cultural, and visual resources. In addition, the potential economic loss from the drop in tourism and damage to homes, businesses, and City infrastructure could substantially impact the local economy.

Wildland fire has always been a part of the City's environment and is a natural process. What has changed is the potential for the loss of life, property and reduction in natural habitat from wildfires as development pushes into WUI areas. Additionally, as described in Section 2.3.1, climate change is anticipated to exacerbate wildfire hazard in the City. As development continues in these areas, the importance of programs and projects for structural protection, public and firefighter safety, and natural resources protection are critical.

7.2.1 Life Safety

The potential for loss of life threatened by wildfire is difficult to calculate. Locally, as represented in Table 4, the 2009 Station Fire resulted in two fatalities; the 1980 stable Fire resulted in one fatality; the 1968 Canyon (Canyon Inn) Fire resulted in eight firefighter fatalities; and the 2016 San Gabriel Complex Fire resulted in three fatalities. Furthermore, the potential for greater loss of life is possible during extreme wildfire events, as is evident in other wildfires throughout California, including in the 1991 Oakland Hills Fire, where 25 people, both emergency responders and residents, perished while trying to evacuate from the fire. 22 people perished in the 2017 Tubbs Fire and 85 in the 2018 Camp Fire as a result of these extreme wildfire events. Without a comprehensive approach to the problems that exist in the VHFHSZ Areas, the conditions that exist in these areas have the potential for greater loss of life, particularly as population increases.

Further, as seen after the devastating 2017 Thomas Fire, which burned approximately 281,893 acres, there is potential for loss of life as a result of heavy rains that occurred after the fire. Without vegetation and trees to stabilize hillsides, heavy rains that follow a fire event can result in mudslides and debris flows. The fire, which burned into the eastern part of the City of Santa Barbara, was followed by the catastrophic debris flow on January 9, 2018, which affected Montecito and the Coast Village Road area of the City of Santa Barbara, causing millions of dollars in damage and taking 23 lives.

7.2.2 Homes, Structures, and Neighborhoods

Home values in the City of Bradbury are some of the highest in the nation. The median listing price of a home within the City of Bradbury is presently $2,324,000 (RocketHomes, 2021). Based on the median home price within the City of Bradbury of $2,324,000 and the approximate number of 400 structures, the potential cost of property loss within the City would total over $929,000,000. The quantity of structures presented includes all single-family residential structure types in the VHFHSZ. For perspective, the 1980 Stable Fire destroyed 49 Bradbury homes and approximately $15 million in damage incurred. A fire that size destroying 49 homes would have an estimated property loss of nearly $114 million.

7.2.2.1 Structural Hardening

As discussed, the topography, vegetation, climatic, and geological conditions in the foothills adjacent to the City of Bradbury 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 refer 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)
- Low-cost-Retrofit-List-Update-5-14-21.pdf (readyforwildfire.org)
- https://ucanr.edu/sites/fire/Prepare/Building/

7.2.2.2 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. The Bradbury Municipal Code, Sections 9.85.020 and 9.85.050 provide definitions of an ADU and the development standards/requirements of an ADU.

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 City has concerns regarding the impact of California's ADU Law that can affect fire safety. Specifically, the City has concerns related to setbacks and prohibition on fire sprinklers. Separate from the wildfire issues, State law continues to prohibit the City from requiring automatic fire sprinklers in ADU's when the main residence was not required to have fire sprinklers. Bradbury's concern over portions of State law's preemption of local requirements that can affect fire safety stems from Bradbury's location and fire history. As noted above, most of Bradbury is located within a VHFHSZ, a wildland urban interface area, an ember intrusion zone, and is officially recognized by the federal government as a community at high risk from wildfire.

7.2.3 Ready! Set! Go!

The City of Bradbury has adopted the LACoFD "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 copy of the LACoFD "Ready! Set! Go!" Action Plan can be found on the LACoFD website: Ready-set-go_04292021-High-Quality-B.pdf (lacounty.gov) and is included as Appendix I of this CWPP.

7.2.4 Critical Infrastructure

Critical infrastructure encompasses physical assets that are vital to maintaining essential services, such as water services, roads, and fire and police services. Damage to critical infrastructure during a wildland fire often results in the temporary delay or loss of critical services to some or all residents within the City.

7.2.4.1 Evacuation Blocks and Routes

As presented in Section 2.9, the City has established evacuation blocks and wildland evacuation routes, which are presented in Figure 4. These evacuation blocks and routes, while not physical infrastructure, are critical components to mitigating wildfire hazard.

7.2.4.2 Water Supply

As described in Section 2.10, water supplies are essential for firefighting efforts and structure protection.

7.2.5 Natural Resources

Natural resources include biological resources, cultural and historic resources, visual resources, streams and water resources, slopes and soil stability, and air quality. The following sections address these City assets in more detail.

7.2.5.1 Biological Resources

Biotic Communities

The City's vegetation (biotic) communities provide important biological habitats for plant and animal species. The vegetation that exists in these communities also becomes fuel available to burn during a wildland fire. The impact of a wildfire in many of these communities can be devastating, especially under extreme wind and weather conditions.

The City's General Plan Environmental Resources Element, General Plan Environmental Impact Report, and LCP identify sensitive biotic communities, which are defined as communities which cannot adapt to new environmental stresses. The Coastal Land Use Plan identifies "Environmentally Sensitive Habitat Area," which is any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem, and which could be easily disturbed or degraded by human activities and developments. The following sensitive biotic communities are present in the City and may be adversely affected by wildfire:

- California Annual Grassland
- Coastal Sage Scrub
- Mixed Chaparral
- Monarch Butterfly Autumnal and Winter Roost Sites
- Perennial Grasslands (Coastal Prairie)
- Hardwood Tree Species
- Conifer Tree Species
- Southern Oak Woodland
- Riparian Woodland/Creeks
- Freshwater Marsh
- Saltwater Marsh

Rare, Endangered, or Threatened Plants and Wildlife

Because of the diversity of biotic communities in the San Gabriel Mountains within the ANF, many different rare, endangered, and threatened animal species exist nearby the City. The protection of these plants and animals is required by law and is essential to biological diversity. Like biotic communities, these plants and animals are threatened by wildfire. The following rare, endangered, or threatened wildlife species may be present near the City in the San Gabriel Mountains within the Angeles National Forest and may be adversely affected by wildfire[16]:

[16] San Gabriel Watershed and Mountains – Special Resources Study and Environmental Assessment. September 2011. Draft_SANG_report_book.indb (npshistory.com)

- Braunton's Milk vetch (*Astragalus brauntonii)*
- Nevin's barberry (endemic) (*Berberis nevinii*)
- Thread-leaved brodiaea (endemic) (*Brodiaea filifolia*)
- Slender-horned spineflower (endemic) (*Dodecahema leptoceras*)
- California Orcutt grass (*Orcuttia californica*)
- Santa Ana sucker (*Catostomus santaanae*)
- Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni)*
- Southern steelhead trout (*Oncorhynchus mykiss*)
- Arroyo toad (*Ananysrus californicus*)
- California red-legged frog (*Rana draytonii*)
- Mountain yellow-legged frog (*Rana muscosa*)
- Desert tortoise (*Gopherus agassizii*)
- Swainson's hawk (*Buteo swainsoni*)
- Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)
- Southwestern willow flycatcher (*Empidonax traillii extimus*)
- California condor (*Gymnogyps californianus*)
- Bald eagle (*Haliaeetus leucocphalus*)
- Coastal California gnatcatcher (*Polioptila californica californica*)
- Least Bell's vireo (*Vireo bellii pusillus*)

The following rare and endangered plant species are present near the City in the San Gabriel Mountains within the Angeles National Forest and may be adversely affected by wildfire[17]:

- California muhly (endemic) (*Muhlenbergia californica*)
- Southern California black walnut (*Juglans californicavar. Californica*)
- Coulter's goldfields (*Lasthenia glabrata ssp. coulteri*)
- Crested milk-vetch (endemic) (*Astralgus bicristatus*)
- Davidson's bush mallow (endemic) (*Malacothamnus davidsonii*)
- Duran's rush (endemic) (*Juncus duranii*)
- Purple needlegrass (*Nasella pulchra*)
- Engelmann oak (*Quercus englemannii*)
- Coast Live Oak (*Quercus agrifolia)*
- fragrant pitcher sage (endemic) (*Lepechinia fragrans*)
- Johnston's bedstraw (endemic) (*Galium johnstonii*)
- lemon lily (*Lilium parryi*)
- Mojave phacelia (endemic) (*Phacelia mohavensis*)
- San Gabriel Mountains dudleya (endemic) (*Dudleya densiflora*)
- San Gabriel Mountains sunflower (endemic) (*Hulsea vestita ssp. gabrielensis*)
- Tehachapi ragwort (*Packera ionophylla*)

[17] San Gabriel Watershed and Mountains – Special Resources Study and Environmental Assessment. September 2011. Draft_SANG_report_book.indb (npshistory.com)

7.2.5.2 Cultural and Historic Resources

The City is committed to the conservation of its cultural and historic resources. The impact of a wildfire poses a threat to these resources through direct flame contact, radiant heat damage, fire byproducts such as smoke and ash, damage caused by fire suppression and rehabilitation activities, and post-fire erosion, debris flows, and flooding. The effects of wildland fire on cultural resources can be considered direct or indirect. Direct effects are those caused by fire and its byproducts (e.g., smoke and ash) and result from the physical state of the fire environment (fuels, weather, terrain) and the ignition pattern. Indirect effects are the biophysical processes acting on the fire-altered environment and human responses. Indirect effects occur when wildland fire or associated fire management actions change the context in which a cultural resource is found, leaving it vulnerable to impacts (e.g., post-fire erosion) (Ryan et al. 2012).

7.2.5.3 Visual Resources

The aesthetic qualities of the City vary as widely as the nature of the topography and land uses. The scenic foothills and ridgelines of the San Gabriel Mountains that provide the backdrop for the City are also the natural features that contribute to wildfire hazard (weather, topography, and fuel). Management of vegetation for fire hazard reduction purposes may impact public scenic views of the mountains above the City. However, large wildfire burn scars would also impact public scenic views until the vegetation recovers. The preservation and enhancement of scenic resources provides important social, recreational, and economic benefits for both residents and visitors. Vegetation management conducted throughout the City under the LACoFD's and Angeles National Forest's guidance, and as proposed in this CWPP, involves thinning and understory ladder fuel treatment, which retains tree canopies and leaves thinned shrublands in a mosaic pattern where 50% to 70% of existing plant material remains. This approach differs from fire break construction, which removes all vegetation down to bare soil, a practice that would have a significantly greater impact on public scenic views.

7.2.5.4 Streams and Water Resources

Vegetation in local watersheds and along streams and water courses provides many important functions in protecting water resources, water quality, and habitat in the watershed. Vegetated riparian corridors may provide water quality buffering benefits to the adjacent streams. Vegetation removal or treatment in riparian corridor areas must be conducted in careful consideration of potential effects on water quality and ecological function. Riparian vegetation provides habitat for terrestrial and aquatic wildlife species, provides streambank stability, reduces erosion, shades the water surface thereby affecting water temperature (which affects aquatic habitat), and is a source for large woody debris, which falls into streams and watercourses providing habitat and affecting flow patterns and pool development (Kocher and Harris 2007). However, when a watershed is catastrophically burned in an expansive wildfire, many of these functions and roles are lost or severely reduced until the vegetation recovers. Following a catastrophic watershed-wide fire, hillslope erosion and sediment yields through watershed tributary channels typically increase by an order of magnitude (or greater) over non-fire average conditions (Neary et al. 2008).

Therefore, sound vegetation management that reduces the extent and frequency of watershed-wide extreme fires also helps avoid and minimize potential sediment and water quality impacts in the watershed. Vegetation management activities seek to maintain the water resource and water quality benefits of watershed vegetation while reducing the hazard and fire risk.

Historic large fires within the Los Angeles area have been wind driven fires. Because of the east/west alignment of the San Gabriel mountain range, winds are funneled down through major drainages. Some creek areas have heavy concentrations of flammable vegetation. A wildfire burning through these areas has the potential for significant loss of riparian habitat and water quality. In addition, erosion occurring on steeper slopes above drainages where soil conditions are susceptible to erosion or are accelerated from a wildfire will end up being deposited in creek areas where flow velocities are sufficiently reduced.

7.2.5.5 Slopes and Soil Stability

Watersheds severely burned by wildfire are vulnerable to accelerated rates of soil erosion and can experience large amounts of post-fire sediment deposits. Increases in post-fire suspended sediments in streams can result from erosion and overland flow, channel scouring, and creep accumulations in stream channels after an event (USDA 2005). While less is known regarding the effect of fire on turbidity, it has been observed that post-fire turbidity levels in stream water are affected by the steepness of the burned watershed (USDA 2005). The little data available regarding post-fire turbidity levels has indicated that U.S. Environmental Protection Agency water quality standard for turbidity can be exceeded after a fire event (USDA 2005). In some cases, during severe, slow-moving fires, the combustion of vegetation during wildfires creates a gas that can penetrate the soil. As the soil cools, this gas condenses and forms a waxy coating that causes the soil to repel water. This phenomenon, called hydrophobicity, increases the rate of surface water runoff as water percolation into the soil is reduced (Moench and Fusaro 2012). This accelerated slope runoff can move dry soil material that has accumulated at the base of slopes, creating flooding and debris flows.

Vegetation helps stabilize slopes and minimize soil erosion by providing root strength and by absorbing soil moisture. Plant roots can anchor into bedrock or more stable soils and can bind weaker soils through fibrous root development. Excessive, haphazard, or indiscriminate vegetation removal can result in the loss of root strength in the soil, and their decay can increase soil moisture levels, increasing the potential for erosion and slope failure (Ziemer 1981). Vegetation also reduces stormwater runoff by capturing and storing rainfall in the canopy and releasing it through evapotranspiration. Vegetation also promotes infiltration of rainfall into the soil (Center for Watershed Protection and USFS 2008).

7.2.5.6 Air Quality

The California Air Resources Board (CARB) regulates the air quality within California. The South Coast Air Quality Management District (SCAQMD) is the air pollution control agency for all of Orange County and the urban portions of Los Angeles County and is mandated to develop plans to meet federal and state air quality standards, monitor air quality, and regulate activities that may result in air pollution within Los Angeles County.

Wildland fire affects air quality by producing smoke emissions that may exceed CARB's standards for carbon monoxide, carbon dioxide, methane and non-methane hydrocarbons, and particulate matter less than 10 and 2.5 microns in diameter (PM_{10} and $PM_{2.5}$). The amount of chemicals and particulate matter produced in a wildland fire is directly related to the amount of fuel consumed.

Carbon dioxide, water vapor, carbon monoxide, particulate matter, hydrocarbons, and other constituent materials are all present in wildfire smoke. The specific composition of smoke depends largely on the fuel type (vegetation types contain different amounts of cellulose, oils, waxes, and starches, which when ignited produce different compounds). In addition, hazardous air pollutants and toxic air contaminants, such as benzene and formaldehyde, are also present in smoke. However, the principal pollutant of concern from wildfire smoke is particulate matter. In general, particulate matter from smoke is very small in size and can be inhaled into the deepest recesses of the lungs, presenting a serious health concern (Lipsett 2008).

Factors including weather, stage of fire, and terrain can all dictate fire behavior and the impact of wildfire smoke. Wind, for instance, generally results in lower smoke concentrations because wind causes smoke to mix with a larger volume of air. Large quantities of pollutants can also be released by wildland fires over a relatively short period of time. Air quality during large fires can become severely hazardous and can remain impaired for several days after the fire is ignited (Lipsett 2008). During the most recent 2020 Bobcat Fire, for example, Los Angeles County and the communities above the foothills of the San Gabriel Mountains experienced weeks of unhealthy or hazardous air quality (County of Los Angeles Public Health, 2020).

Wildland fire mitigation involves many fuels management practices such as prescribed burning, cutting, chipping, and mechanical methods. Prescribed burning, like wildfire, produces chemical and particulate matter that has the potential to exceed CARB standards. But unlike wildfire, prescribed burning can be mitigated through smoke management practices outlined by CARB and the SCAQMD to avoid exceeding air quality standards. Other fuel management practices where vegetation is not burned, but cut, chipped, or mechanically removed, do not exceed air quality standards and are considered a nonsignificant, short-term activity.

7.2.6 Economics

The potential impact of wildfire on structure loss is significant. The 1980 Stable Fire destroyed 49 Bradbury homes and approximately $15 million in damage incurred. With the buildup of fuels and the potential for new homes built in the VHFHSZ areas of Bradbury, a wildfire of that proportion would have similar results and a much greater dollar loss. Additionally, repair and rebuilding of infrastructure following a wildfire can be a significantly costly effort for municipalities and utilities.

The local Bradbury and Los Angeles County economy is heavily dependent on the beauty of its natural and cultural resources, with a significant amount of revenue generated by the tourism industry. There is a high potential for a wildland conflagration to temporarily disrupt both the quality of life and economic stability of the City. The potential for economic losses due to litigation resulting from wildfire damage is also a reality. Damage claims against the property owners where the fire originated and/or spread from or through their property, due to untreated wildland areas, represents potential economic loss to both the City and private property owners. Utility companies have also been found responsible for wildfire ignitions and resulting damages, with significant settlements being paid to fire victims and local municipalities. For example, Pacific Gas & Electric (PG&E) settled with Sonoma County and the City of Santa Rosa for over $300 million (combined)—their share of the $1 billion deal the utility made with local governments to settle claims for damages caused by wildfires in 2017 and 2018 (Press Democrat 2020). Other potential economic impacts associated with wildfires includes increased insurance costs for property owners, the potential for dropped policies, and public safety power shutoffs implemented by utility companies to reduce ignition potential. A side effect of public safety power shutoffs is the loss of business revenue due to business closures and the direct loss of business materials or assets that require energy to produce, store, or maintain.

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8 Action Plan

This section identifies the goals of the CWPP and identifies recommended action items to be implemented by the City that serve to minimize wildfire impacts to the community. The recommendations and proposed Action Plans within this CWPP are currently being collaborated with the City of Bradbury. Many of the recommendations and proposed Action Plans are to be determined by the City, in collaboration with the cooperators/stakeholders, including the LACoFD and USFS. Future project and actions identified in this section would need to be funded and approved by the City prior to implementation. Implementation shall be determined by available budgets, Grants, and/or available resources.

8.1 Goals

The goal of this CWPP is to identify action items that can be implemented by the City that serve to protect lives, property, and natural resources threatened by wildland fire. The City, along with the LACoFD and USFS – Angeles National Forest, 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.

8.2 Action Items

The policies and actions outlined in this section are proposed for implementation under this CWPP. Recommendations for each action are provided.

8.2.1 Codes and Standards

Table 10 outlines policies and actions to reduce wildfire hazards that are related to codes and standards.

Table 10. Policies and Actions Related to Codes and Standards

Action Number	Description	Responsible Party
Policy 1. Increase the survivability of homes in the City's Very High Fire Hazard Severity Zone Areas through the adoption of fire safe building codes.		
1.1	Monitor changes in Fire, Building, and Residential codes. Modify and adopt codes as needed.	Joint responsibility between the City of Bradbury and LACoFD
1.2	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)	Joint responsibility between the City of Bradbury and LACoFD
Policy 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.		
2.1	Require additions or remodels 50% or greater than the existing residential structure's square footage in the VHFHSZ Areas to comply with the Fire Department Fuel Modification Zone and Defensible requirements and Fire Hazard Reduction Programs.	Joint responsibility between the City of Bradbury and LACoFD
2.2	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.	LACoFD
Policy 3. Create a defensible community by increasing the number of homes that comply with the LACoFD's Defensible Space Requirements.		
3.1	Complete a survey of all homes in the City's VHFHSZ Areas to determine the percentage of homes that comply with the LACoFD Defensible Space and Fuel Modification Requirements.	LACoFD

Table 10. Policies and Actions Related to Codes and Standards

Action Number	Description	Responsible Party
3.2	Pursuant to the California Fire Code, Bradbury Municipal Code Title IV, Chapter 3, Section 4.03.010, and Title 32 of the Los Angeles County Code of Ordinances, examine current LACoFD enforcement capability and recommend policy, procedures, and funding sources to enhance the ability of the department to conduct initial inspections, follow-up enforcement of defensible space violations, and address issues where defensible space requirements span multiple parcels.	LACoFD
3.3	Continue vacant lot brush management and defensible enforcement on undeveloped and developed properties within the VHFHSZ Areas.	Los Angeles County Agriculture Weights and Measures (ACWM) Weed Abatement Division
3.4	Evaluate ways to allow the Fire Department to work with insurance companies and private property owners in reducing fire hazard on individual properties and within neighborhoods.	Joint responsibility between the City of Bradbury and LACoFD

8.2.2 Funding

Table 11 outlines policies and actions to reduce wildfire hazards that are related to funding.

Table 11. Policies and Actions Related to Funding

Action Number	Description	Responsible Party
Policy 4. Develop funding sources and incentive programs for residents of the Very High Fire Hazard Severity Zone Areas to encourage reduction of wildfire hazards and risks.		
4.1	Research grant funding opportunities for wildland fire projects and apply for appropriate grants or cost-share programs. Wildland fire projects may include those associated with vegetation management or treatment, structural retrofits (structural hardening), planning, and community education or engagement.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
4.2	Research grant funding to plan and develop a City Hazard Mitigation Plan to incorporate into the City's General Plan.	City of Bradbury

Table 11. Policies and Actions Related to Funding

Action Number	Description	Responsible Party
4.3	Develop additional funding sources to implement vegetation and fire management projects within the City. Funding sources could include private property owner funding, City general fund, cooperative funds, etc.	City of Bradbury and LACoFD
4.4	Secure grant funding to support the City of Bradbury residents and emergency responders (firefighter, first responders, law enforcement) to ensure the community is prepared to protect against, respond to, and recover from wildfire disasters and emergencies. This includes City radios, emergency supplies, wildfire cameras, a fuel cell for the City's generator, and other emergency related items that will benefit the City in the event of a wildfire.	City of Bradbury
4.5	Continue to develop and evaluate the permit fee schedule for misc. building and zoning report inspections, plan review, Pre-application Review Team, and Forestry Fuel Modification Plan Check submittals reviewed for VHFHSZ Area requirements (evaluated every three years).	LACoFD
4.6	As appropriate, evaluate the opportunity to incorporate projects and actions identified in this CWPP into the City's General Plan update.	City of Bradbury

8.2.3 Fire Rehabilitation

Table 12 outlines policies and actions to reduce wildfire hazards that are related to fire rehabilitation.

Table 12. Policies and Actions Related to Fire Rehabilitation

Action Number	Description	Responsible Party
Policy 5. Post-fire rehabilitation guidelines should be established for the City.		
5.1	Develop appropriate post-fire rehabilitation guidelines for property owners that address post-fire effects of flooding and soil erosion.	Joint responsibility between the City of Bradbury and LACoFD
5.2	Develop a public education pamphlet on post-fire rehabilitation guidelines.	Joint responsibility between the City of Bradbury and LACoFD

Table 12. Policies and Actions Related to Fire Rehabilitation

Action Number	Description	Responsible Party
5.3	Ensure that post-fire rehabilitation guidelines are developed in cooperation with appropriate federal, state, and local agencies including Incident Command, if applicable, and Los Angeles County Flood Control.	Joint responsibility between the City of Bradbury and LACoFD

8.2.4 Evacuation

Table 13 outlines policies and actions to reduce wildfire hazards that are related to evacuation.

Table 13. Policies and Actions Related to Evacuation

Action Number	Description	Responsible Party
Policy 6. Increase evacuation safety for residents and the general public in the Very High Fire Hazard Severity Areas.		
6.1	Continue educational campaign to make residents, businesses, schools, and the public aware of evacuation planning and hazards.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
6.2	Promote an educational campaign with property owners' associations and neighborhoods on the creation of a Red Flag Warning Plan.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
6.3	Continue to ensure that vegetation road clearance is implemented along primary response routes in the VHFHSZ Areas.	LACoFD
6.4	Investigate methods for publicly identifying evacuation routes in the VHFHSZ area roadways.	Joint responsibility between the City of Bradbury and LACoFD
6.5	Develop training bulletins for LACoSD employees identifying recommended evacuation routes and proposed traffic control points. LACoSD staff in cooperation with LACoFD staff would accomplish this action.	Joint responsibility between the City of Bradbury, LACoFD, and LACoSD
6.6	Develop a simple, straightforward directive for the use of LACoSD Watch Commanders and Field Supervisors identifying the duties and responsibilities of officers in the event of a major fire. This would be accomplished by LACoSD staff in cooperation with LACoFD staff.	Joint responsibility between the City of Bradbury, LACoFD, and LACoSD

Table 13. Policies and Actions Related to Evacuation

Action Number	Description	Responsible Party
6.7	Identify specific roads that do not meet LACoFD 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.	LACoFD
6.8	Conduct a detailed evacuation study for the City's VHFHSZ Areas. The study should address the impact of increased residential density on roadway capacities and evacuation capabilities.	Joint responsibility between the City of Bradbury and LACoFD
6.9	Routinely update the LACoFD's "Ready! Set! Go!" brochure to reflect changing conditions, policies, and best practices.	LACoFD

8.2.5 Fire Protection

Table 14 outlines policies and actions to reduce wildfire hazards that are related to fire protection.

Table 14. Policies and Actions Related to Fire Protection

Action Number	Description	Responsible Party
Policy 7. Reduce fire engine response times in all Very High Fire Hazard Severity Zone Areas to 8 minutes or Less.		
7.1	Evaluate LACoFD response times for the VHFHSZ Areas.	LACoFD
7.2	Develop appropriate actions (development standards, vegetation management, signing, etc.) from evaluation of LACoFD response times.	LACoFD
Policy 8. Provide the highest level of fire protection services to the firefighters and residents within the Very High Fire Hazard Severity Zone Areas.		
8.1	Conduct department training classes focused on Wildland-Urban Interface (WUI) Operations for all operations staff levels.	LACoFD

Table 14. Policies and Actions Related to Fire Protection

Action Number	Description	Responsible Party
8.2	Continue to implement the LACoFD annual defensible space inspections within the VHFHSZ to ensure annual "Fuel Modification and VHFHSZ Defensible Space Requirements" are met to satisfy the California Fire Code, Chapter 49, to slow the spread of approaching wildfire and increase firefighter safety (where feasible along the foothills).	LACoFD
8.3	Increase the amount of interagency wildland fire training to gain expertise in wildland firefighting strategies, tactics, communications, and equipment.	Joint responsibility between the LACoFD, USFS, and other agencies
8.4	Train firefighters to properly turn off water to compromised structures that have free-flowing water in order to maintain water system supply and pressure (for future proposed project related infrastructure).	Joint responsibility between the City of Bradbury, LACoFD, and Water Resources
8.5	Maintain and regularly update the existing wildland fire pre-attack, firefighting safety zones, and escape routes mapping and preplan VHFHSZ Areas using Geographic Information Systems (GIS).	LACoFD
8.6	Purchase a Remote Automatic Weather Station (RAWS) to monitor fire weather and get more accurate fire weather forecasts for the community. The closest RAWS is approximately 2.5 miles south of Bradbury, where terrain is different. The City may purchase a new RAWS and pay for annual maintenance to supplement the Fire Department's RAWS program.	City of Bradbury
8.7	Work with neighboring jurisdictions on wildland fire mitigation projects and operational concerns.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
8.8	Develop appropriate improvements needed to make identified safety zones useable for fire suppression operations.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
8.9	Improve LACoFD's radio communications via infrastructure upgrades or completing projects that enhance coverage throughout the City (as needed).	Joint responsibility between the City of Bradbury and LACoFD
8.10	Create, fund, and implement a communications system equipment replacement plan (as needed).	LACoFD
8.11	Research available funding and grants to underground the existing utility poles throughout the City and/or encase utility wires, as a way to mitigate wildfire.	City of Bradbury

8.2.6 Vegetation/Fuels Management

Table 15 outlines policies and actions to reduce wildfire hazards that are related to vegetation/fuels management.

Table 15. Policies and Actions Related to Vegetation/Fuels Management

Action Number	Description	Responsible Party
Policy 9. Support collaborative fuels management projects between the City and residents of the Very High Fire Hazard Severity Zone Areas to encourage fire hazard reduction and protection of natural resources. This includes compliance with LACoFD Defensible Space and Fuel Modification Requirements, as well as additional vegetation management projects requested by property owners.		
9.1	Develop affordable incentive programs to allow property owners to maintain defensible space around homes.	City of Bradbury
9.2	Work with neighboring jurisdictions on wildfire mitigation projects such as defensible space chipping, vegetation road clearance, and fuels management projects.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
9.3	Continue to develop and implement the LACoFD's Fuel Modification and Defensible Space Requirements through the Fire Code (State and County). This will ensure that fuels management projects on private lands decrease fire hazard and balance natural resource values.	Joint responsibility between the LACoFD and the State of California

8.2.7 Public Education

Table 16 outlines policies and actions to reduce wildfire hazards that are related to public education.

Table 16. Policies and Actions Related to Public Education

Action Number	Description	Responsible Party
Policy 10. Increase the community's knowledge and awareness of wildland fire and develop training and education programs to prepare, motivate, and educate the community.		
10.1	Continue to work with the City Staff, council members, Public Safety Committee, and community members living in the VHFHSZ Areas to develop evacuation preplans and preparedness for wildfire.	Joint responsibility between the City of Bradbury and LACoFD
10.2	Develop a City of Bradbury Fire Safe Council to update the community on public education projects to increase wildland fire public awareness and preparedness.	Joint responsibility between the City of Bradbury and LACoFD
10.3	Work with communities, neighborhoods, and individuals to get the message across that reducing the wildland fire threat requires them to take personal responsibility for preparedness, evacuation, defensible space, driveways, and roadways, and community cooperation.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
10.4	To reduce impacts to water availability and pressure during wildfire events, work with property owners to educate them not to use sprinkler systems to water down roofs during wildfires.	Joint responsibility between the City of Bradbury and LACoFD
10.5	Regularly update the County's Plant Selection Guidelines by Zone and Fire-Safe Landscaping brochures to educate the public on fire safe landscaping, power line hazards, and wildland fire safety. The brochure should include fire safe landscaping, native landscaping, water conservation, soil stabilization, and non-invasive plant species concerns.	LACoFD
10.6	Develop a bilingual public information strategy to educate Bradbury residents on wildland fire that is also culturally relevant. Topics to include defensible space, fire landscaping, road access, Red Flag Warning, wildfire ignition risks, resource concerns, and evacuation. Incorporate video and other visual engagement strategies where feasible.	Joint responsibility between the City of Bradbury and LACoFD

Table 16. Policies and Actions Related to Public Education

Action Number	Description	Responsible Party
10.7	Encourage residents to sign up and create a City of Bradbury Community Emergency Response Team (CERT) program through the LACoFD, so residents can learn about hazards that may impact their area. Once a CERT Program is created, work on the development of a wildfire module for the CERT Program that is focused on wildland fire.[18]	Joint responsibility between the City of Bradbury and LACoFD
10.8	Develop educational material for the public to eradicate and reduce the potential for the expansion of invasive species that has the potential to occur from defensible space projects.	Joint responsibility between the City of Bradbury and LACoFD
10.9	Routinely update the County's "Ready! Set! Go!" Brochure to reflect changing conditions, policies, and best practices and make available in both English and Spanish.	LACoFD
10.10	Conduct outreach with the real estate community to work though upcoming Assembly Bill 38 requirements associated with wildfire-related real estate disclosures and to coordinate delivery of the Defensible Space Requirements documents to home buyers in the VHFHSZ Areas.	Joint responsibility between the City of Bradbury and LACoFD
10.11	Coordinate with the South Coast Air Quality Management District (SCAQMD) to disseminate information related to air quality and wildfire smoke impacts.	Joint responsibility between the City of Bradbury, LACoFD, and SCAQMD
10.12	Continue to work with other agencies through the Connect-CTY platform on the City of Bradbury's webpage to disseminate pertinent information regarding wildfire emergencies.[19]	City of Bradbury
Policy 11. Work with all City departments and staff to increase their knowledge, awareness, prevention, and preparedness for wildland fire.		
11.1	Develop a communication system between the City of Bradbury Staff and the Public Safety Committee; this would include coordinating a training course on the use of HAM radios (or other communication devises used in an emergency event) with the Los Angeles County Office of Emergency Preparedness. This will allow for the City Staff and the Public Safety Committee to effectively communicate with one another and develop a strategic communication action plan for the City.	City of Bradbury
11.2	Continue to work with the Planning Commission to ensure a clear understanding of landscape design, defensible space requirements, and vegetation management issues related to visual impacts.	City of Bradbury

[18] https://fire.lacounty.gov/community-emergency-response-team/
[19] https://www.cityofbradbury.org/alert_detail.php

Table 16. Policies and Actions Related to Public Education

Action Number	Description	Responsible Party
11.2	Develop annual City staff training on wildland fire safety to train City staff working in the VHFHSZ Areas. Training should include the development of a Red Flag Warning program, process for fire complaints, fire reporting procedures, fire prevention, and defensible space requirements.	Joint responsibility between the City of Bradbury and LACoFD
11.3	Coordinate with City Departments during planning, vegetation management, and other CWPP implementation tasks to streamline efforts and maximize the use of available City resources.	City of Bradbury
Policy 12. Work cooperatively with federal, state, and local jurisdictions to provide the highest level of fire protection, prevention, and mitigation projects and programs in the City's Wildland-Urban Interface area.		
12.1	Establish communication with the Los Angeles County Office of Emergency Preparedness – Area D, to establish a mutual aid agreement to augment City Staff with nearby City's and/or municipalities during a wildfire emergency or another disaster, to assist City of Bradbury Staff with daily disaster activities.	City of Bradbury
12.2	Continue to work with cooperating agencies on suppression, training, prevention, evacuation, and public education in the VHFHSZ Areas that benefit the entire community.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
12.3	Support collaborative vegetation management projects between the City and surrounding jurisdictions that reduce fire hazard and protect natural resources.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
12.4	Ensure that the City and surrounding jurisdictions and agencies work cooperatively to address fire hazard and environmental impacts.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
12.5	Coordinate vegetation management actions where needed with Los Angeles County Flood Control.	Joint responsibility between the City of Bradbury, LACoFD, and USFS
12.6	Coordinate with stakeholders (Los Angeles County Fire Department, Monrovia Fire Department, Arcadia Fire Department, U.S. Forest Service, Southern California Edison, CAL FIRE, Area D, and others) to facilitate information and data sharing, resource sharing, coordination of management activities, facilitating property access, grant funding, and cost-sharing opportunities.	Joint responsibility between the City of Bradbury, LACoFD, and USFS

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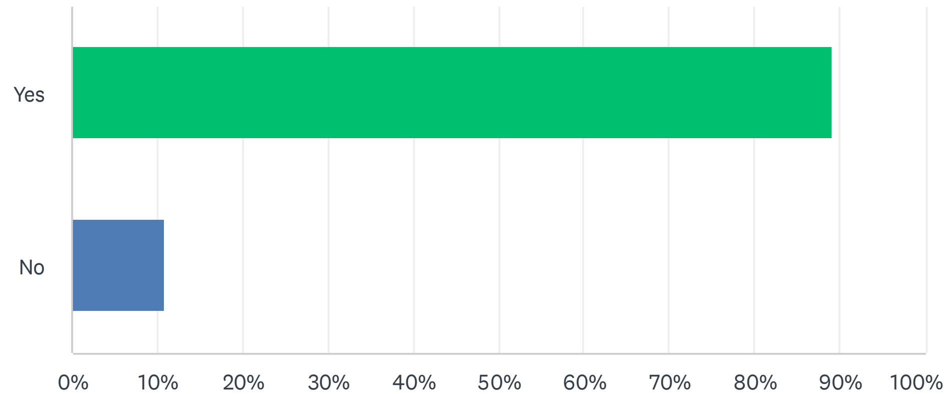
Appendix A

City of Bradbury Survey Questionnaire and Results

Q1 Are you aware that a City of Bradbury Community Wildfire Protection Plan (CWPP) is being created?

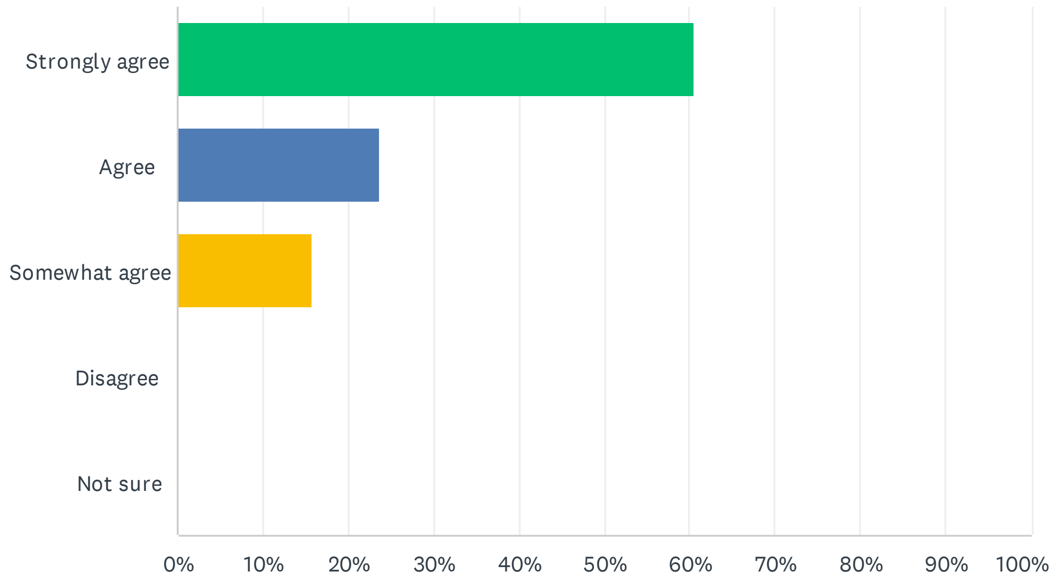
Answered: 37 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	89.19%	33
No	10.81%	4
TOTAL		37

Q2 Rate your reaction to the following statement: There is a wildfire threat to the City of Bradbury?

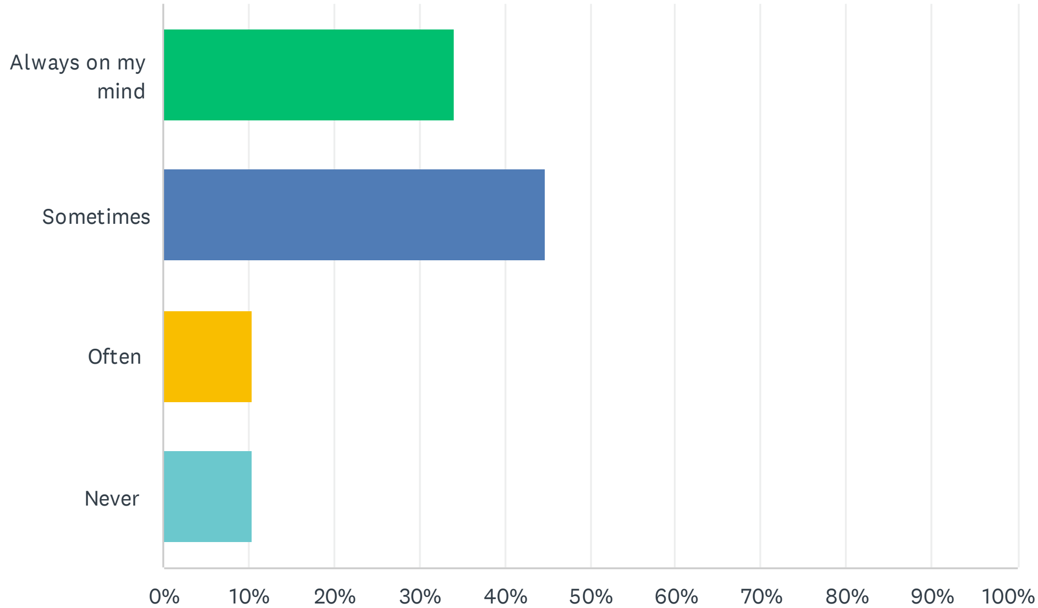
Answered: 38 Skipped: 0



ANSWER CHOICES	RESPONSES	
Strongly agree	60.53%	23
Agree	23.68%	9
Somewhat agree	15.79%	6
Disagree	0.00%	0
Not sure	0.00%	0
TOTAL		38

Q3 Rate your reaction to the following statement: I worry about wildfire:

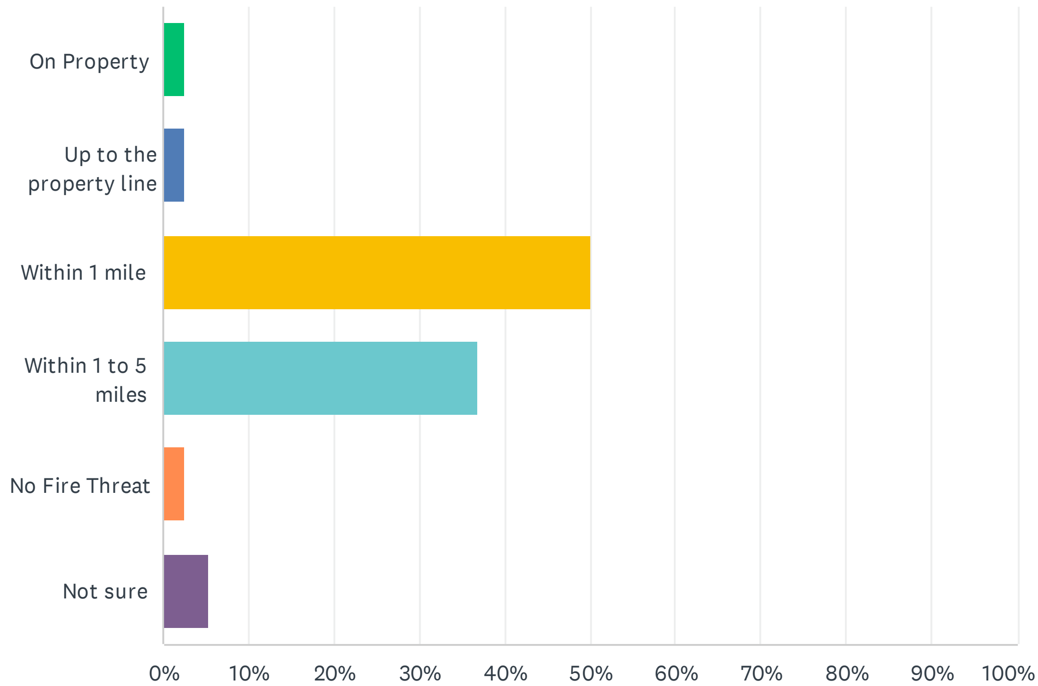
Answered: 38 Skipped: 0



ANSWER CHOICES	RESPONSES	
Always on my mind	34.21%	13
Sometimes	44.74%	17
Often	10.53%	4
Never	10.53%	4
TOTAL		38

Q4 How close has wildfire has come to your residence during the time you've lived in your current location?

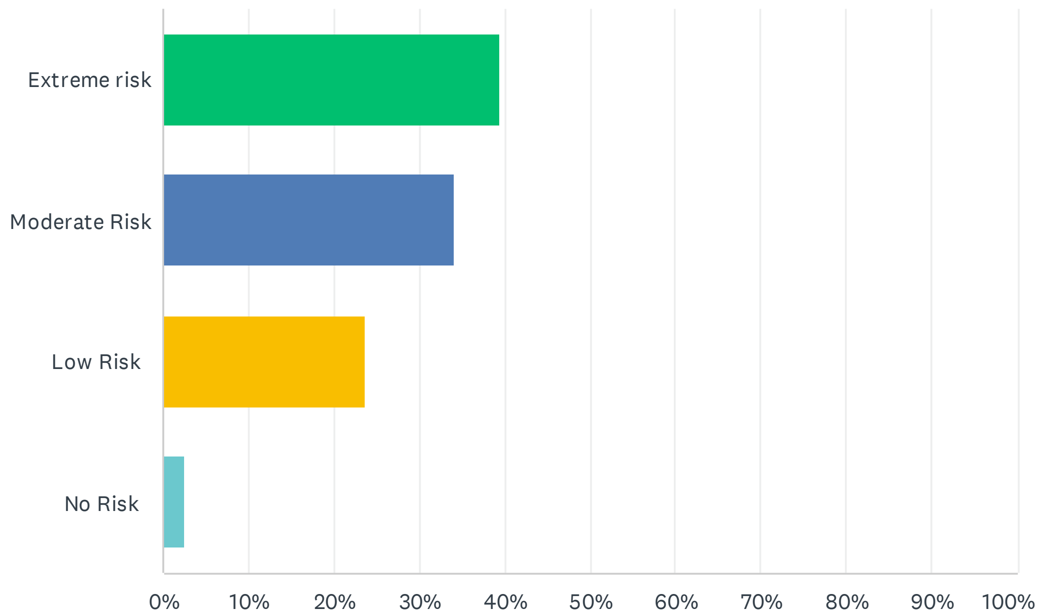
Answered: 38 Skipped: 0



ANSWER CHOICES	RESPONSES	
On Property	2.63%	1
Up to the property line	2.63%	1
Within 1 mile	50.00%	19
Within 1 to 5 miles	36.84%	14
No Fire Threat	2.63%	1
Not sure	5.26%	2
TOTAL		38

Q5 What level of risk do you believe wildfires pose to your property?

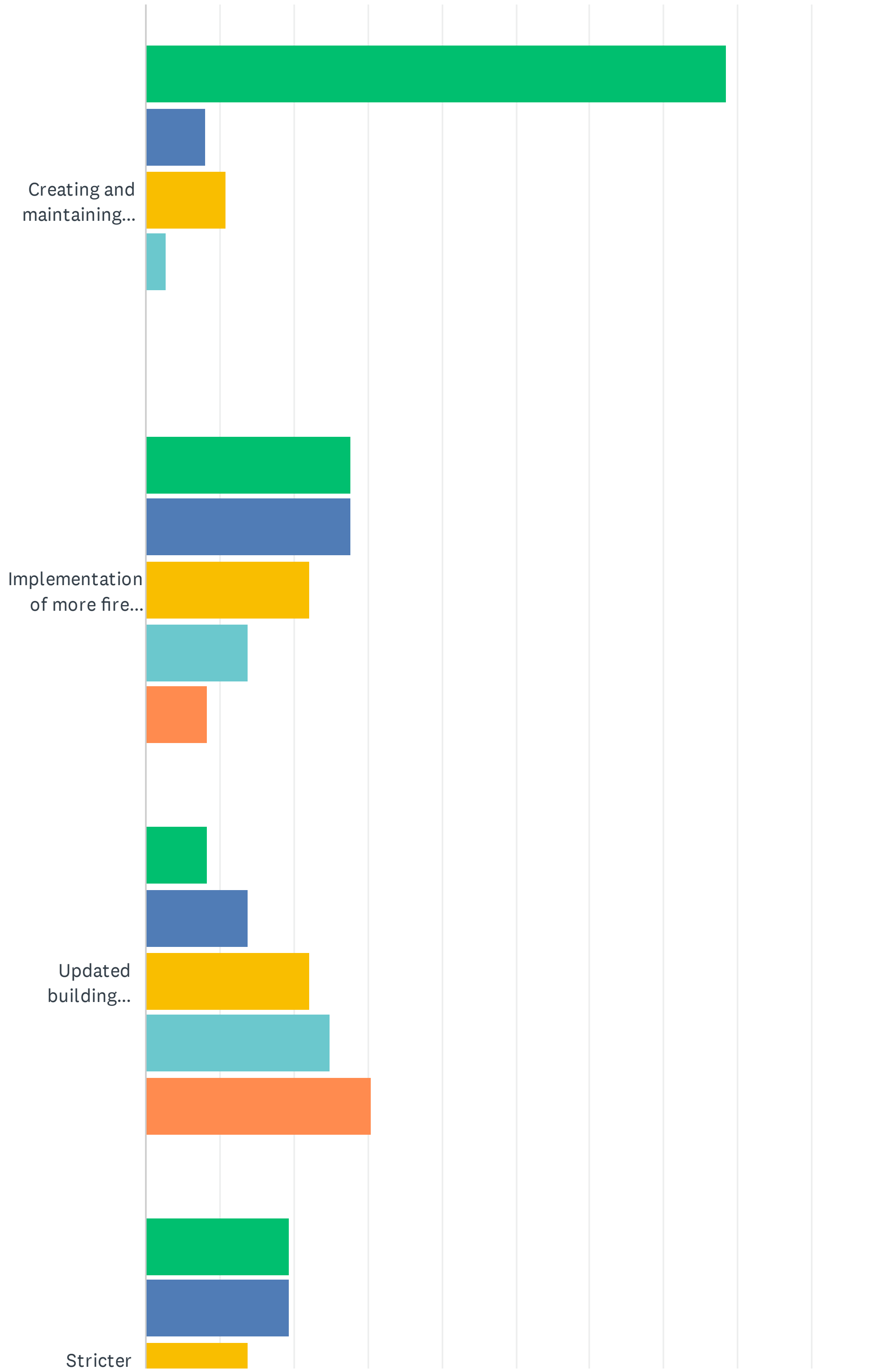
Answered: 38 Skipped: 0

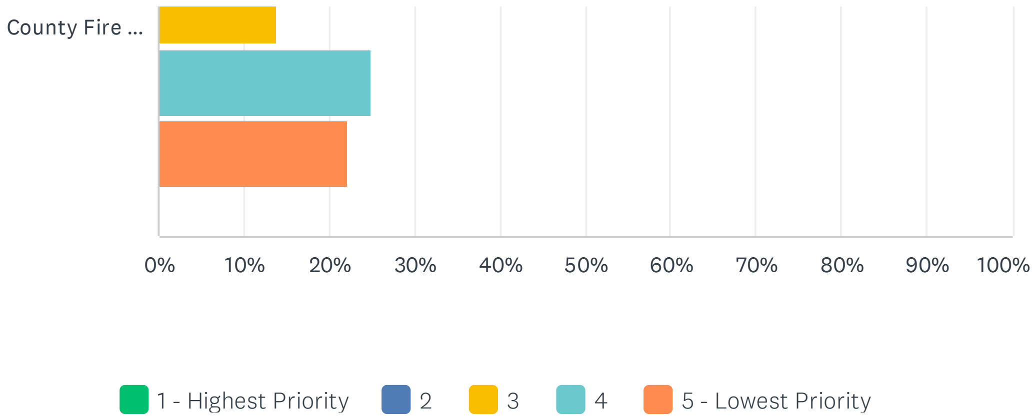


ANSWER CHOICES	RESPONSES	
Extreme risk	39.47%	15
Moderate Risk	34.21%	13
Low Risk	23.68%	9
No Risk	2.63%	1
TOTAL		38

Q6 What do you think would be the best way to decrease wildfire hazards on your property (Rank answers with 1 for the highest priority and 5 for lowest priority)?

Answered: 38 Skipped: 0

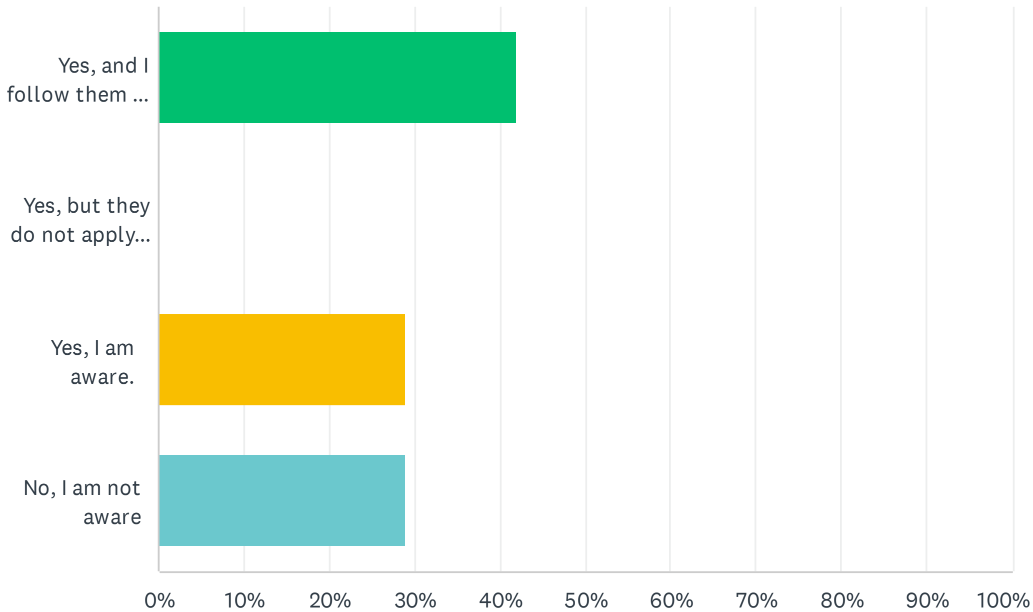




	1 - HIGHEST PRIORITY	2	3	4	5 - LOWEST PRIORITY	TOTAL	WEIGHTED AVERAGE
Creating and maintaining fuel modification zones by managing vegetation and fuels (including grasses, shrubs, chaparral, trees, etc.)	78.38% 29	8.11% 3	10.81% 4	2.70% 1	0.00% 0	37	1.38
Implementation of more fire resistive landscape	27.78% 10	27.78% 10	22.22% 8	13.89% 5	8.33% 3	36	2.47
Updated building construction of older homes	8.33% 3	13.89% 5	22.22% 8	25.00% 9	30.56% 11	36	3.56
Stricter County Fire and City rules and regulations	19.44% 7	19.44% 7	13.89% 5	25.00% 9	22.22% 8	36	3.11

Q7 Are you aware that there are City guidelines available for landscaping to reduce wildfire risk?

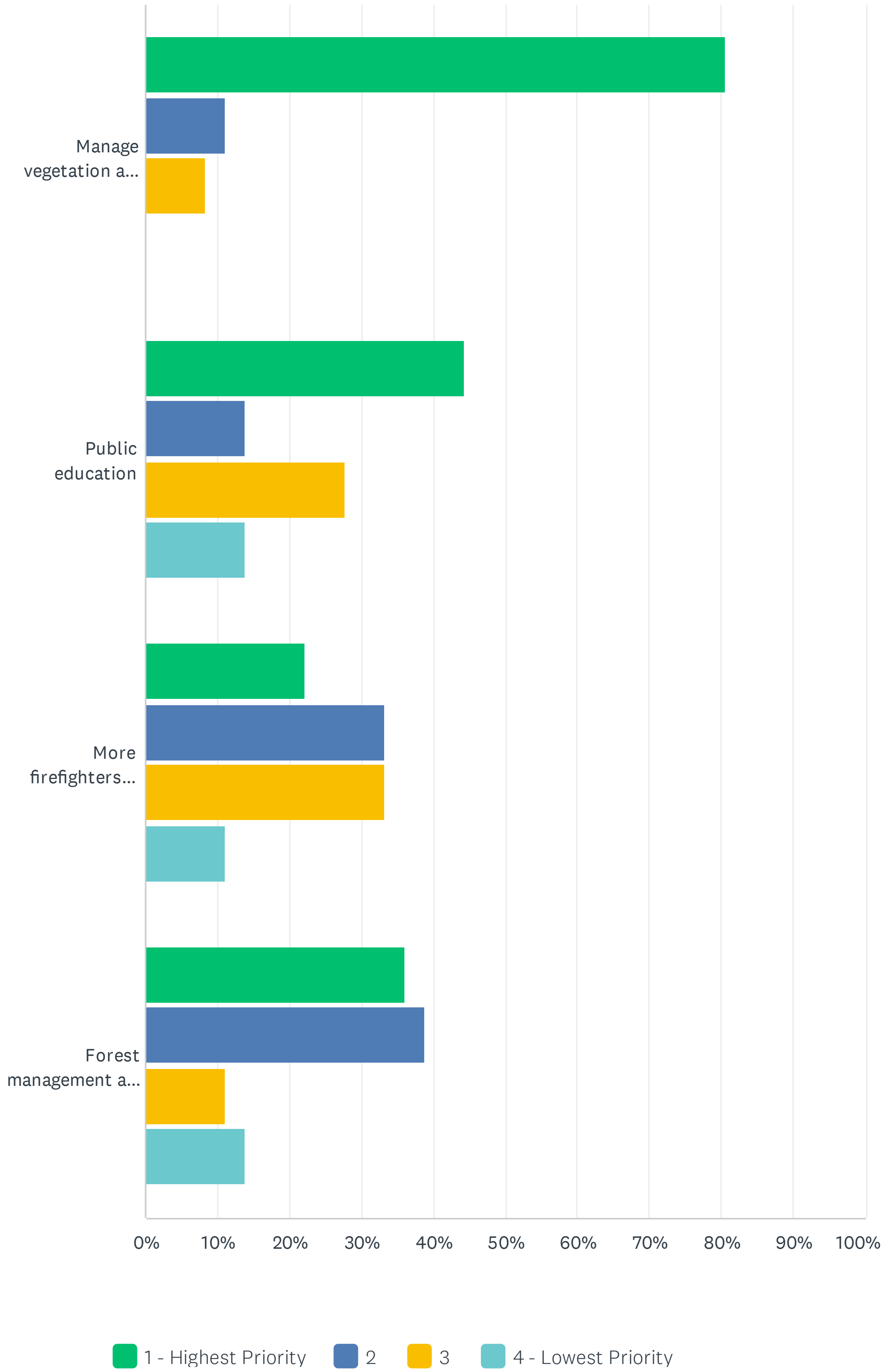
Answered: 38 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes, and I follow them on my property.	42.11%	16
Yes, but they do not apply to where I live.	0.00%	0
Yes, I am aware.	28.95%	11
No, I am not aware	28.95%	11
TOTAL		38

Q8 What do you believe would be the best way to decrease wildfire hazards within the Bradbury community? (Rank answers with 1 for the highest priority and 4 for lowest priority)

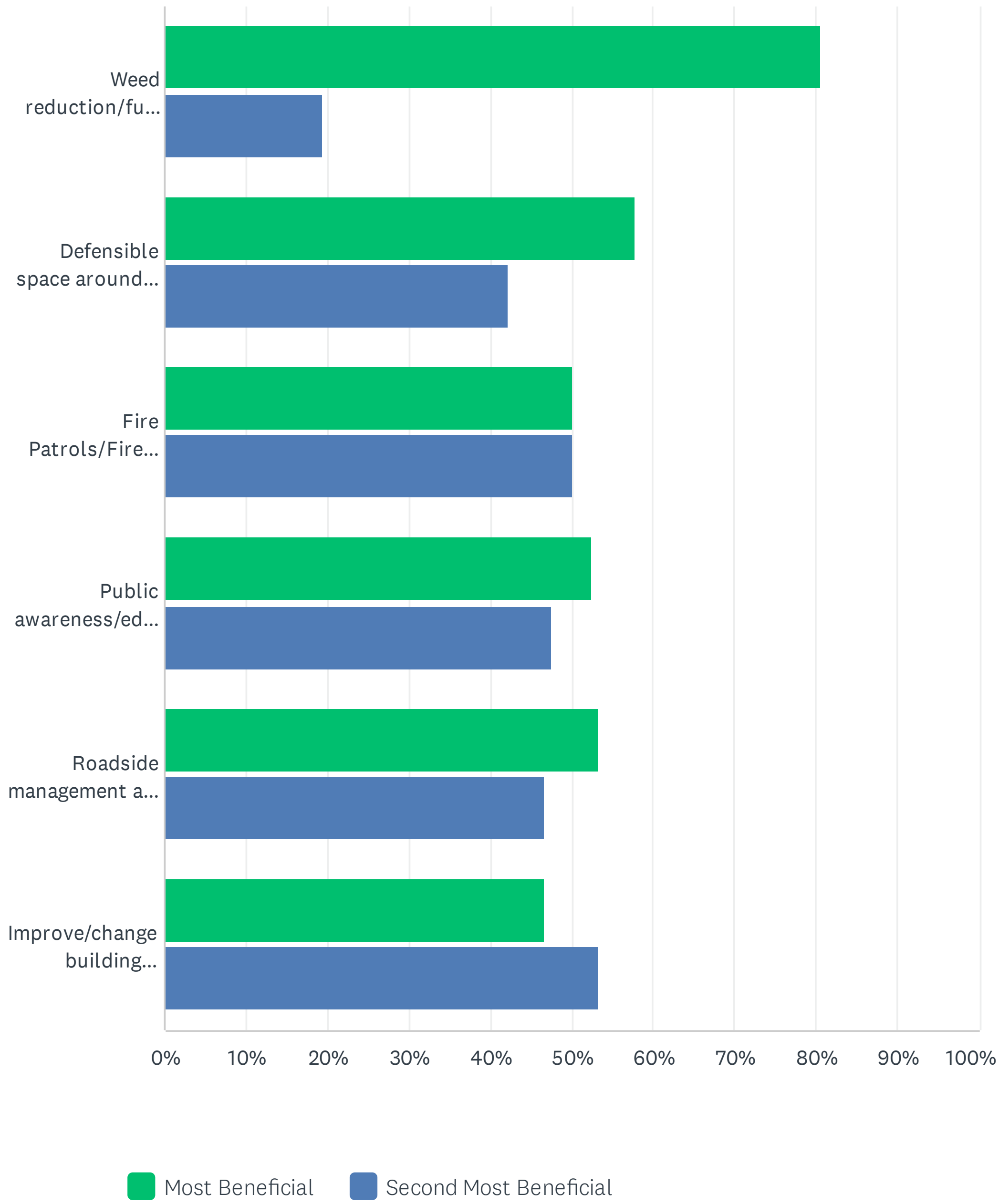
Answered: 37 Skipped: 1


Manage vegetation a...
Public education
More firefighters...
Forest management a...
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
1 - Highest Priority
2
3
4 - Lowest Priority

	1 - HIGHEST PRIORITY	2	3	4 - LOWEST PRIORITY	TOTAL	WEIGHTED AVERAGE
Manage vegetation and fuels (i.e. grasses, shrubs, chaparral, trees, etc.) by mowing or thinning or controlled burning	80.56% 29	11.11% 4	8.33% 3	0.00% 0	36	1.28
Public education	44.44% 16	13.89% 5	27.78% 10	13.89% 5	36	2.11
More firefighters/fire fighter equipment and supplies	22.22% 8	33.33% 12	33.33% 12	11.11% 4	36	2.33
Forest management and increase in governmental funding	36.11% 13	38.89% 14	11.11% 4	13.89% 5	36	2.03

Q9 What do you feel are the top 2 most beneficial methods to reducing wildfire risk in your community?

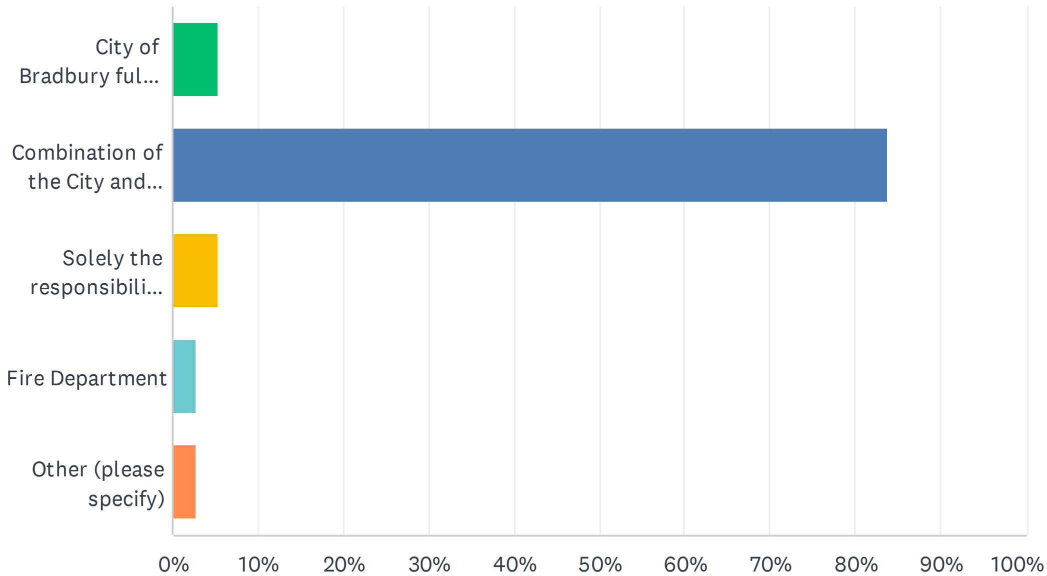
Answered: 37 Skipped: 1



	MOST BENEFICIAL	SECOND MOST BENEFICIAL	TOTAL	WEIGHTED AVERAGE
Weed reduction/fuel load reduction/brush management/dead tree removal	80.65% 25	19.35% 6	31	1.19
Defensible space around homes/in homes including installation of fire resistive and native/drought tolerant plantings	57.69% 15	42.31% 11	26	1.42
Fire Patrols/Fire Department Training/Effective Enforcement/Improved Fire Department Resources/Improved response times	50.00% 11	50.00% 11	22	1.50
Public awareness/education of wildfire risk	52.38% 11	47.62% 10	21	1.48
Roadside management and improved roadway accessibility	53.33% 8	46.67% 7	15	1.47
Improve/change building practices/maintenance/fire resistant homes	46.67% 7	53.33% 8	15	1.53

Q10 Who should be responsible for reducing the wildfire risk within the City of Bradbury?

Answered: 37 Skipped: 1



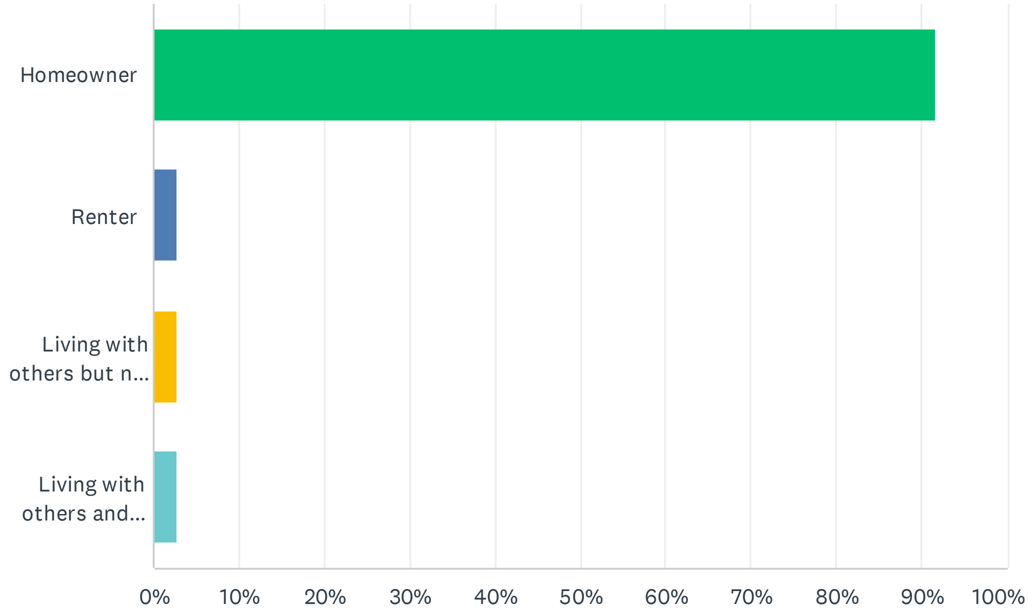
ANSWER CHOICES	RESPONSES	
City of Bradbury fully responsible	5.41%	2
Combination of the City and individual property owners	83.78%	31
Solely the responsibility of the individual property owner	5.41%	2
Fire Department	2.70%	1
Other (please specify)	2.70%	1
TOTAL		37

Q11 What actions would you like to have included in the CWPP and taken to reduce the risk of wildfire?

Answered: 22 Skipped: 16

Q12 Which of the following best describes your current housing situation?

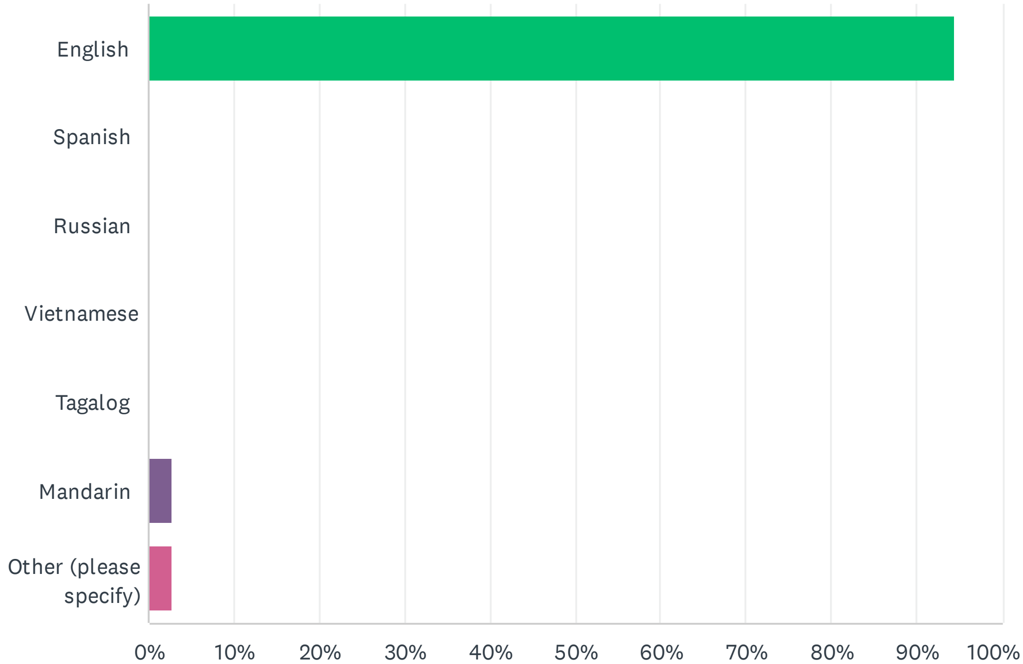
Answered: 36 Skipped: 2



ANSWER CHOICES	RESPONSES	
Homeowner	91.67%	33
Renter	2.78%	1
Living with others but not paying rent or mortgage	2.78%	1
Living with others and assisting with paying rent or mortgage	2.78%	1
TOTAL		36

Q13 What is the primary language spoken in your home?

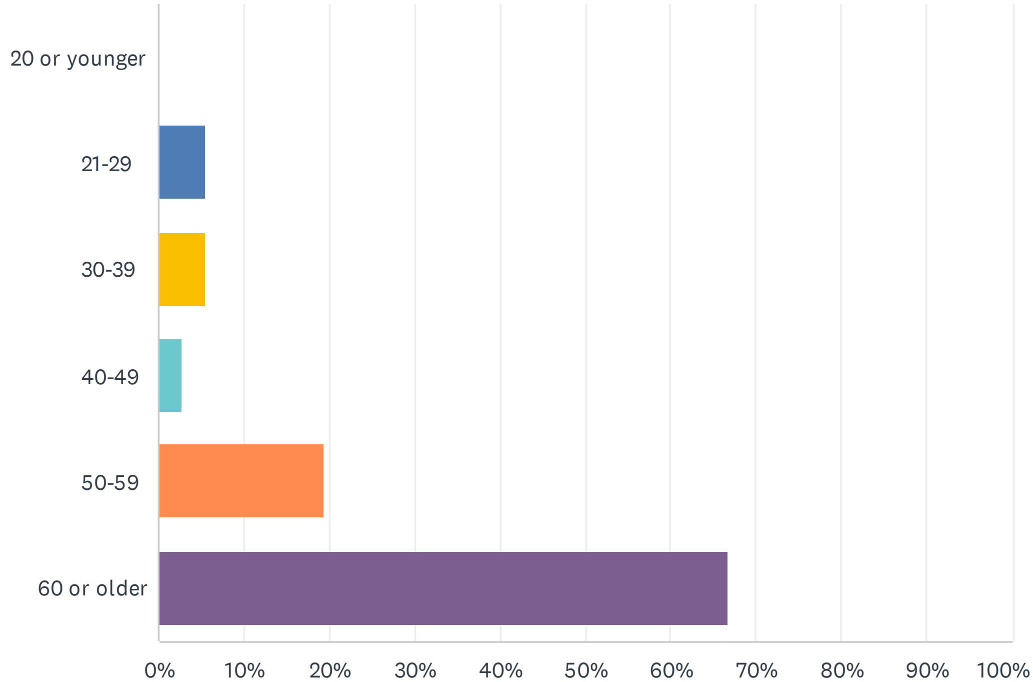
Answered: 36 Skipped: 2



ANSWER CHOICES	RESPONSES	
English	94.44%	34
Spanish	0.00%	0
Russian	0.00%	0
Vietnamese	0.00%	0
Tagalog	0.00%	0
Mandarin	2.78%	1
Other (please specify)	2.78%	1
TOTAL		36

Q14 Which category below includes your age?

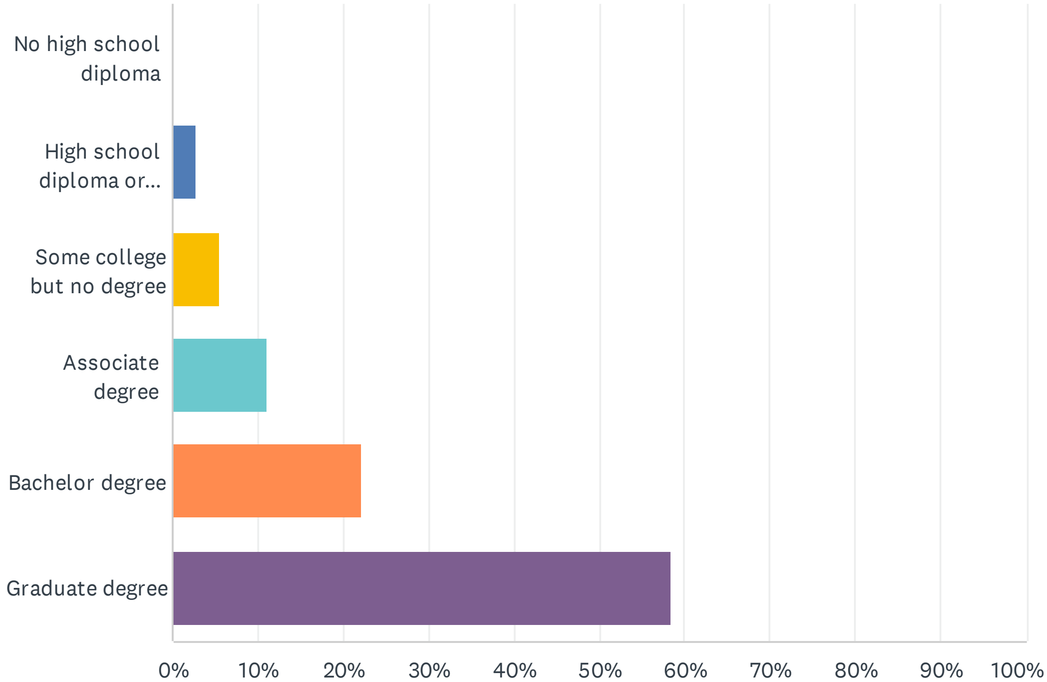
Answered: 36 Skipped: 2



ANSWER CHOICES	RESPONSES	
20 or younger	0.00%	0
21-29	5.56%	2
30-39	5.56%	2
40-49	2.78%	1
50-59	19.44%	7
60 or older	66.67%	24
TOTAL		36

Q15 What is the highest level of education you have attained?

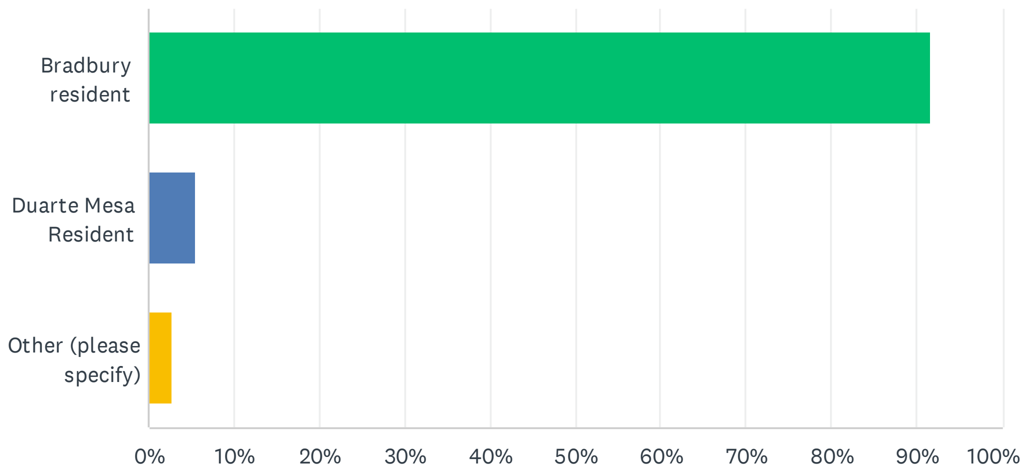
Answered: 36   Skipped: 2



ANSWER CHOICES	RESPONSES	
No high school diploma	0.00%	0
High school diploma or equivalent (e.g., GED)	2.78%	1
Some college but no degree	5.56%	2
Associate degree	11.11%	4
Bachelor degree	22.22%	8
Graduate degree	58.33%	21
TOTAL		36

Q16 Which best describes you?

Answered: 36 Skipped: 2



ANSWER CHOICES	RESPONSES	
Bradbury resident	91.67%	33
Duarte Mesa Resident	5.56%	2
Other (please specify)	2.78%	1
TOTAL		36

Appendix B

Los Angeles County Fire Department's Acceptable Plant List

Los Angeles County Fire Department's: Acceptable Plant List by FMZ

Botanical Name	Common Name	Zone [1]	Minimum Distance from Structure[2]
Ground Cover			
Acacia redolens 'Desert Carpet'/'Low Boy'	Desert Carpet Acacia	B	30
Achillea tomentosa	Woolly Yarrow	A	
Ajuga reptans	Carpet Bugle	A	
Arctostaphylos (Prostrate Varieties)	Manzanita	B	
Artemisia californica (Cultivars)	Sagebrush - Prostrate Forms	B	30
Artemesia 'Powis Castle'	NCN	B	
Baccharis pilularis 'Pigeon Point'/'Twin Peaks'	Prostrate Coyote Brush	B	
Campanula poscharkyana	Serbian Bellflower	A	
Ceanothus gloriosus	Point Reyes Ceanothus	B	
Cerastium tomentosum	Snow-In-Summer	A	
Chamaemelum nobile	Chamomile	A	
Cistus salviifolius 'Prostratus'	Sageleaf Rockrose	B	
Coprosma kirkii	Mirror Plant	B	
Coreopsis auriculata 'Nana'	Tickseed	A	
Cotoneaster (Prostrate Varieties)	Cotoneaster	B	
Dalea greggii	Trailing Indigo Bush	B	
Delosperma alba	White Training Ice Plant	A	
Dichondra micrantha	Dichondra	A	
Drosanthemum floribundum	Rosea Ice Plant	A	
Duchesnea indica	Indian Mock Strawberry	A	
Dymondia margaretae	NCN	A	
Erigeron glaucus	Seaside Daisy	A	
E. karvinskianus	Santa Barbara Daisy	B	
Euonymus fortunei 'Colorata'	Purple-Leaf Winter Creeper	B	
Festuca cinerea(ovina'Glauca')	Blue Fescue	A	
F. rubra	Red Fescue	A	
Fragaria chiloensis	Wild Strawberrry	A	
Gazania Hybrids	Trailing Gazania	A	
Geranium incanum/sanguineum	Cranesbill	A	
Glechoma hederacea	Ground Ivy	A	
Helianthemum nummularium	Sunrose	A	
Herniaria glabra	Green Carpet	A	
Heuchera species and Cultivars	Coral Bells	A	
Hypericum calycinum/coris	Aaron's Beard	B	
Iberis sempervirens	Evergreen Candytuft	A	
Iva hayesiana	Poverty Weed	B	30

Juniperus (Prostrate species/cultivars)		B	
Laurentia fluviatilis	Blue Star Creeper	A	
Lysimachia nummularia	Moneywort	A	
Liriope spicata	Creeping Lily Turf	A	
Liriope muscari	Lily Turf	A	
Mahonia repens	Creeping Mahonia	B	
Myoporum 'Pacificum' & 'Putah Creek'	Pacific Myoporum	B	
M. parvifolium	NCN	A	
Oenothera berlandieri	Mexican Evening Primrose	B	
O. stubbei	Baja Evening Primrose	A	
Ophiopogon japonicus	Mondo Grass	A	
Pachysandra terminalis	Japanese Spurge	A	
Pelargonium peltatum/tomentosum	Ivy Geranium	A	
Persicaria capitata	Pink Clover	A	
Phlox subulata	Moss Pink	A	10
Phyla nodiflora (Lippia repens)	Lippia	A	
Potentilla tabernaemontanii	Spring Cinquefoil	A	
Ribes viburnifolium	Catalina Perfume	B	
Rosmarinus officinalis (Prostrate Varieties)	Prostrate Rosemary	B	30
Scaevola 'Mauve Clusters'	NCN	A	
Salvia sonomensis	Creeping Sage	B	
Sedum species	Stonecrops	A	
Senecio mandraliscae/serpens	Kleinia/Blue Chalksticks	A	
Soleirolia soleirolii	Baby's Tears	A	
Teucrium cossonii majoricum	Germander	A	
T. X lucidrys 'Prostratum'	Prostrate Germander	A	
Thymus species	Mother of Thyme	A	
Trachelospermum jasminoides	Star Jasmine	A	
Trifolium fragiferum	White Clover	A	
Verbena species (Prostrate Varities)	Garden Verbena	A	
Vinca minor	Dwarf Periwinkle	A	
Viola odorata	Sweet Violet	A	
Wedelia trilobata	Yellow Dot	B	
Zoysia tenuifolia	Korean Grass	A	
Miscellaneous Perennials, Grasses, Ferns etc.			
Acorous gramineous and Cultivars	Sweet Flag	A	
Agapanthus africanus	Lily of the Nile	A	
Alstroemeria cooperi	Peruvian Lily	A	
Armeria species	Thrifts	A	
Bamboos	Bamboo	B	30
Bergenia cordifolia	Heart Leaf Bergenia	A	
Cycas species	Cycads	A	
Cyrtomium falcatum	Holly Fern	A	

Davalia tricomanoides	Rabbits Foot Fern	A	
Epilobium canum	California Fuchia	B	
Helictotrichon sempervirens	Blue Oat Grass	A	15
Hemerocallis hybrids	Daylily	A	
Iris douglassiana	Coastal Iris	A	
Iris germanica	Bearded Iris	A	
Kalanchoe species	Kalanchoe	A	
Leymus condensatus 'Canyon Prince'	Canyon Prince Wild Rye	B	
Lobelia laxiflora		A	10
Pelargonium species	Geranium	A	
Penstemon species	Beard Tongue	A	
Plumeria	Plumeria	A	
Phlebodium aureum	Rabbits Foot Fern	A	
Tulbaghia violacea	Society Garlic	A	
Zephyranthes candida	Zephyr Lily	A	
Shrubs			
Abelia grandiflora (Prostrata)	Glossy Abelia	A	10
Abutilon hybridum	Flowering Maple	A	10
Acanthus mollis	Bear's Breech	A	
Agave species	Agave	A	
Aloe species	Aloe	A	
Alyogyne huegelii	Blue Hibiscus	A	10
Arbutus unedo (Dwarf Cultivars)	Dwarf Strawberry Tree	A	10
Arctostaphylos species	Manzanita	B	
Aucuba japonica	Japanese Aucuba	A	
Baccharis species	Various	B	
Berberis thunbergii	Japanese Barberry	B	
B. thunbergii ' prostrate cultivars'		A	10
Bougainvillea sp.	Bougainvillea	B	
Buddleja davidii	Butterfly Bush	B	
Buxus microphylla japonica	Japanese Boxwood	A	10
Caesalpinia (Shrub Forms)	Bird of Paradise Bush	A	10
Camellia species	Camellia	A	10
Calliandra californica/eriophylla	Baja Fairy Duster	B	
Callistemon citrinus	Lemon Bottlebrush	B	
C. viminalis "Little John"	NCN	A	10
Calycanthus occidentalis	Western Spice Bush	B	
Carissa macrocarpa and Cultivars	Natal Plum	A	10
Carpenteria californica	Bush Anemone	A	10
Cassia artemisioides	Feathery Cassia	A	30
Ceanothus species	Wild Lilac	B	30
Cercocarpus betuiloides	Mountain Mahogany	B	30
Choisya ternata	Mexican orange	B	

Cistus species	Rockrose	B	
Comarostaphylis diversifolia	Summer Holly	B	
Convolvulus cneorum	Bush Morning Glory	B	
Coprosma pumila/repens	Mirror Plant	B	
Cotoneaster species & cultivars	Cotoneaster	B	
Crassula species	NCN	A	
Cuphea hyssopifolia	False Heather	A	
Cycas revoluta	Sago Palm	A	
Dasylirion quadrangulatum/wheeleri	Mexican Grass Tree	A	10
Dendromecon harfordii	Island Bush Poppy	B	
Dietes bicolor/irioides	Fortnight Lily	A	
Dodonaea viscosa (Purpurea)	Hopseed Bush	B	
Elaeagnus pungens & cultivars	Silverberry	B	
Encelia californica	Coast Sunflower	A	10
E. farinosa	Brittle Bush	B	
Erigonum giganteum	St. Catherine's Lace	B	
Escallonia species	Escallonia	A	10
Euonymus japonica & cultivars	Evergreen Euonymus	A	10
Euphorbia species		A	
Euryops pectinatus	NCN	A	
Fatsia japonica	Japanese Aralia	A	
Fouquieria splendens	Ocotillo	A	
Fremontodendron species & cultivars	Flannel Bush	B	
Gardenia jasminoides	Gardenia	A	
Garrya elliptica	Coast Silktassel	B	
Grevillea species & cultivars	Grevillea	B	
Grewia occidentalis	Lavender Starflower	B	
Hakea suaveolens	Sweet Hakea	B	
Hebe species & cultivars	Hebe	A	10
Hesperaloe parviflora	Red Yucca	A	
Hibiscus rosa - sinensis	Chinese Hibiscus	A	10
Ilex species	Holly	B	
Juniperus species	Juniper	B	
Justicia brandegeana	Shrimp Plant	A	10
J. californica	Chuparosa	B	
Keckiella cordifolia	Heart-Leaved Penstemon	B	
Kniphofia uvaria	Red-Hot Poker	A	
Lantana Camara & hybrids	Lantana	A	10
Larrea tridentata	Creosote Bush	B	
Lavandula species	Lavender	A	10
Lavatera assurgentiflora/maritima	California Tree Mallow	B	
Leonotis leonrus	Lion's Tail	B	
Leptospermum scoparium & varities	New Zealand Tea Tree	B	
Leucophyllum species		B	
Ligustrum japonicum	Wax-leaf Privet	A	10

Lupinus species	Lupine	B	
Mahonia aquifolium ('Compacta')	Oregon Grape	A	10
M. fremontii	Desert Mahonia	B	
M. 'Golden Abundance'	NCN	B	
M. lomariifolia	Venetian Blind Mahonia	A	
Malosma - See Rhus			
Malva species	Mallow	A	10
Melaleuca nesophila	Pink Melaleuca	A	10
Mimulus species (Diplacus)	Monkey Flower	A	10
Myrica californica	*Pacific Wax Myrtle*	*B*	
Myrsine africana	*African Boxwood*	*A*	*10*
Myrtus communis 'Compacta'	Dwarf Myrtle	A	10
Nandina domestica (including dwarf varieties)	Heavenly Bamboo	A	
Nerium oleander	Oleander	B	
N.o. 'Petite Salmon'	NCN	A	10
Opuntia species	Prickly Pear, Cholla etc.	A	
Phlomis fruticosa	Jerusalem Sage	A	
Phoenix roebelenii	Pygmy Date Palm	A	
Phormium tenax and Cultivars	New Zealand Flax	A	
Photinia fraseri	Photinia	B	
Pittosporum tobira ('Variegata')	Tobira	B	
P.t.'Wheeler's Dwarf'	Dwarf Pittosporum	A	
Punica granatum 'Nana'	Dwarf Pomegranate	A	10
Prunus ilicifolia	Hollyleaf Cherry	B	
Pyracantha species	Firethorn	B	
Rhamnus california/crocea	Coffeeberry	B	
Rhaphiolepis indica and Cultivars	India Hawthorn	A	10
Rhus integrifolia/laurina	Lemonade Berry	B	40
R. ovata	Sugar Bush	B	30
Ribes species	Currant/Gooseberry	A	10
Romneya coulteri	Matilija Poppy	B	
Rosa species (except R. californica)	Rose	A	
Rosmarinus officinalis & cultivars	Rosemary	B	
Salvia species - native varieties	Sage	B	
S. greggii/leucantha	Autumn Sage	A	10
Santolina chamaecyparissus/rosmarinifolius	Lavender Cotton	A	10
Simmondsia chinensis	Jojoba	B	
Strelitzia nicolai/regina	Bird of Paradise	A	
Tagetes lemmonii	Copper Canyon Daisy	B	
Tibouchina urvilleana	Princess Flower	A	10
Trichostema lanatum	Wooly Blue Curls	B	
Viburnum species	Viburnum	A	10
Westringia fruticosa	Coast Rosemary	A	10
Xylosma congestum	Shiny Xylosma	B	
X.c. 'Compacta'	Compact Xylosma	A	10

Yucca species	Yucca	B	
Trees	**Trees**	**Trees**	**Trees**
Acacia farnesiana	Sweet Acacia	A	15
A. greggii	Catclaw Acacia	B	
A. salicina	Willow Acacia	A	15
A. smallii	NCN	A	15
A. stenophylla	Shoestring Acacia	A	15
Acer negundo	Box Elder	B	
A. palmatum	Japanese Maple	A	
A. saccharinum	Silver Maple	B	30
Aesculus californica	California Buckeye	B	
Agonis flexuosa	Peppermint Tree	B	
Albizia julibrissin	Silk Tree	B	
Alnus rhombifolia	Alder	B	
Arbutus unedo ('Marina')	Strawberry Tree	A	15
Archontophoenix cunninghamiana	King Palm	A	
Bauhinia variegata	Purple Orchid Tree	B	
Betula pendula	European White Birch	A	10
Brachychiton acerifolius/populneus	Flame Tree/Bottle Tree	B	
Brahea armata/edulis	Blue Hesper Palm	A	10
Butia capitata	Pindo Palm	A	10
Callistemon citrinus	Lemon Bottlebrush	B	
C. viminalis	Weeping Bottlebrush	A	15
Calocedrus decurrens	Incense Cedar	B	
Calodendrum capense	Cape Chestnut	B	
Cedrus deodara	Deodar Cedar	B	30
Ceratonia siliqua	Carob	B	30
Cercidium floridum/microphyllum	Blue Palo Verde	A	
Cercis occidentalis/canadensis	Western Redbud	A	10
Chamaerops humilis	Mediterranean Fan Palm	A	10
Chilopsis linearis	Desert Willow	A	15
Chionanthus retusus	Chinese Fringe Tree	A	10
Chitalpa X tashkentensis	Chitalpa	A	10
Chorisia speciosa	Floss Silk Tree	B	
Cinnamomum camphora	Camphor Tree	B	30
Citrus species	Citrus	A	10
Cocculus laurifolius	Laurel Leaf Snail Seed	B	
Cordyline australis	Giant Dracaena	A	
Cyathea cooperi	Australian Tree Fern	A	
Dicksonia antarctica	Tazmanian Tree Fern	A	
Dracaena draco	Dragon Tree	A	
Eriobotrya deflexa/japonica	Bronze Loquat/Loquat	A	10
Erythrina species	Coral Tree	B	

Feijoa sellowiana	Pineapple Guava	A	10
Ficus species	Fig	B	50
Fraxinus species	Ash	B	30
Geijera parviflora	Australian Willow	A	15
Ginkgo biloba	Maidenhair Tree	A	15
Gleditsia triacanthos	Honey Locust	A	15
Grevillea robusta	Silk Oak	B	
Heteromeles arbutifolia	Toyon	A	15
Hymenosporum flavum	Sweetshade Tree	A	15
Jacaranda mimosifolia	Jacaranda	B	
Juglans californica	Black Walnut	B	
Koelreuteria bipinnata/paniculata	Chinese Flame Tree	B	
Lagerstroemia indica	Crape Myrtle	A	10
Laurus nobilis	Sweet Bay	B	
Leptospermum laevigatum	Australian Tea Tree	A	15
Liquidambar formosana	Chinese Sweet Gum	A	15
L. styraciflua	American Sweet Gum	B	
Liriodendron tulipfera	Tulip Tree	B	
Lithocarpus densiflorus	Tanbark Oak	B	
Lophpstemon confertus (Tristania)	Brisbane Box	A	15
Lyonothamnus floribundus	Catalina Ironwood	A	15
Magnolia grandiflora	Southern Magnolia	B	
M. X soulangeana	Saucer Magnolia	A	10
Maytenus boaria	Mayten Tree	A	10
Melaleuca quinquenervia	Cajeput Tree	A	15
Metasequoia glypstroboides	Dawn Redwood	A	15
Metrosideros excelsus	New Zealand Christmas Tree	A	10
Morus alba	White Mulberry	B	
Olea europea	Olive - Fruitless only	A	15
Parkinsonia aculeata	Jerusalem Thorn	A	10
Phoenix dactylifera	Date Palm	B	
Pinus species	Pine	B	75
Pistacia chinensis	Chinese Pistache	B	
Pittosporum phillyraeoides	Willow Pittosporum	A	10
P. rhombifolium	Queensland Pittosporum	B	
Platanus racemosa	California Sycamore	B	
Podocarpus gracilior/macrophyllus	Fern Pine/Yew Pine	B	
Populus fremontii	Fremont Cottonwood	B	
Prosopis chilensis	Chilean Mesquite	B	
P. glandulosa	Honey Mesquite	A	15
Prunus cerasifera 'Atropurpurea'	Purple-leaf Plum	A	10
Punica granatum	Pomegranate	B	
Pyrus calleryana/kawakamii	Ornamental Pear	A	15
Quercus species	Oak	B	30
Rhus lancea	African Sumac	B	

Robinia ambigua	Locust	B	
Sapium sebiferum	Chinese Tallow Tree	B	
Schefflera actinophylla	Queensland Unbrella Tree	A	
Sophora japonica	Japanese Pagoda Tree	B	
Stenocarpus sinuatus	Firewheel Tree	A	10
Syagrus romanzoffianum	Queen Palm	A	
Tabebuia species	Trumpet Tree	A	15
Tipuana tipu	Tipu Tree	B	
Tupidanthus calyptratus	Tupidanthus	A	
Trachycarpus fortunei	Windmill Palm	A	
Umbellularia californica	California Bay	B	
Washingtonia filifera	California Fan Palm	B	30
Zelkova serrata	Sawleaf Zelkova	B	

Source: Los Angeles County Fire Department, Fuel Modification Unit.

Notes:

1. The plant list above is intended to be a representative sample of which plants are appropriate in Zones A or B considering their size, moisture content, leaf litter production, and chemical composition.
2. Plants with certain physical and chemical characteristics make them more flammable and should not be planted close to structures in fire hazard areas. These trees should be spaced to allow a minimum canopy clearance at maturity from the structure as specified in the above table.
3. Landscape Designers may choose plants that are not on this list and may be acceptable if their plant characteristics are fuel modification zone appropriate.
4. Additionally, selecting regionally appropriate plants and the consideration of climate and microclimate adaptability is the responsibility of the Landscape Designer.

Appendix C

Los Angeles County Fire Department's Undesirable Plant List

Los Angeles County Fire Department's: Undesirable Plant List by FMZ

Botanical Name	Common Name	Comment[1]
Adenostoma fasciculatum	Chamise	F
Adenostoma sparsifolium	Red Shank	F
Artemesia californica	California Sagebrush	F
Carpobrotus edulis	Hottentot-fig	F, I
Cortaderia spp.	Pampas Grass	F, I
Cupressus spp.	Cypress	F
Eriogonum fasciculatum	Common Buckwheat	F
Eucalyptus spp.	Eucalyptus	F
Jasminum humile	Italian Jasmine	F
Plumbago auriculata	Cape Plumbago	F
Tecoma capensis	Cape Honeysuckle	F

Source: Los Angeles County Fire Department, Fuel Modification Unit.

Notes:

1. F = flammable, I = Invasive
2. Certain plants are considered to be undesirable in the landscape due to characteristics that make them highly flammable. These characteristics can be either physical or chemical. Physical properties would 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. Plants with these characteristics should not be planted close to structures in fire hazard areas. These species are typically referred to as "Target Species" since their complete or partial removal from the landscape is a critical part of hazard reduction. Therefore, any plant listed in the above table is not allowed as part of an acceptable Fuel Modification Plan.
3. Plants on this list that are considered invasive are a partial list of commonly found plants. There are many other plants considered invasive that should not be planted in a fuel modification zone and they can be found on The California Invasive Plant Council's Website www.cal-ipc.org/ip/inventory/index.php. Other plants not considered invasive at this time may be determined to be invasive after further study.
4. For the purpose of using this list as a guide in selecting plant material, it is stipulated that all plant material will burn under various conditions.
5. The absence of a particular plant, shrub, groundcover, or tree, from this list does not necessarily mean it is fire resistive.
6. All vegetation used in Fuel Modification Zones and elsewhere within the Chadwick Ranch Estates Project site shall be subject to approval of the L.A. County Fire Department's Fuel Modification Unit or Fire Code official.

Appendix D

Los Angeles County Fire Department's Repopulation Information Guide Sheet

LOS ANGELES COUNTY FIRE DEPARTMENT

REPOPULATION GENERAL INFORMATION

This document contains important general information and resources. Specific repopulation information for the Lake Fire, when available, can be found in the *News Release/Media Advisory Section* and/or on the current *Incident Update Information Sheet*. Click here to return to the Lake Fire Status webpage when you have finished reading this information.

REPOPULATION – GENERAL INFORMATION

Frequently asked question: The fire is out in my area; why can't I go home?

The Los Angeles County Fire Department recognizes that evacuation orders can cause undue strain on those eager to return home. Please understand that incident commanders are continuously evaluating both fire and infrastructure conditions so that repopulation can occur as quickly as possible, but not at the expense of your safety. **YOUR SAFETY IS OUR PRIMARY CONCERN.**

Some, but not all, of the factors that need to be considered before any evacuations can be lifted are:

- Amount of fire personnel still working in an area and the type of work being performed.
- Damage to roads/guardrails, etc. that must be repaired prior to allowing public access.
- Removal of trees or large debris impacting the roadway.
- Damage to utility infrastructure that must be repaired prior to allowing public access (e.g., clearing power lines from roadways, replacing downed power poles, etc.).
- Public health considerations.

When evacuations are lifted and repopulation begins to occur, it may sometimes include the entire evacuation area but, more likely, will affect only one portion of the evacuation area at a time. Repopulating in segments not only allows us to get some residents home as quickly as possible, but also reduces the impact on law enforcement officials who need to check for identification when these areas are reopened to residents only (which is usually the case).

When an area is repopulated, we ask those residents to please be mindful of people working in the area as essential services continue to be restored. Stay vigilant as you drive into areas that have been impacted by the fire as road crews, firefighters, and other personnel are focused on completing their assignments. As traffic flow is introduced into these areas, people may be more focused on the damage and not aware of their immediate surroundings. Please stay alert and pay attention.

LOS ANGELES COUNTY FIRE DEPARTMENT

REPOPULATION
GENERAL INFORMATION

As the area is repopulated, please be aware that there may be intermittent power outages and associated street closures as power is restored or equipment is repaired throughout the impacted areas.

Because there are many hazards that can exist when returning to your home after a wildfire, we urge you to take safety precautions, such as personal protective equipment (breathing protection, proper clothing, gloves, boots, and eye/face protection). Click here to learn more about how to safely re-enter areas burned by wildfire.

# # #

Appendix E

City of Bradbury Water Supply Standards

CHAPTER 8. - WATER SERVICE REQUIREMENTS

Sec. 17.08.010. - Water service requirements.

(a) Minimum requirement. With respect to water service, the following water service requirements are hereby established and shall require that any new construction of habitable structures and accessory buildings over 1,000 square feet of interior additions or remodeling of habitable structures or accessory buildings which adds over 1,000 square feet within the City and for which a permit is required to be issued:

Lot Size	Any Lot
Fire Flow Req.	1,250 GPM
Duration Req.	Two Hours
Fire Hydrant Spacing	500 Feet

(b) Service. All such water service shall be connected to the existing domestic water service system.

(c) Computation of available fire flow shall be based upon a minimum of 20 pounds per square inch gauge of residual operation pressure remaining in the street main from which the flow is measured.

(d) The City Council may reduce the 1,250 GPM fire flow requirement upon the recommendation of the Planning Commission in exceptional circumstances and where the applicant proves to the satisfaction of the Council that the condition set forth in Chapter 4 of the Bradbury Zoning Code exist.

Bradbury Municipal Code, Title IX—Development Code

May 1, 2013 **Chapter 1—Zoning Regulations** Index Page 2

Bradbury Municipal Code, Title XVII—Building Regulations

(Prior Code, § 8700; Ord. No. 347U , § 9, 3-21-2017; Ord. No. 347 , § 9, 6-20-2017)

Appendix F

City of Bradbury General Plan Sections

City of Bradbury General Plan Policies

1.1 Land Use Goals, Objectives, and Policies

1.1.1 Land Use Goals

The objectives and policies expressed throughout the General Plan shall be based on achieving and implementing the following goals:

1. Financial sustainability.
2. Independent local government.
3. Local responsive and responsible governance.
4. Quiet and peaceful living environment.
5. Safety community.
6. Compatibility between rural agriculture and residential estate development.
7. Balance the City's rural character, including agricultural opportunities, preservation of open-space and natural topography, with residential necessities such as traditional municipal services and utilities.
8. Living/housing opportunities for all ages and economic levels.
9. Services for residents that encompass and are sensitive to an aging population and cultural diversity.

- Land Use Goal No. 1. The Land Use Element maintains the existing rural residential character of the City. The element designates the general location, distribution, and extent of existing and permitted development.
- Land Use Goal No. 2. Preserve the identity, image, and environmental quality of the hillside and open space areas in perpetuity by enforcing the Hillside Development Standard.

1.1.2 Land Use Objectives

- Land Use Objective No. 1. To maintain the existing character of the community and to preserve those environmental resources and amenities that make the City of Bradbury a desirable place to live.

1.1.3 Land Use Policies

- Land Use Policy No. 1. The residential character of the community and environmental resources important to the City will be maintained.

1.1.4 Land Uses Implementation Programs

The City of Bradbury intends to complete the following items which address the objectives and policies of the Land Use Element of the General Plan:

- Land Use Action No. 1. Encourage as much hillside preservation as possible through the use of conservation easements, acquisition efforts by conservation organizations or preservation as natural preserves that promote the protection of natural hillsides as open-space in perpetuity.

- Land Use Action No. 2. Work with the City of Monrovia to adjust the common municipal boundaries to expand the City of Bradbury to the edge of the Wild Rose Avenue right-of-way to be consistent with the legal boundaries of the Bradbury Estates Community Services District.

- Land Use Action No. 3. Revise the City's Design Guidelines to promote sustainable building and development design alternatives.

- Land Use Action No. 4. Encourage the homeowners associations to consider the update or adoption of design guidelines for their respective jurisdictions.

- Land Use Action No. 5. Engage the community and the homeowner associations to explore the need to control development intensity including but not limited to re-examination of lot coverage definitions, relationship of setbacks and building height and the ratio of main dwelling unit footprints to the total parcel size.

- Land Use Action No. 6. Perform a biennial review of the Hillside Development Standards and update if necessary, to carry out the goals of the General Plan.

1.2 Health and Safety Element Goals, Objectives, and Policies

1.2.1 Safety Goals

- Safety Goal No. 1. To protect the citizens, their property, and public facilities from natural and man-made hazards.

- Safety Goal No. 2. To establish, maintain and develop awareness on the part of all residents of Bradbury as to how to react to protect themselves and each other, in the event of a natural or man-made hazard or disaster.

- Safety Goal No. 3. To achieve a greater sense of citizen satisfaction with the safety services within the community, through constantly monitoring the effective and efficient staffing of safety service personnel.
- Safety Goal No. 4. To minimize the risk to persons and property due to seismic activity.
- Safety Goal No. 5. To minimize the risk to lives and property due to fire hazards.
- Safety Goal No. 6. To minimize the risk to persons and property due to the use and storage of hazardous materials.
- Safety Goal No. 7. Protect the community from floods and landslides.
- Safety Goal No. 8. Assure that existing and new development addresses fire protection in a proactive and preventative way.

1.2.2 Safety Objectives

- Safety Objective No. 1. Prepare the community for expected or unexpected disasters resulting from natural or man-made causes.
- Safety Objective No. 2. Prepare the residents of Bradbury to be aware of potential hazards and disasters and to be prepared to be self-reliant for at least seven-days in the event of a disaster.
- Safety Objective No. 3. Communicate with Bradbury residents through all available media, that safety personnel are properly trained to provide assistance in the event of a disaster.
- Safety Objective No. 4. Implement the City's Hazard Mitigation Plan in a timely manner.
- Safety Objective No. 5. Reduce the possibility of hazardous materials becoming a health and safety issue within the community.
- Safety Objective No. 6. Assure that potential flooding and landslide hazards are reviewed during new development.
- Safety Objective No. 7. Ensure that adequate service levels of fire protection are maintained in the City.

1.2.3 Safety Policies

- Safety Policy No. 1. Support community programs that train volunteers to assist "First Responders" in the implementation of the Hazard Mitigation Plan programs.
- Safety Policy No. 2. Implement precautionary measures in high risk areas to reduce injury and loss of property caused by natural or manmade hazards.

- Safety Policy No. 3. Review all development proposals for compliance with established hazard avoidance criteria.
- Safety Policy No. 4. Provide adequate levels of service to ensure that the residents are protected to the best of the City's ability from natural and manmade disasters.
- Safety Policy No. 5. Cooperate with Federal, State and County agencies responsible for the enforcement of all health and safety laws and regulations.
- Safety Policy No. 6. Establish and maintain a variety of media sources to enable interactive safety awareness and preparedness educational opportunities for the residents.
- Safety Policy No. 7. Obtain materials and support the dissemination of written information to all Bradbury households regarding minimizing or avoiding hazards within the home.
- Safety Policy No. 8. Provide opportunities to continually advise and update community residents regarding actions and activities they should engage in after a significant natural or manmade disaster.
- Safety Policy No. 9. Support continuing review and updating of the City's Disaster Preparedness Program manual.
- Safety Policy No. 10. Work closely with adjacent cities, County, State and Federal agencies to inform, monitor and communicate the presence of wild animals.
- Safety Policy No. 11. Maintain and evaluate the level of safety services available to the community.
- Safety Policy No. 12. Restrict development in areas prone to seismic hazards.
- Safety Policy No. 13. Continue to support "mutual assistance" agreements between local and State firefighting agencies.
- Safety Policy No. 14. Continue to support programs to reduce fire hazards within the community.
- Safety Policy No. 15. Provide appropriate firefighting equipment, personnel, and peak load water supply.
- Safety Policy No. 16. Provide access to potable water for emergency purposes.
- Safety Policy No. 17. Regulate and monitor, to the extent possible, the delivery, use and storage of hazardous materials within the City.
- Safety Policy No. 18. Require all existing and new development to install and maintain adequate smoke detection systems.
- Safety Policy No. 19. All new development to install fire sprinkler systems.
- Safety Policy No. 20. Require that all new development incorporate sufficient measures to mitigate flood and landslide hazards including but not limited to on-site drainage systems and grading of site to minimize storm-water runoff.

1.2.4 Safety Implementation Program

The City of Bradbury intends to complete the following items which address the objectives and policies of the Safety Element of the General Plan:

- Safety Action No. 1. Adopt ordinances that require new development to utilize techniques and equipment that reduce consumption of renewable resources.
- Safety Action No. 2. Assure that the land use element recognizes and addresses seismic threats from development in areas of the City.
- Safety Action No. 3. Promote public education about fire safety at home.
- Safety Action No. 4. Promote public education about disaster preparedness.
- Safety Action No. 5. Update the hillside development standards which include fire prevention design measures.
- Safety Action No. 6. Continue to make emergency and disaster preparedness a community priority.
- Safety Action No. 7. Update and review the Emergency Operations Plan annually.
- Safety Action No. 8. City staff to continue to work with the LACFD on brush removal and weed abatement from April to June.
- Safety Action No. 9. Conduct public outreach on wildfire prevention awareness.
- Safety Action No. 10. Promote voluntary efforts to tree trimming and brush and weed abatement.
- Safety Action No. 11. Maintain and update the multi-hazard emergency plan for the City.
- Safety Action No. 12. Continue to support and participation with the Emergency Response Committee.

Appendix G

BehavePlus Fire Behavior Analysis Summary

BehavePlus Fire Behavior Modeling Analysis

1.1 BehavePlus Fire Behavior Modeling History

Fire behavior modeling has been used by researchers for approximately 50+ years to predict how a fire will move through a given landscape (Linn 2003). The models have had varied complexities and applications throughout the years. One model has become the most widely used as the industry standard for predicting fire behavior on a given landscape. That model, known as "BEHAVE", was developed by the U. S. Government (USDA Forest Service, Rocky Mountain Research Station) and has been in use since 1984. Since that time, it has undergone continued research, improvements, and refinement. The current version, BehavePlus 6.0, includes the latest updates incorporating years of research and testing. Numerous studies have been completed testing the validity of the fire behavior models' ability to predict fire behavior given site specific inputs. One of the most successful ways the model has been improved has been through post-wildfire modeling (Brown 1972, Lawson 1972, Sneeuwjagt and Frandsen 1977, Andrews 1980, Brown 1982, Rothermel and Rinehart 1983, Bushey 1985, McAlpine and Xanthopoulos 1989, Grabner, et. al. 1994, Marsden-Smedley and Catchpole 1995, Grabner 1996, Alexander 1998, Grabner et al. 2001, Arca et al. 2005). In this type of study, Behave is used to model fire behavior based on pre-fire conditions in an area that recently burned. Real-world fire behavior, documented during the wildfire, can then be compared to the prediction results of Behave and refinements to the fuel models incorporated, retested, and so on.

Fire behavior modeling conducted on this site includes a relatively high-level of detail and analysis which results in reasonably accurate representations of how wildfire may move through available fuels on and adjacent the property. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. To objectively predict flame lengths, spread rates, and fireline intensities, this analysis incorporated predominant fuel characteristics, slope percentages, and representative fuel models observed on site. The BehavePlus fire behavior modeling system was used to analyze anticipated fire behavior within and adjacent to key areas just outside of the proposed lots. Predicting wildland fire behavior is not an exact science. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather and the limits of weather forecasting. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire prevention planning information. To be used effectively, the basic assumptions and limitations of BehavePlus must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuels less than one-quarter inch in diameter. These are the fine fuels that carry fire. Fuels greater than one inch have little effect while fuels greater than three inches have no effect on fire behavior.
- Second, the model bases calculations and descriptions on a wildfire spreading through surface fuels that are within six feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.
- Third, the software assumes that weather and topography are uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
- Fourth, the BehavePlus fire behavior computer modeling system was not intended for determining sufficient fuel modification zone/defensible space widths. However, it does provide the average length of

the flames, which is a key element for determining "defensible space" distances for minimizing structure ignition.

Although BehavePlus has some limitations, it can still provide valuable fire behavior predictions which can be used as a tool in the decision-making process. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur on a site. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven fuel characteristics help define the 13 standard fire behavior fuel models[1] and the five custom fuel models developed for Southern California[2]. According to the model classifications, fuel models used in BehavePlus have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface to volume ratio. Observation of the fuels in the field (on site) determines which fuel models should be applied in BehavePlus. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models and the custom Southern California fuel models:

- Grasses — Fuel Models 1 through 3
- Brush — Fuel Models 4 through 7, SCAL 14 through 18
- Timber — Fuel Models 8 through 10
- Logging Slash — Fuel Models 11 through 13

In addition, the aforementioned fuel characteristics were utilized in the recent development of 40 new fire behavior fuel models[3] developed for use in BehavePlus modeling efforts. These new models attempt to improve the accuracy of the standard 13 fuel models outside of severe fire season conditions, and to allow for the simulation of fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the new 40 fuel models:

- Non-Burnable — Models NB1, NB2, NB3, NB8, NB9
- Grass — Models GR1 through GR9
- Grass-shrub — Models GS1 through GS4
- Shrub — Models SH1 through SH9
- Timber-understory — Models TU1 through TU5
- Timber litter — Models TL1 through TL9

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1 Anderson, Hal E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. USDA Forest Service Gen. Tech. Report INT-122. Intermountain Forest and Range Experiment Station, Ogden, UT.

2 Weise, D.R. and J. Regelbrugge. 1997. Recent chaparral fuel modeling efforts. Prescribed Fire and Effects Research Unit, Riverside Fire Laboratory, Pacific Southwest Research Station. 5p.

3 Scott, Joe H. and Robert E. Burgan. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

- Slash blowdown   Models SB1 through SB4

BehavePlus software was used in the development of the City of Bradbury Community Wildfire Protection Plan (CWPP) in order to evaluate potential fire behavior for the surrounding areas of the City. Existing site conditions were evaluated, and local weather data was incorporated into the BehavePlus modeling runs.

1.2 Fire Models

Dudek utilized the BehavePlus software package to analyze fire behavior potential for the City of Bradbury. As is customary for this type of analysis, two fire scenarios were evaluated, including one summer, onshore weather condition (northwest from the City) and two extreme fall, offshore weather condition (north and northeast of the City). Fuels and terrain at and beyond this distance can produce flying embers that may affect the more interior homes of the City. It is the fuels adjacent to and within fuel modification zones that would have the potential to affect the structures within the City from a radiant and convective heat perspective as well as from direct flame impingement. BehavePlus software requires site-specific variables for surface fire spread analysis, including fuel type, fuel moisture, wind speed, and slope data. The output variables used in this analysis include flame length (feet), rate of spread (feet/minute), fireline intensity (BTU/feet/second), and spotting distance (miles). The following provides a description of the input variables used in processing the BehavePlus models for the naturally vegetated hillsides adjacent to the City. In addition, data sources are cited and any assumptions made during the modeling process are described.

1.2.1 Vegetation (Fuels)

To support the fire behavior modeling efforts conducted for this CWPP, the different vegetation types observed adjacent to the City were classified into the aforementioned numeric fuel models. As is customary for this type of analysis, the terrain and fuels directly adjacent to the City and within the naturally vegetated hillsides of the San Gabriel Mountains are used for determining flame lengths and fire spread. It is these fuels that would have the potential to affect the structures throughout the City from a radiant and convective heat perspective as well as from direct flame impingement.

Vegetation types were derived from a site visit that was conducted by a Dudek Fire Protection Planner. Based on the site visit, four different fuel models were used in the fire behavior modeling effort presented herein. Fuel model attributes are summarized in Table G-1. Modeled areas include Coast live oak and western sycamore Riparian with non-native chaparral and shrub understory (Fuel Model SH4 = Timber-Shrub) occur near the base of the San Gabriel Mountains, north of the City. Mature tree canopies for coast live oak trees (*Quercus agrifolia)* and western sycamore trees (*Platanus racemosa*) are assumed to have a canopy base height ranging from 35 to 45 feet off the ground. Canopy bulk density, the weight of canopy fuels per cubic foot of volume, is assumed to be the maximum allowable value in BehavePlus to represent broadleaf trees which, given canopy density and leaf size, have more weight per area than conifer trees (the standard for this value input in BehavePlus (Heinsch and Andrews 2010)). Foliar moisture, the moisture content of canopy foliage, is assumed to be 100%, a reasonable estimate in lieu of site-specific data (Scott and Reinhardt 2001).

Table G-1: Existing Fuel Model Characteristics

Fuel Model	Description	Location	Fuel Bed Depth (Feet)
Sh4	Riparian Habitat (Timber Shrub)	Riverbed that runs near the base of the San Gabriel Mountains, north of the City of Bradbury	>8.0 ft.
Sh5	High Load, Dry Climate Shrub	Scrub and chaparral naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury.	>4.0 ft.
Gs2	Moderate load, Dry Climate Grass-Shrub	Scrub and grasses naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury.	<3.0 ft.
FM4	Chaparral	Chaparral fuel model naturally growing throughout the hillsides of the San Gabriel Mountains north of the City of Bradbury	>6.0 ft.

1.2.2 Topography

Slope is a measure of angle in degrees from horizontal and can be presented in units of degrees or percent. Slope is important in fire behavior analysis as it affects the exposure of fuel beds. Additionally, fire burning uphill spreads faster than those burning on flat terrain or downhill as uphill vegetation is pre-heated and dried in advance of the flaming front, resulting in faster ignition rates. Slope values ranging from 18 to 45% were measured around the perimeter of the City from U.S. Geological Survey (USGS) topographic maps.

1.2.3 Weather

Historical weather data for the Bradbury region was utilized in determining appropriate fire behavior modeling inputs for the Proposed Project area fire behavior evaluations. To evaluate different scenarios, data from both the 50th and 97th percentile moisture values were derived from Remote Automated Weather Station (RAWS) and utilized in the fire behavior modeling efforts conducted in support of this report. Weather data sets from the Henninger Flats Station RAWS[4] were utilized in the fire modeling runs.

RAWS fuel moisture and wind speed data were processed utilizing the Fire Family Plus software package to determine atypical (97th percentile) and typical (50th percentile) weather conditions. Data from the RAWS was evaluated from August 1 through November 30 for each year between 1994 and 2018 (extent of available data record) for 97th percentile weather conditions and from June 1 through September 30 for each year between 1994 and 2018 for 50th percentile weather conditions.

Following analysis in Fire Family Plus, fuel moisture information was incorporated into the Initial Fuel Moisture file used as an input in BehavePlus. Wind speed data resulting from the Fire Family Plus analysis was also determined. Initial wind direction and wind speed values for the two BehavePlus runs were manually entered during the data input phase. The input wind speed and direction is roughly an average surface wind at 20 feet above the vegetation over the analysis area. Table G-2 summarizes the wind and weather input variables used in the Fire BehavePlus modeling efforts.

4 https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCHEN
Latitude: 34.1142 Longitude: -118.0536; Elevation: 2,800 ft.)

Table G-2: Variables Used for Fire Behavior Modeling

Model Variable	Summer Weather (50th Percentile)	Peak Weather (97th Percentile)
Fuel Models	FM4, Gs2, Sh4 and Sh5	FM4, Gs2, Sh4, and Sh5
1 h fuel moisture	5%	2%
10 h fuel moisture	6%	3%
100 h fuel moisture	9%	5%
Live herbaceous moisture	39%	30%
Live woody moisture	78%	60%
20 ft. wind speed	19 mph (sustained winds)	18 mph (sustained winds); wind gusts of 50 mph
Wind Directions from north (degrees)	200 and 290	0 and 80
Wind adjustment factor	0.4	0.4
Slope (uphill)	18 to 38%	20 to 45%

1.3 Fire Behavior Modeling Efforts

As mentioned, the BehavePlus fire behavior modeling software package was utilized in evaluating anticipated fire behavior adjacent to the Proposed Project site. Three focused analyses were completed, each assuming worst-case fire weather conditions for a fire approaching the City from the north, east, and west/northwest. The results of the modeling effort included anticipated values for surface fires (flame length (feet), rate of spread (mph), and fireline intensity (Btu/ft/s)) and crown fires (critical surface intensity (Btu/ft/s), critical surface flame length (feet), transition ratio (ratio: surface fireline intensity divided by critical surface intensity), transition to crown fire (yes or no), crown fire rate of spread (mph), critical crown rate of spread (mph), active ratio (ratio: crown fire rate of spread divided by critical crown fire rate of spread), active crown fire (yes or no), and fire type (surface, torching, conditional crown, or crowning)). The aforementioned fire behavior variables are an important component in understanding fire risk and fire agency response capabilities. 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, Bevins, and Seli 2008). Fireline intensity is a measure of heat output from the flaming front, and also affects the potential for a surface fire to transition to a crown fire. Fire spread rate represents the speed at which the fire progresses through surface fuels and is another important variable in initial attack and fire suppression efforts (Rothermel and Rinehart 1983). Spotting distance is the distance a firebrand or ember can travel down wind and ignite receptive fuel beds.

1.4 Fire Behavior Modeling Results

The results presented in Table G-3 values based on inputs to the BehavePlus software and are not intended to capture changing fire behavior as it moves across a landscape. Changes in slope, weather, or pockets of different fuel types are not accounted for in this analysis. For planning purposes, the averaged worst-case fire behavior is the most useful information for conservative fuel modification design. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns.

Based on the BehavePlus analysis, worst-case fire behavior is expected in untreated, surface shrub and chaparral fuels northeast and east of the proposed Project site under Peak weather conditions (represented by Fall Weather, Scenario 3). The fire is anticipated to be a wind-driven fire from the north/northeast during the fall. Under such conditions, expected surface flame lengths reach 42 feet with wind speeds of 50+ mph. Under this scenario, fireline intensities reach 18,499 BTU/feet/second with fast spread rates of 6.2 mph and could have a spotting distance up to 2.3 miles away.

Table G-3: RAWS BehavePlus Fire Behavior Model Results – Existing Conditions

Fire Scenario	Flame Length[1] (feet)	Spread Rate[1] (mph[5])	Fireline Intensity[1] (Btu/ft/s)	Spot Fire[1] (miles)	Surface Fire to Tree Crown Fire	Tree Crown Fire Rate of Spread (mph)	Crown Fire Flame Length (feet)
Scenario 1: 38% slope; Summer Onshore Wind (50th percentile)							
Riparian Habitat - Timber Shrub[2,3] (Sh4)	10.9’	0.9	1,013	0.5	Crowning [4]	0.8	110.8’
Sagebrush scrub (Sh5)	19.5’	1.5	3,599	0.7	Crowning [4]	0.8	116.3
Moderate load grass-shrub (Gs2)	7.8’	2.3	9,509	0.4	Crowning [4]	0.8	109.0
Chaparral (FM 4)	30.4’	0.7	500	1.0	Crowning [4]	0.8	123.2
Scenario 2: 43% slope; Fall Offshore, Extreme Winds (97th percentile)							
Riparian Habitat - Timber Shrub (Sh4)	12.8’ (23.5’)[6]	1.1 (4.2)	1,453 (5,471)	0.5 (1.5)	Crowning [4]	1.0 (4.1)	133.1’
Sagebrush scrub (Sh5)	25.0’ (41.8’)	2.1 (6.4)	6,184 (18,966)	0.8 (2.3)	Crowning [4]	1.0 (4.1)	141.6’
Moderate load grass-shrub (Gs2)	10.1’ (19.1’)	1.0 (3.9)	870 (3,450)	0.4 (1.4)	Crowning [4]	1.0 (4.1)	131.0’
Chaparral (FM 4)	38.1’ (70.4’)	3.1 (11.9)	15,517 (58,853)	1.1 (3.3)	Crowning [4]	1.0 (4.1)	151.3’
Scenario 3: 20% slope; Fall, Offshore, Extreme Winds (97th percentile)							
Sagebrush scrub (Sh5)	24.0’ (41.3’)	1.9 (6.2)	5,697 (18,499)	0.8 (2.3)	No	N/A	N/A
Moderate load grass-shrub (Gs2)	9.7’ (18.9’)	0.9 (3.8)	797 (3,380)	0.4 (1.3)	No	N/A	N/A
Chaparral (FM 4)	36.5’ (69.6’)	2.9 (11.6)	14,172 (57,575)	1.1 (3.3)	No	N/A	N/A

Note:

1. Wind-driven surface fire.
2. Riparian overstory torching increases fire intensity. Modeling included canopy fuel over Sh4, which represents surface fuels beneath the tree canopies.
3. A surface fire in the mixed sycamore riparian forest would transition into the tree canopies generating flame lengths higher than the average tree height (25 feet). Viable airborne embers could be carried downwind for approximately 1.0 mile and ignite receptive fuels.
4. Crowning= fire is spreading through the overstory crowns.
5. MPH=miles per hour
6. Spotting distance from a wind driven surface fire; it should be noted that the wind mph in parenthesis represent peak gusts of 50 mph

The following describes the fire behavior variables (Heisch and Andrews 2010) as presented in Table G-3:

Surface Fire:

- Flame Length (feet): The flame length 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.
- Fireline Intensity (Btu/ft/s): Fireline intensity is the heat energy release per unit time from a one-foot wide section of the fuel bed extending from the front to the rear of the flaming zone. Fireline intensity is a function

of rate of spread and heat per unit area, and is directly related to flame length. Fireline intensity and the flame length are related to the heat felt by a person standing next to the flames.

- Surface Rate of Spread (mph): Surface rate of spread is the "speed" the fire travels through the surface fuels. Surface fuels include the litter, grass, brush and other dead and live vegetation within about 6 feet of the ground.

Crown Fire:

- Transition to Crown Fire: Indicates whether conditions for transition from surface to crown fire are likely. Calculation depends on the transition ratio. If the transition ratio is greater than or equal to 1, then transition to crown fire is Yes. If the transition ratio is less than 1, then transition to crown fire is No.
- Crown Fire Rate of Spread (mph): The forward spread rate of a crown fire. It is the overall spread for a sustained run over several hours. The spread rate includes the effects of spotting. It is calculated from 20-ft wind speed and surface fuel moisture values. It does not consider a description of the overstory.

Fire Type: Fire type is one of the following four types: surface (understory fire), torching (passive crown fire; surface fire with occasional torching trees), conditional crown (active crown fire possible if the fire transitions to the overstory), and crowning (active crown fire; fire spreading through the overstory crowns). Dependent on the variables: transition to crown fire and active crown fire.

The information in Table G-4 presents an interpretation of the outputs for five fire behavior variables as related to fire suppression efforts. The results of fire behavior modeling efforts are presented in Table G-3. Identification of modeling run locations is presented graphically in Figure 8 of the CWPP.

Table G-4: Fire Suppression Interpretation

Flame Length (ft)	Fireline Intensity (Btu/ft/s)	Interpretations
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 to 8 feet	100-500 BTU/ft/s	Fires are too intense for 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 to 11 feet	500-1000 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 1000 BTU/ft/s	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Appendix H

FlamMap Fire Behavior Analysis Summary

FlamMap Fire Behavior Modeling Analysis

1.1 FlamMap Fire Behavior Modeling

The FlamMap software package (Finney et al. 2015) was used to evaluate fire hazard in the City. The FlamMap software package is a publicly available resource available through the Fire, Fuel, and Smoke Science Program of the U.S. Forest Service. FlamMap uses the same fire spread equations built into the BehavePlus software package but allows for a geographical presentation of fire behavior outputs as it applies the calculations to each pixel in an associated geographic information system (GIS) landscape (Finney 1998). FlamMap is a GIS-based software package that models potential fire behavior for constant weather conditions (wind and fuel moisture) and generates map files of potential fire behavior characteristics (e.g., flame length, crown fire activity). FlamMap outputs represent fire behavior calculated for each pixel within the analysis area independently and does not calculate fire spread across a landscape. The software requires a minimum of five input variables, including elevation, slope, aspect, fuel model, and canopy cover. To use the crown fire activity model for forested land cover types, additional input variables are necessary, including stand height, canopy base height, and canopy bulk density. Wind and weather data are also critical components to FlamMap modeling efforts. The following sections present a background on fire behavior modeling and present the methods and data sources used in performing the FlamMap fire behavior modeling analysis for this CWPP.

1.2 Fire Behavior Modeling Background

Predicting wildland fire behavior is not an exact science due to the many variables that must be considered. As such, the movement of a fire will likely never be fully predictable, especially considering the variations in weather, the limits of weather forecasting, and the weather that is often created by firestorms. Nevertheless, practiced and experienced judgment, coupled with a validated fire behavior modeling system, results in useful and accurate fire information (Rothermel 1993). To be used effectively, the basic assumptions and limitations of fire behavior modeling applications must be understood.

- First, it must be realized that the fire model describes fire behavior only in the flaming front. The primary driving force in the predictive calculations is dead fuel less than 0.25 inches in diameter. These are the fine fuels that carry fire. Fuels greater than 1 inch in diameter have little effect, while fuels greater than 3 inches in diameter have no effect on fire behavior.
- Second, the model bases surface fire calculations and descriptions on a wildfire spreading through fuels that are within 6 feet of the ground and contiguous to the ground. Surface fuels are classified as grass, grass/shrub, shrub, timber litter, timber understory, or slash.
- Third, the software assumes that weather is uniform. However, because wildfires almost always burn under non-uniform conditions, creating their own weather, length of projection period and choice of fuel model must be carefully considered to obtain useful predictions.
- Fourth, fire behavior computer modeling systems are not intended for determining sufficient fuel modification zone/defensible space widths. However, results can provide the average length of the flames, which is a key element for determining defensible space distances for minimizing structure ignition.

FlamMap can provide valuable fire behavior predictions, which can be used as a tool in the decision-making process. In order to make reliable estimates of fire behavior, one must understand the relationship of fuels to the fire environment and be able to recognize the variations in these fuels. Fuels are made up of the various components of vegetation, both live and dead, that occur in a particular landscape. The type and quantity will depend upon soil, climate, terrain, and management and disturbance (e.g., fire) history. The major fuel groups of grass, grass/shrub, shrub, trees, tree litter, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content, and chemical properties.

The seven (7) principal fuel characteristics help define the 13 standard fire behavior fuel models (Anderson 1982). According to the model classifications, fuel models used for fire behavior modeling (BehavePlus, FlamMap, FARSITE) have been classified into four groups, based upon fuel loading (tons/acre), fuel height, and surface area-to-volume ratio. Observation of the fuels in the field determines which fuel models should be applied in modeling efforts. The following describes the distribution of fuel models among general vegetation types for the standard 13 fuel models:

- Grasses – fuel models 1 through 3
- Brush – fuel models 4 through 7
- Timber – fuel models 8 through 10
- Logging slash – fuel models 11 through 13

In addition, the aforementioned fuel characteristics were utilized in the development of 40 newer fire behavior fuel models (plus 5 non-burnable models) (Scott and Burgan 2005) developed for use in the BehavePlus, FlamMap, and FARSITE modeling systems. These newer models attempt to improve the accuracy of the 13 standard fuel models and to allow for the simulation of fuel treatment prescriptions. The following describes the distribution of fuel models among general vegetation types for the 40 newer fuel models:

- Non-burnable – models NB1, NB2, NB3, NB8, NB9
- Grass – models GR1 through GR9
- Grass shrub – models GS1 through GS4
- Shrub – models SH1 through SH9
- Timber understory – models TU1 through TU5
- Timber litter – models TL1 through TL9
- Slash blowdown – models SB1 through SB4

1.3 FlamMap Analysis

1.3.1 Base Mapping Data

FlamMap (version 6.0) was used for the modeling analysis. The base data for the modeling analysis was obtained from the LANDFIRE (Landscape Fire and Resource Management Planning Tools) data distribution site (LANDFIRE 2019). LANDFIRE is shared program between the wildland fire management programs of the U.S. Forest Service and U.S. Department of the Interior and provides landscape-scale GIS data layers. LANDFIRE Remap (LF 2.0.0) data file was obtained and used for the model base data set. The LF Remap represents circa 2016 ground conditions and has a data resolution of 30 meters. The LANDFIRE data was obtained in a Landscape file format, which is a composite GIS file that includes the following layers:

- **Elevation:** Necessary for adiabatic adjustment of temperature and humidity and for conversion of fire spread between horizontal and slope distances.
- **Slope:** Necessary for computing slope effects on fire spread and solar radiance.
- **Aspect:** Important in determining the solar exposure of grid cells.
- **Fuel Model:** A numerical assignment of vegetation/fuels that represent distinct distributions of fuel loadings found among surface fuel components (live and dead), size classes, and fuel types. The fuel models are described by the most common fire carrying fuel type (grass, brush, timber (tree) litter or timber understory), loading and surface area-to-volume ratio by size class and component, fuelbed depth, and moisture of extinction. The fuel model set used for this analysis was the 40-fuel model set from Scott and Burgan (2005). The models included in the analysis are summarized in Table H-1.

Table H-1. Fuel Models in Modeling Area

Fuel Model	Description
GR1 (101)	Short, Sparse Dry Climate Grass
GR2 (102)	Low Load, Dry Climate Grass
GS1 (121)	Low load, Dry Climate Grass-Shrub
GS2 (122)	Moderate Load, Dry Climate Grass-Shrub
SH1 (141)	Low Load, Dry Climate Shrub
SH2 (142)	Moderate Load Dry Climate Shrub
SH5 (145)	High Load, Dry Climate Shrub
NB1 (91)	Urbane/Developed

- **Canopy Cover:** Necessary for computing shading and wind reduction factors for all fuel models. Canopy cover is measured as the horizontal fraction of the ground that is covered directly overhead by tree canopy.
- **Stand Height:** The representation of the average height of dominant and co-dominant trees in a stand (not the tallest height or average height of all trees). Stand height is used in FlamMap for computing wind reduction to midflame height and spotting distances from torching trees. Stand height is a necessary dataset for utilizing the torching, spotting, and crown fire model in FlamMap.
- **Canopy Base Height:** A variable used for determining transition from surface fire to crown fire; represents the height to the bottom of the live tree crown. Canopy base height is a necessary dataset for utilizing the torching, spotting, and crown fire model in FlamMap.
- **Canopy Bulk Density:** Used to determine the characteristics of crown fires and describes the density of available canopy fuel in a stand. It is defined as the mass of available canopy fuel per canopy volume unit. Canopy bulk density is a necessary data set for utilizing the torching, spotting, and crown fire model in FlamMap.

The FlamMap analysis area encompassed the City of Bradbury plus a buffer of approximately 5 miles. LANDFIRE data layers were projected to the NAD 83, California State Plane, Zone 5 coordinate system. In addition to the Landscape file, wind and weather data were incorporated into the model inputs, as described below.

1.3.2 Wind and Fuel Moisture

In order to utilize weather and fuel moisture variables for the fire behavior modeling area, data from the Henninger Flats Remote Automated Weather Station (RAWS)[1] was analyzed. Utilization of RAWS data is necessary for fire behavior modeling as it includes data for fuel moisture, temperature, relative humidity, and wind speed. The Henninger RAWS is located approximately 16 miles to the northwest of the City. The following summarizes the location and available data ranges for the Herringer RAWS:

Latitude: 34.1142
Longitude: -118.0536
Elevation: 2,800 feet
Data years: 1994 to 2019

Wind and weather data are a required component to fire behavior modeling efforts. The Henninger RAWS data was processed with the FireFamily Plus version 5.0 (FireFamily Plus 2019) software package to determine weather conditions to be incorporated into modeling efforts. The selected weather scenario used 97th percentile conditions to mimic a fire event during Sundowner wind conditions. The analysis period for weather data analysis was May 1–December 31.

These weather values were incorporated into the Initial Fuel Moisture file used as an input in FlamMap. Wind direction and wind speed values for the FlamMap run were manually entered during the data input phase. Table H-2 presents the wind and weather values used in the FlamMap fire behavior modeling runs conducted in support of this CWPP.

Table H-2. FlamMap Weather Input Variables

Model Variable	Value
1-hour fuel moisture	2%
10-hour fuel moisture	3%
100-hour fuel moisture	5%
Live herbaceous moisture*	30%
Live woody moisture	60%
20-foot wind speed (mph)	50 mph (maximum speed)
Wind direction	80 degrees (Santa Ana)

Note:
* Live herbaceous moisture values were lower than 30% so the herbaceous fuels are considered fully cured (Scott and Burgan 2005).

Finally, wind vectors were modeled within the FlamMap runs using the WindNinja tool embedded in the FlamMap software. WindNinja models the effect of topography on wind speed and direction and generates wind vector files for use in the modeling runs. The grid resolution for the WindNinja analysis was set at 60 meters.

1.3.3 Model Outputs

Three output grid files were generated for the FlamMap run and represent flame length, crown fire activity, and spotting potential. 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). It is a somewhat subjective and non-scientific measure of fire behavior but is extremely important to fireline

1 https://wrcc.dri.edu/cgi-bin/rawMAIN.pl?caCHEN
Latitude: 34.1142 Longitude: -118.0536; Elevation: 2,800 ft.)

personnel in evaluating fireline intensity and is worth considering as an important fire variable (Rothermel 1993). Flame length values in the resulting grid file are in feet. Table H-3 presents an interpretation of flame length and its relationship to fireline intensity. Fireline intensity is a measure of heat output from the flaming front and also affects the potential for a surface fire to transition to a crown fire.

Table H-3. Fire Suppression Interpretation

Flame Length	Fireline Intensity	Interpretations
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 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 head of fire are ineffective.

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

Model outputs for crown fire activity include three potential options: surface fire, passive crown fire (torching), or active crown fire. Surface fires may transition to crown fire, depending on surface fire intensity and crown characteristics. Ladder fuels facilitate ignition of crown fuels by the surface fire and then transition to some form of crown fire (Seli et al. 2015). As presented in Table H-3, crown fires present significant resistance to control and are a characteristic of extreme fire behavior.

Model outputs for spotting are the maximum spotting distance (in meters) from a crown fire. FlamMap only generates spotting potential where crown fires occur (e.g., in oak woodlands), so this analysis does not account for spotting generated in a fire burning in chaparral vegetation. FlamMap outputs generate point data set coded with the maximum spotting distance. This data set was then buffered to create a spotting potential layer, where the buffer radius equaled the maximum spotting distance. The buffering exercise represented a circular area around each spotting point, which is not an accurate representation of upwind spotting distances (as the modeling scenario utilized a Sundowner wind event). However, this analysis does give an estimate of potential fire hazard associated with spotting (embers) in the downwind area of the City.

A map depicting potential flame length values is presented in Figure 9.

Appendix I

Los Angeles County Fire Department's "Ready Set, GO!" Plan

READY! SET! GO!

YOUR PERSONAL WILDFIRE ACTION PLAN

fire.lacounty.gov

MESSAGE FROM FIRE CHIEF DARYL L. OSBY

Dear Residents,

Los Angeles County is one of the most beautiful places to live, but for those living in "wildland urban interface areas," it does not come without risks. With a year-round fire season and ever-growing number of wildfires, firefighters and residents alike are now constantly on heightened alert for the threat of wildfires.

The Los Angeles County Fire Department, along with our partnering agencies, stand ready to quickly respond to contain wildfires, utilizing our firefighting resources from the air and ground to help protect you and your property from wildfire.

But, we can't do this without your cooperation. Preparation and prevention go hand-in-hand. This *Ready! Set! Go!* brochure was designed to provide you with critical information on creating defensible space around your home, retrofitting your home with fire-resistant materials, and preparing you to safely evacuate well ahead of a wildfire. Please protect yourself, your family, and your property from a devastating wildfire by taking the time to learn about *Ready! Set! Go!*

In Los Angeles County, wildfires will continue to be fueled by a build-up of seasonal dry vegetation and driven by dry conditions and locally strong winds, making them extremely dangerous and challenging for firefighters to control. Yet, many homeowners don't consider how a wildfire could affect them, and very few residents have properly prepared for evacuation until it is too late.

You play the most important role in protecting yourself, family, and property. Through planning and preparation, we can all be ready for the next wildfire. I hope you find the information in this brochure helpful as you prepare your home and family for a wildfire.

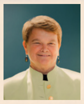
As always, if you need additional information about preparing for a wildfire or any other natural disaster, please contact your nearest fire station or visit us at fire.lacounty.gov.

Daryl L. Osby
Los Angeles County Fire Chief

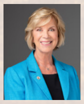
COUNTY OF LOS ANGELES BOARD OF SUPERVISORS

HILDA L. SOLIS
Chair and Supervisor, First District
hildasolis.org

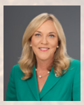
HOLLY J. MITCHELL
Supervisor, Second District
hollyjmitchell@bos.lacounty.gov



SHEILA KUEHL
Supervisor, Third District
supervisorkuehl.com



JANICE HAHN
Supervisor, Fourth District
hahn.lacounty.gov



KATHRYN BARGER
Supervisor, Fifth District
kathrynbarger.lacounty.gov

INSIDE

READY!

SET!

GO!

Preparing for a wildfire starts with three simple steps:

READY! **SET!** **GO!**

Please keep this plan on hand as a quick reference for helping your family and property be safe in the event of a wildfire.

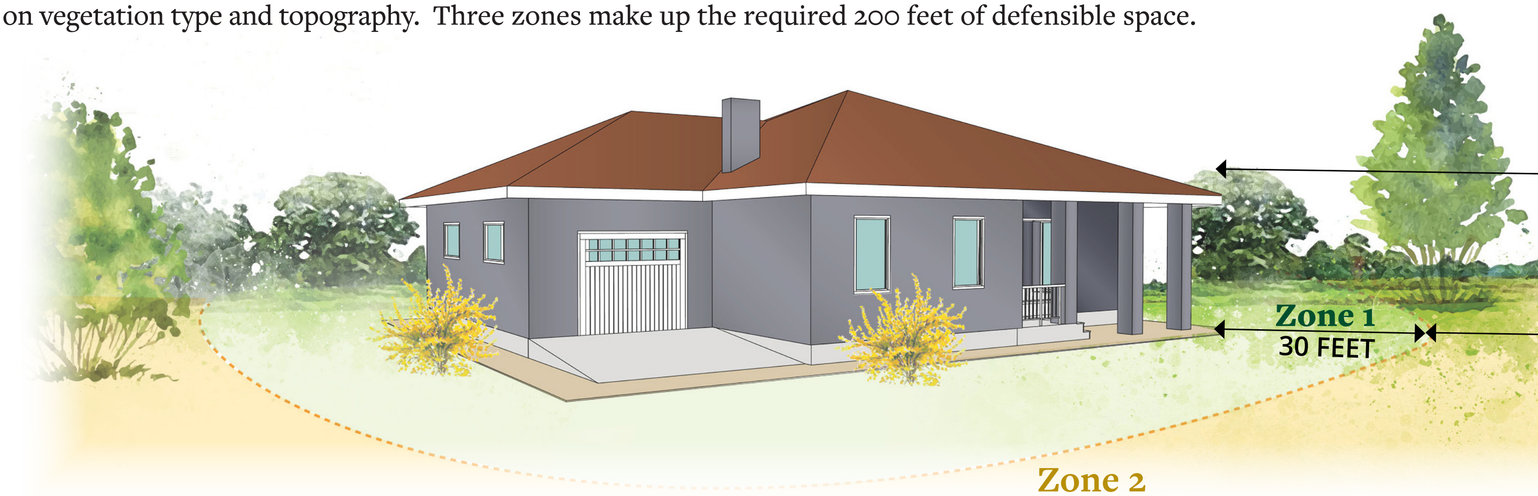
READY!

Living in the Wildland Urban Interface

Ready! Set! Go! begins with a house that firefighters can defend.

Defensible Space

Creating and maintaining defensible space is essential for increasing your home's chance of surviving a wildfire. It's the buffer homeowners are required to create between their structure and the native landscape. This space slows the spread of wildfire and improves the safety of firefighters defending your home. Defensible space composition varies, depending on vegetation type and topography. Three zones make up the required 200 feet of defensible space.



Zone 2

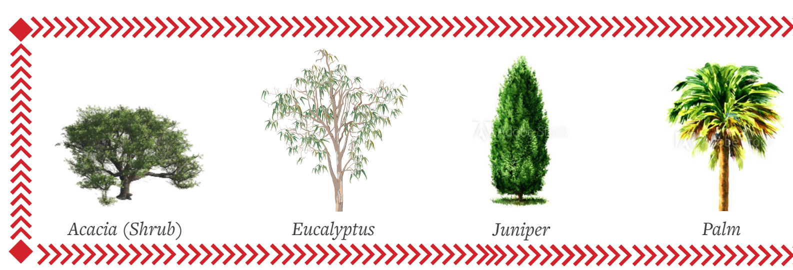
Extends from the outer edge of Zone 1 to 100 feet from the structure

- Cut or mow annual grass down to a maximum height of three inches.
- Create vertical and horizontal spacing between trees and shrubs (the distance between trees should be three times the height).
- Remove fallen leaves, needles, twigs, bark, cones, and small branches. However, a mulch layer may be permitted to a depth of four inches, if erosion control is an issue.
- Irrigation is recommended to maintain vegetation moisture content.

Zone 1

Extends 30 feet out from the structure

- Remove all dead or dying vegetation.
- Remove dead or dry leaves and pine needles from your yard, roof, and rain gutters.
- Trim trees regularly to keep branches a minimum of 10 feet from other trees.
- Remove dead branches hanging over your roof. And, keep branches 10 feet away from your chimney.
- Relocate exposed woodpiles outside of Zone 1 unless they are completely contained in a fire-resistant enclosure.
- Remove vines and climbing plants from combustible structures (e.g., bougainvillea, wisteria).
- Remove or prune vegetation near windows (you should be able to see out the windows).
- Remove vegetation and items around and under decks that could catch fire.
- Create separations between trees, shrubs, and items that could catch fire, such as patio furniture, swing sets, etc.
- Irrigation is recommended to maintain vegetation moisture content.



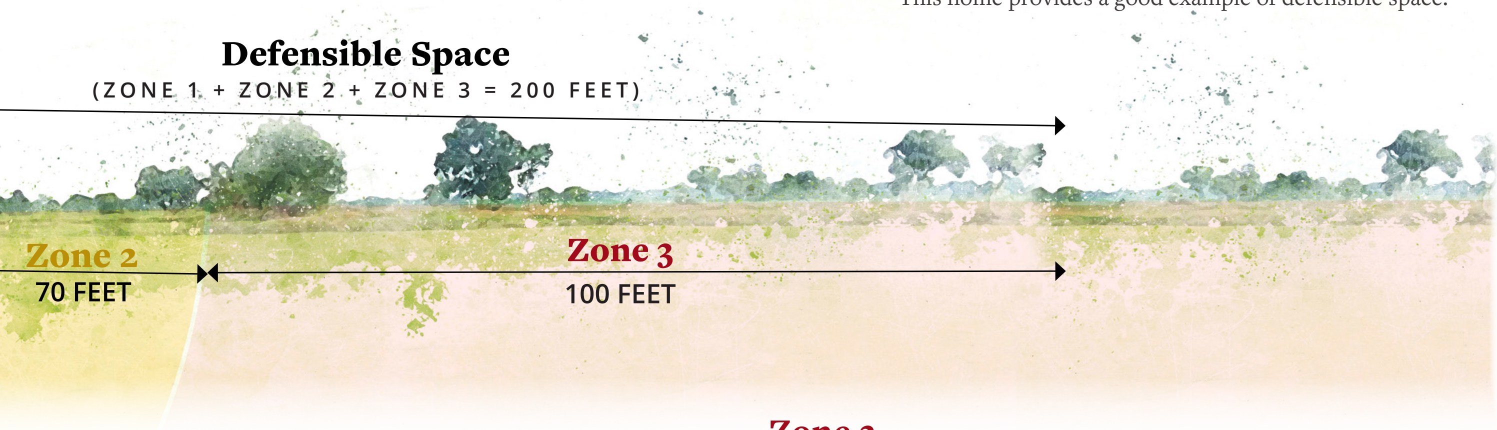
READY!

HAZARDOUS

ORNAMENTAL LANDSCAPE

Preventing conditions where fire can travel from adjacent fuels, through an ornamental landscape to your structure, is the key to creating defensible space. Fire spreads through convection, conduction, radiation, or embers. Proper maintenance of ornamental vegetation reduces ember production, fire propagation, intensity, and duration of the approaching flames.

This home provides a good example of defensible space.



Zone 3

Extends from the outer edge of Zone 2 to 200 feet from the structure

Zone 3 consists of mostly native plants appropriately thinned and spaced by 30 to 50 percent. The objective is to reduce vegetation density and overall fuel load. This slows the rate of fire spread, reducing flame lengths and fire intensity before it reaches irrigated zones or structures.

- Irrigation systems are not required.
- Vegetation consists of modified existing native vegetation.
- Additional ornamental shrubs and trees are generally not recommended due to water conservation goals.
- Existing native vegetation is modified by thinning and removing plants constituting a high fire risk, including, but not limited to, laurel sumac, chamise, ceanothus, sage, sage brush, buckwheat, and California juniper.
- Remove the lower ⅓ of large shrubs and all dead wood to reduce fuel loads.
- Trees should be limbed up to at least six feet above grade and a minimum of three times the height of underlying plants.
- As the distance from structures increases, native plants may be removed in reduced amounts.
- Spacing for large native shrubs or groups of native shrubs is 15 feet between the edge of their canopies.
- Spacing for existing native trees or small groups of trees is 30 feet between the edge of canopies. This depends on the species, topography, and orientation on the site.

HIGH-HAZARD PLANTS

Pine

Pampas Grass

Note: Special attention should be given to the use and maintenance of ornamental plants known or thought to be high-hazard plants when used in close proximity to structures. Examples include acacia, cedar, cypress, eucalyptus, Italian cypress, juniper, palms (remove all dead fronds), pine (removal within 30 feet of structures), and pampas grass. These plantings should be properly maintained and not allowed to be in mass plantings that could transmit fire from the native growth to any structure.

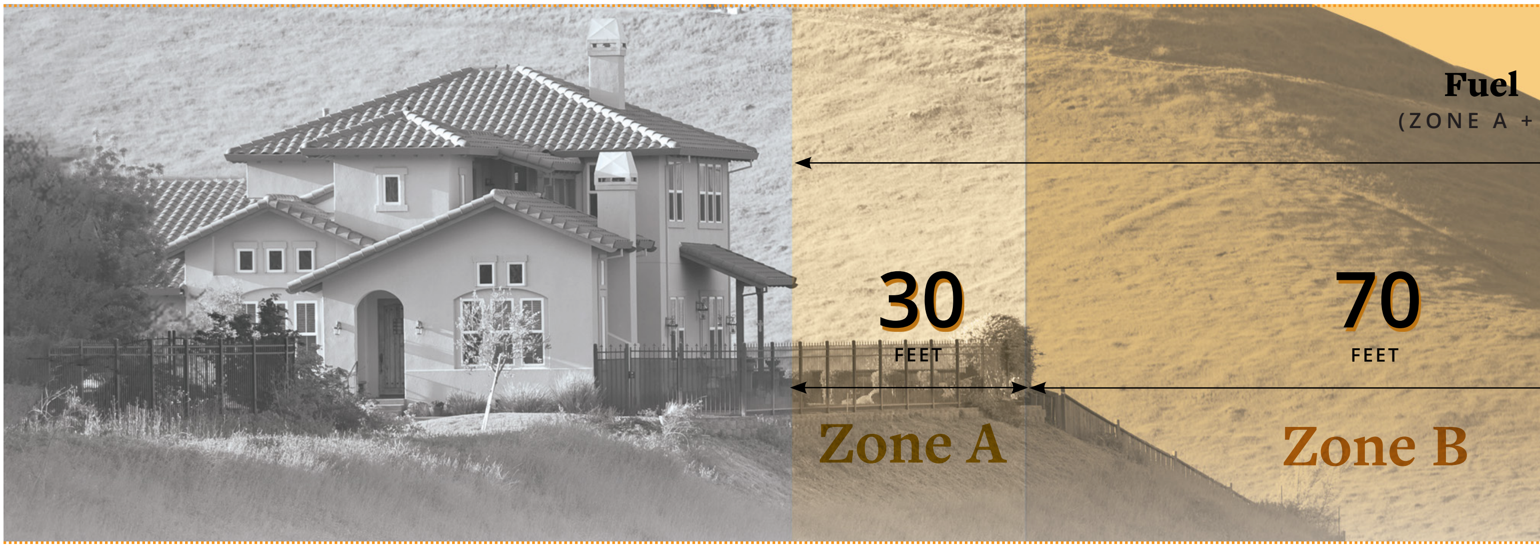
Fuel Modification

What Is Fuel Modification?

The Fuel Modification Plan Review Program affects new structures and developments built in fire hazard severity zones. A Fuel Modification Plan (or landscape plan) identifies defensible space zones and restricts or limits planting around structures.

For further information, please visit bit.ly/fuelmod or call (626) 969-5205.

Fuel Modification Zones



Zone A

EXTENDS 30 FEET FROM THE STRUCTURE

- Irrigated area consisting of low-growing, small herbaceous plants with high-moisture content immediately around structures.
- Hedges shall not be within five feet of any structures.
- Occasional accents of woody shrubs or small patio trees 10 feet from structures. Single plants and/or groups of plants are widely spaced (the distance between plants is three times the height).
- Cut annual grasses to three inches and remove leaf litter.
- Vines and climbing plants are not allowed on combustible structures.
- Use rock or non-combustible mulch within five feet of structures.

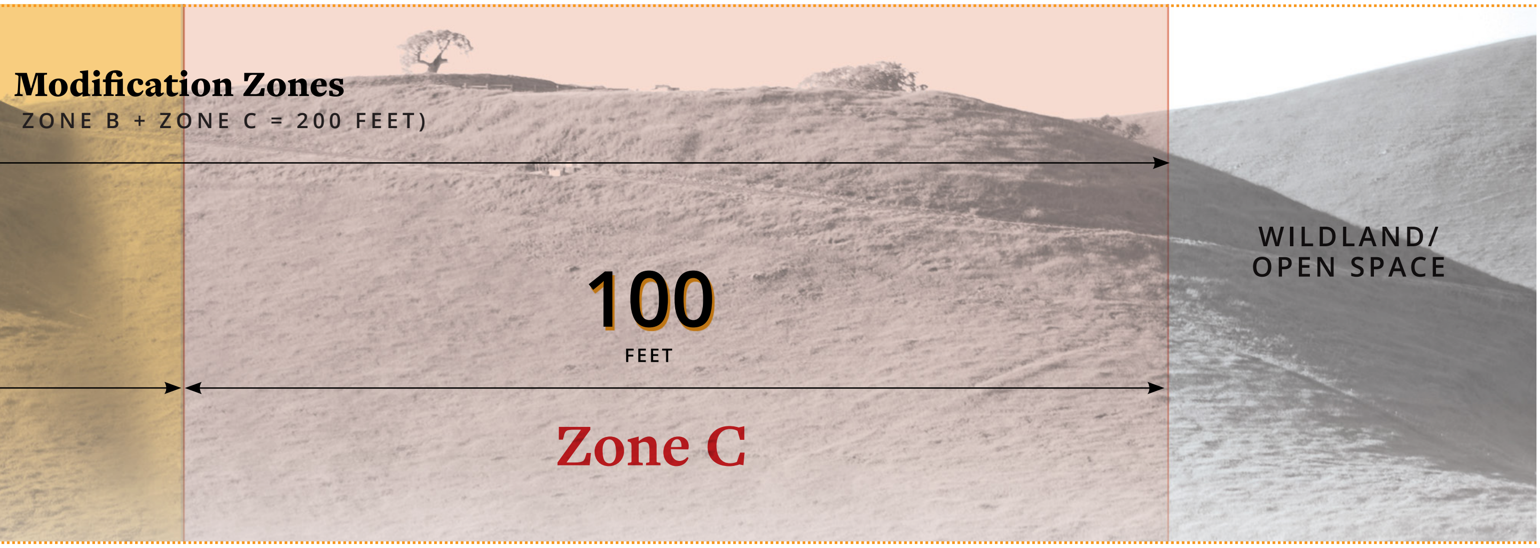
Ideal Fuel Modification Landscape:

Limited woody plant material, high moisture content, adequate spacing, and inorganic mulch throughout Zone A.

READY!

Create a Defensible Home

A home with defensible space has the greatest potential of surviving a wildfire. Defensible homes are compliant with the Los Angeles County Fire Department's brush clearance requirements. Homes built after January 1, 1996, have been through the Fire Department's Fuel Modification Program, where strict planting requirements and construction standards improve fire safety in the high and very high fire hazard severity zones.



Zone B

EXTENDS FROM THE OUTER EDGE OF ZONE A TO 100 FEET FROM THE STRUCTURE

- Irrigated with slightly denser planting than Zone A. Avoid woody plants larger than three feet in height at maturity under tree canopies.
- Has zone-appropriate shade trees with adequate spacing.
- Minimize continuous canopy coverage to reduce fire transmission.
- Screening plants may be used; however, continuous hedges are discouraged as this promotes accumulation of dead litter inside the live hedge and creates a continuous fuel ladder to the structure.

Zone C

EXTENDS FROM THE OUTER EDGE OF ZONE B TO 200 FEET FROM THE STRUCTURE

- Thin to remove dead vegetation and prevent overgrowth.
- Thin native species to slow the fire's progress and reduce its intensity by decreasing availability of continuous fuels.
- Native vegetation is thinned 30 to 50 percent in Zone C.

READY!

Safeguard or "Harden" Your Home

The ability of your home to survive a wildfire depends on the materials your home is constructed of and the quality of the "defensible space" surrounding it. Windblown embers from a wildfire will find the weak link in your home's fire protection scheme and gain the upper hand because of a small, overlooked, or seemingly inconsequential factor. However, there are measures you can take to safeguard your home from wildfire. While you may not be able to accomplish all of the measures listed below, each will increase your home's - and possibly your family's - safety and survival.

Tour a Wildfire-Ready Home

Address 1

• Make sure your address is clearly visible from the road. The address needs to be a contrasting color to the surface that it is mounted on, so it can be seen.

Chimney 2

• Cover your chimney and stovepipe outlets with a non-flammable screen of ⅛-inch wire mesh or smaller to prevent embers from escaping and igniting a fire.

• Tree branches must be removed within 10 feet of any chimney (exception: oak trees).

Deck/Patio Cover 3

• Use heavy timber or non-flammable construction material for decks and patio covers, especially within the first 10 feet of the home.

• Enclose the underside of balconies and decks with fire-resistant materials to prevent embers from blowing underneath.

• Keep your deck clear of combustible items, such as baskets, dried flower arrangements, and other debris.

Driveways and Access Roads 4

• Driveways should be designed to allow fire and emergency vehicles and equipment to reach your home (current fire code requirement is 15 feet wide).

• Access roads should have a minimum 10-foot clearance on either side of the traveled section of the roadway and should allow for two-way traffic.

• Locked or electric gates should have a disconnect or a lock box.

• Ensure that all gates open inward and are wide enough to accommodate emergency equipment.

• Trim trees and shrubs above all roads clear to the sky, with the exception of Oak trees which only need to be cleared to a height of 13½ (or 13.5) feet.

Garage 5

• Have a fire extinguisher and tools, such as a shovel, rake, bucket, and hoe, available for fire emergencies.

• Install a solid door with self-closing hinges between living areas and the garage. Install weather stripping around and under the doors to prevent ember intrusion.

• Store all combustibles and flammable liquids away from ignition sources.

• Keep the garage closed whenever possible.

Home Site and Yard 6

• Ensure you have up to a 200-foot radius of defensible space (cleared vegetation) around your home. If the 200-foot distance is on adjacent property, contact your local fire station for assistance in obtaining adequate clearance.

• Cut dry weeds and grass before noon when temperatures are cooler to reduce the chance of sparking a fire when using metal tools.

• Landscape with fire-resistant plants that are low-growing with high-moisture content.

• Keep woodpiles, propane tanks, and combustible materials away from your home and other structures, such as garages, barns, and sheds (recommended 30 feet).

• Ensure trees and branches are at least four feet away from power lines. Notify your power company if this condition exists; they will complete required work.

READY!

Inside

- Keep a working fire extinguisher on hand and train your family how to use it. Store in an easily accessible location (check expiration date regularly).

- Install smoke alarms on each level of your home and adjacent to the bedrooms. Test them monthly and change the batteries twice a year.

Non-Combustible Boxed-In (Soffit) Eaves

- Box-in eaves with non-combustible materials to prevent accumulation of embers.

Non-Combustible Fencing 7

- Make sure to use non-combustible fencing to protect your home during a wildfire.

Rain Gutters

- Screen or enclose rain gutters to prevent accumulation of plant debris.

Roof 8

- Your roof is the most vulnerable part of your home because it can easily catch fire from windblown embers.
- Homes with wood shake or shingle roofs are at a higher risk of being destroyed during a wildfire.
- Build your roof or re-roof with fire-resistant materials that include composition, metal, or tile.
- Block any spaces between roof decking and covering to prevent ember intrusion.
- Clear pine needles, leaves, and other debris from your roof and gutters.
- Cut any tree branches within 10 feet of your roof.

Vents

- Vents on homes are particularly vulnerable to flying embers.
- All vent openings should be covered with ⅛-inch or smaller metal mesh. Do not use fiberglass or plastic mesh because they can melt and burn.
- Attic vents in eaves or cornices should be baffled or otherwise to prevent ember intrusion (mesh is not enough).

Walls 9

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

Water Supply 10

- Have multiple garden hoses that are long enough to reach any area of your home and other structures on your property.

Windows 11

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

Utilities

- Ensure that your family knows where your gas, electric, and water main shut-off controls are and how to safely shut them down in an emergency.

SET!

Create Your Own Wildfire Action Plan

Now that you have done everything you can to protect your home, it's time to prepare your family. **Your Wildfire Action Plan must be prepared with all members of your household well in advance of a wildfire.** Each family's plan will be different, depending on their situation. Once you finish your plan, practice it regularly with your family, and post it in a safe and accessible place for quick implementation.

1 Important Phone Numbers

- ☐ A family communication plan that designates an out-of-area friend or relative as a point-of-contact to act as a single source of communication among family members in case of separation.
- ☐ Maintain a list of emergency contact numbers posted near your phone and in your Emergency Supply Kit (see page 12 in this guide).

2 What to Take

- ☐ Assemble an Emergency Supply Kit (see page 12 in this guide).
- ☐ Keep an extra Emergency Supply Kit in your car in case you can't get to your home because of fire.
- ☐ Have a portable radio or scanner, so that you can stay updated on the fire.

3 Prepare to Evacuate

- ☐ Designate an emergency meeting location, outside the fire or hazard area. It is critical to determine who has safely evacuated from the affected area.
- ☐ Have several different travel routes from your home and community identified. Practice these often, so everyone in your family is familiar in case of emergency.
- ☐ Have all of the necessary supplies and/or boarding options for your pets and large animals identified and/or packed. If trailers are necessary for larger animals, have a plan that is tested and ready to implement.

Your Personal
WILDFIRE ACTION PLAN

During High Fire Danger days in your area, monitor your local media for information on wildfires and be ready to implement your plan. Hot, dry, and windy conditions create the perfect environment for a wildfire.

1 IMPORTANT PHONE NUMBERS

EMERGENCY CONTACTS

Name

( ) Phone

Name

( ) Phone

SCHOOLS

Name

( ) Phone

Name

( ) Phone

FAMILY & FRIENDS

Name

( ) Phone

Name

( ) Phone

2 WHAT TO TAKE

- ○ Insurance Papers
- ○ Photos
- ○ Emergency Supply Kit
- ○ Prescriptions
- ○ Important Documents
- ○ ________

3 EVACUATION

WHEN TO GO

WHERE TO GO

HOW TO GET THERE

DESTINATION

WHO TO TELL (BEFORE AND AFTER)

ANIMAL SHELTER

Name

( ) Phone

LOS ANGELES COUNTY FIRE DEPARTMENT

IF YOU HAVE AN EMERGENCY, CALL 9-1-1

Public Information Office: (323) 881-2411

fire.lacounty.gov

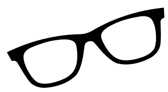
SET!

Assemble Your Emergency Supply Kit

Put together your emergency supply kit long before a wildfire or other disaster occurs, and keep it easily accessible, so you can take it with you when you have to evacuate. Plan to be away from your home for an extended period of time. Each person should have a readily accessible emergency supply kit. Backpacks work great for storing these items (except for food and water) and are easy to grab. Storing food and water in a tub or chest on wheels will make it easier to transport. Keep it light to be able to easily lift it into your vehicle.

Essential Supplies

- ☐ Three-day supply of non-perishable food and three gallons of water per person
- ☐ Map marked with at least two evacuation routes
- ☐ Prescriptions or special medications
- ☐ Change of clothing and closed-toe shoes
- ☐ Extra eyeglasses or contact lenses



- ☐ An extra set of car keys, credit cards, and cash
- ☐ First aid kit

- ☐ Flashlight
- ☐ Battery-powered radio and extra batteries
- ☐ Sanitation supplies
- ☐ Copies of important documents (e.g., birth certificates, passports, etc.)

- ☐ Don't forget food and water for your pets!

If Time Allows

- ☐ Easy-to-carry valuables
- ☐ Family photos and other irreplaceable items
- ☐ Personal computer data on hard drives/flash drives
- ☐ Chargers for cell phones, laptops, etc.

Pre-Evacuation Preparation Steps

When an evacuation is anticipated and if time permits, follow these checklists to give your home the best chance of surviving a wildfire:

Animals

- ☐ Locate your pets and keep them nearby.
- ☐ Prepare large animals for transport and think about moving them to a safe location early.

Inside

- ☐ Shut all windows and doors.
- ☐ Remove flammable window shades, lightweight curtains, and close metal shutters.
- ☐ Move flammable furniture to the center of the room, away from windows and doors.
- ☐ Leave your lights on, so firefighters can see your home under smoky conditions.
- ☐ Shut off the air conditioning.
- ☐ Shut off the gas meter and all pilot lights.

Outside

- ☐ Gather flammable items from the exterior of the house and bring them inside (e.g., patio furniture, children's toys, doormats, etc.) or place them in your pool.
- ☐ Turn off propane tanks. Move propane BBQ appliances away from structures.
- ☐ Connect garden hoses to outside water valves or spigots for use by firefighters.
- ☐ Don't leave sprinklers on or water running. They can affect critical water pressure.
- ☐ Leave exterior lights on.
- ☐ Put your emergency supply kit in your vehicle.
- ☐ Back your loaded vehicle into the driveway with all doors and windows closed. Carry your car keys with you.
- ☐ Have a ladder available in a conspicuous location for firefighter use.
- ☐ Seal attic and ground vents with a non-combustible material or commercial seals, if time permits.
- ☐ Monitor your property and your wildfire situation. Don't wait for an evacuation order, if you feel threatened and need to, leave.
- ☐ Check on neighbors and make sure they are preparing to leave.

GO!

TAKE ACTION IMMEDIATELY WHEN WILDFIRE STRIKES

Go Early

By leaving early, you will give your family the best chance of surviving a wildfire. You also help firefighters by keeping roads clear of congestion, enabling them to move more freely throughout the neighborhood and do their job.

When to Go

Leave early enough to avoid being caught in fire, smoke, or road congestion. Don't wait to be told by authorities to leave. In an intense wildfire, they may not have time to knock on every door. If you are advised to leave, don't hesitate!

The terms "Voluntary" and "Mandatory" are used to describe evacuation orders. However, local jurisdictions may use other terminology such as "Precautionary" and "Immediate Threat." These terms are used to alert you to the significance of the danger. All evacuation instructions provided by emergency personnel should be followed immediately for your safety.

Where to Go

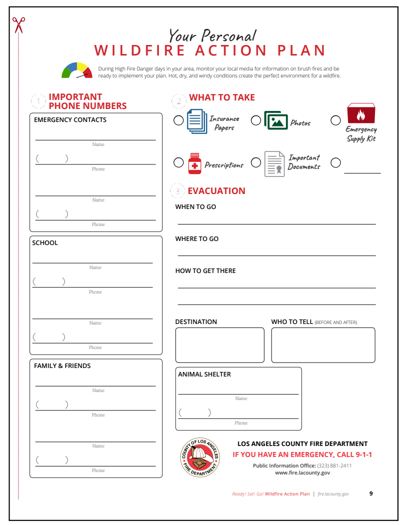
Leave for a pre-determined location. It should be a low-risk area, such as a well-prepared neighbor or relative's house, a Red Cross shelter or evacuation center, motel, etc.

How to Get There

Have several evacuation routes in case one route is blocked by the fire or by emergency vehicles and equipment. Choose an evacuation route away from the fire.

Follow these steps as soon as possible to get ready to GO!

- **Review your Wildfire Action Plan evacuation checklist.**



Your Personal
WILDFIRE ACTION PLAN

During High Fire Danger days in your area, monitor your local media for information on brush fires and be ready to implement your plan. Hot, dry, and windy conditions create the perfect environment for a wildfire.

1 IMPORTANT PHONE NUMBERS

EMERGENCY CONTACTS
Name
Phone
Name
Phone

SCHOOL
Name
Phone
Name
Phone

FAMILY & FRIENDS
Name
Phone
Name
Phone

2 WHAT TO TAKE

Insurance Papers
Photos
Emergency Supply Kit
Prescriptions
Important Documents

3 EVACUATION

WHEN TO GO

WHERE TO GO

HOW TO GET THERE

DESTINATION

WHO TO TELL (BEFORE AND AFTER)

ANIMAL SHELTER
Name
Phone

LOS ANGELES COUNTY FIRE DEPARTMENT
IF YOU HAVE AN EMERGENCY, CALL 9-1-1
Public Information Office: (323) 881-2411
www.fire.lacounty.gov

Ready! Set! Go! Wildfire Action Plan | fire.lacounty.gov 9

- Ensure your Emergency Supply Kit is in your vehicle.

- Cover up to protect against heat and flying embers. Wear long pants, a long-sleeve shirt, heavy shoes/boots, a cap, dry bandana (for face cover), goggles, or glasses. 100% cotton is preferable.

- Locate your pets and take them with you.

GO!

Survival Tips if You Become Trapped

In Your Home

- ☐ Stay calm and keep your family together.
- ☐ Call 9-1-1 and inform authorities of your location.
- ☐ Fill sinks and tubs for an emergency water supply.
- ☐ Keep doors and windows closed, but unlocked.
- ☐ Remove curtains from the windows.
- ☐ Turn your interior and exterior lights on.
- ☐ Stay inside your home.
- ☐ Shelter away from outside walls.

In Your Vehicle

- ☐ Stay calm.
- ☐ Park your vehicle in an area clear of vegetation.
- ☐ Close all vehicle windows and vents.
- ☐ Cover yourself with a wool or cotton blanket or jacket.
- ☐ Lie on the vehicle floor.
- ☐ Use your cell phone and call 9-1-1 to inform authorities of your location.

On Foot

- ☐ Stay calm.
- ☐ Go to an area clear of vegetation, a ditch or depression on level ground, if possible.
- ☐ Lie face down and cover up your body.
- ☐ Use your cell phone and call 9-1-1 to inform authorities of your location.

Returning Home After a Wildfire

Do not return home until emergency officials determine it is safe. You will receive proper notification to do so as soon as it is possible, considering safety and accessibility.

When You Return Home

- ☐ Be alert for downed power lines and other hazards.
- ☐ Check propane tanks, regulators, and lines before turning gas on.
- ☐ Check your residence carefully for hidden embers or smoldering fires.

Remember the Six P's

P

People and Pets

Papers, *phone numbers, and important documents*

Prescriptions, *vitamins, and eyeglasses*

Pictures *and irreplaceable memorabilia*

Plastic *(e.g., credit cards, ATM cards) and cash*

Personal computer *hard drives and flash drives*

OFFICIAL

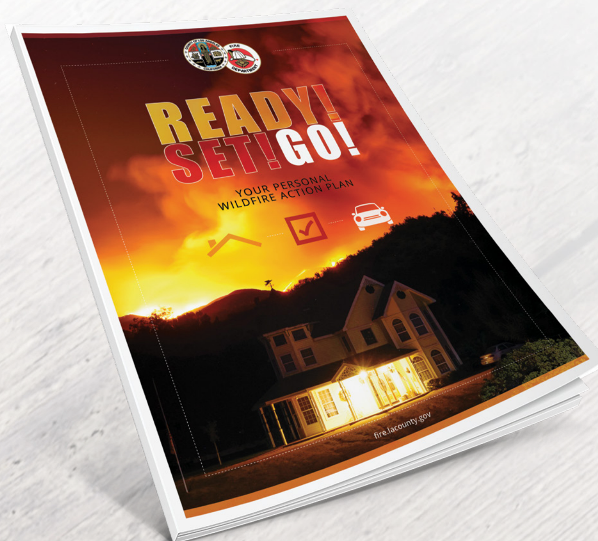
- facebook.com/LACoFD
- twitter.com/LACoFD
- instagram.com/lacountyfd
- youtube.com/user/LosAngelesCountyFD
- vimeo.com/user4029934

PUBLIC INFORMATION OFFICE

- twitter.com/lacofdpio
- twitter.com/lacofdespanol

LACOFD FOUNDATION

- facebook.com/LAFIRETEAM
- twitter.com/LACountyFire1
- instagram.com/lafireteam



Download the *Ready! Set! Go!* Wildfire Action Plan at fire.lacounty.gov/rsg or by scanning this QR code with your smart phone.

LOS ANGELES COUNTY
FIRE DEPARTMENT
Public Information Office

1320 N. Eastern Avenue
Los Angeles, California 90063
323-881-2411
fire.lacounty.gov

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LOS ANGELES COUNTY
FIRE DEPARTMENT FOUNDATION

1320 N. Eastern Ave.
Los Angeles, CA 90063
323-793-FIRE
supportlacountyfire.org

The Los Angeles County Fire Department Foundation
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Learn more or donate online at SupportLACountyFire.org
or donate by texting F-I-R-E-S to 44321.

Appendix J

Glossary of Terms

Glossary of Terms

BehavePlus: Fire behavior prediction and fuel modeling computer program designed to model fire behavior characteristics based on fuel, weather, and topographic inputs. Model outputs include flame length values, fire spotting potential, and rate of fire spread.

Brush: A collective term that refers to stands of vegetation dominated by shrubby, woody plants or low-growing trees; usually of a vegetation type undesirable for livestock or timber management.

Brush Fire: A fire burning in vegetation that is predominantly shrubs, brush, and scrub growth.

Burning Conditions: The state of the combined factors of the environment that affect fire behavior in a specified fuel type.

Canopy: The forest cover of branches and foliage formed by tree crowns. The stratum containing the crowns of the tallest vegetation present (living or dead), usually above 20 feet.

Chipping: Using a mechanical chipper to chip cut vegetation into small chips.

Closure: Legal restriction, but not necessarily elimination, of specified activities such as smoking, camping, or entry that might cause fires in a given area.

Combustible: Any material that, in the form in which it is used and under the conditions anticipated, will ignite and burn.

Conflagration: A raging, destructive fire. Often used to describe a fire burning under extreme fire weather. The term is also used when a wildland fire burns into a WUI, destroying structures.

Crown Fire: A fire that advances from top-to-top of trees or shrubs more or less independent of a surface fire.

Cured: The stage when herbaceous fuel moisture falls to 30% or less.

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 advancing wildfire. This will create an area for housing increased emergency fire equipment, for evacuating or sheltering civilians in place, and a point for fire suppression to occur.

Duff: The layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles and leaves and immediately above the mineral soil.

Exotic Pest Plant: A non-indigenous plant species, or one introduced to this state that either purposefully or accidentally escapes into the wild where it reproduces on its own either sexually or asexually.

Exposure: (1) Property that may be endangered by a fire burning in another structure or by a wildfire; (2) direction in which a slope faces, usually with respect to cardinal directions; (3) the general surroundings of a site with special reference to its openness to winds.

Extreme Fire Behavior: A level of fire behavior characteristics that ordinarily precludes methods of direct control. One or more of the following is usually involved: high rates of spread, prolific crowning and/or spotting, presence of fire whirls, a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environments and behave erratically, sometimes dangerously.

Fine Fuels: Fast-drying dead fuels that are less than 0.25-inch in diameter and are generally characterized by a comparatively high surface area to volume ratio. These fuels (grass, leaves, needles, etc.) ignite readily and are consumed rapidly by fire when dry.

Fire Behavior: The manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Department: Any regularly organized fire department, fire protection district or fire company regularly charged with the responsibility of providing fire protection to the jurisdiction.

Fire Front: That part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, it is assumed to be the leading edge of the fire perimeter.

Fire Hazard: A fuel complex, defined by volume, type condition, arrangement, and location that determines the degree of ease of ignition and of resistance to control.

Fire Hydrant: A valved connection on a piped water supply system having one or more outlets that is used to supply hose and fire department pumpers with water.

Fire Ladders: Areas where vegetation allows fire to quickly transmit from grass to brush and then to the canopy of trees, producing a high intensity fire with less potential for fire control.

Fire Prevention: Activities, including education, engineering, enforcement, and administration that are directed at reducing the number of wildfires, the costs of suppression, and fire-caused damage to resources and property.

Fire Protection: The actions taken to limit the adverse environmental, social, political, and economic effects of fire. Protection is relative, not absolute.

Fire Regime: Periodicity and pattern of naturally occurring fires in a particular area or vegetative type, described in terms of frequency, biological severity, and area of extent.

Fire Retardant: Any substance, except plain water, that by chemical or physical action reduces flammability of fuels or slows their rate of combustion.

Fire Season: (1) Period(s) of the year during which wildland fires are likely to occur, spread, and affect resource values sufficient to warrant organized fire management activities; (2) a legally enacted time during which burning activities are regulated by state or local authority.

Fire Triangle: Instructional aid in which the sides of a triangle are used to represent the three factors (oxygen, heat, fuel) necessary for combustion and flame production; removal of any of the three factors causes flame production to cease.

Fire Weather: Weather conditions which influence fire starts, fire behavior, or fire suppression.

Firebrand: Any source of heat, natural or human made, capable of igniting wildland fuels. Flaming or glowing fuel particles that can be carried naturally by wind, convection currents, or gravity into unburned fuels. Examples include leaves, pinecones, glowing charcoal, and sparks.

Firebreak: A natural or constructed barrier used to stop or check fires that may occur or to provide a control line from which to work.

Firefighter: A person who is trained and proficient in the components of structural or wildland fire.

Fireline: That portion of the fire upon which resources are deployed and actively engaged in suppression action. In a general sense, the working area around a fire.

Flame: A mass of gas undergoing rapid combustion, generally accompanied by evolution of sensible heat and incandescence.

Flammability: The relative ease with which fuels ignite and burn regardless of the quantity of the fuels.

Fuel Break: An area, strategically located for fighting anticipated fires, where the previously-occurring vegetation has been permanently modified or replaced so that fires burning into it can be more easily controlled. Fuel breaks divide fire-prone areas into smaller areas for easier fire control and to provide access for firefighting.

Fuel Loading: The volume of fuel in a given area generally expressed in tons per acre.

Fuel Model: Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

Fuel Modification: Any manipulation or removal of fuels to reduce the likelihood of ignition or the resistance to fire control.

Fuels: All combustible material within the WUI or intermix, including vegetation and structures.

Hazard: The degree of flammability of the fuels once a fire starts. This includes the fuel (type, arrangement, volume, and condition), topography, and weather.

Ignition Time: Time between application of an ignition source and self-sustained combustion of fuel.

Invasive Plant Species: A plant species that is not native to the region and has demonstrated the ability to aggressively outcompete native plant species that would normally colonize a given area.

Ladder Fuels: Fuels that provide vertical continuity allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease.

Limbing: To remove the lower branches from trees, brush or shrubs in an area to reduce fire ladders. The root structure of the plants is not disturbed.

McLeod: A firefighting tool used for scraping soil and small roots, and grasses to construct fire line. The tool head is a large hoe approximately 12 inches wide, with one side a solid scraping blade for scraping soil and the other side with metal fingers for scraping vegetation but leaving soil.

Mosaic: To reduce the total volume of vegetation within an area by removing vegetation in a cluster or mosaic pattern.

Multicutting: A vegetation management method where cut vegetation is reduced in size by cutting vegetation into lengths no longer than 6 inches on length. Multicut vegetation is then left on site no greater than 12 inches in depth.

Overstory: That portion of the trees in a forest that forms the upper or uppermost layer.

Peak Fire Season: That period of the year during which fires are expected to ignite most readily, to burn with greater than average intensity, and to create damages at an unacceptable level.

Pile Burn: A prescribed burn method where fire is ignited to individual piles within a project area. Vegetation in this method of burning is cut and piled into stacks within the project area and then burned.

Prescribed Burn: A wildland fire tool that uses the knowledgeable application of fire to a specific unit of land to meet predetermined fire and resource management objectives. Specific prescriptions for burning vegetation are developed for each area based on weather, topography, and fuel type.

Prescribed Fire: A fire burning within prescription. This fire may result from either planned or unplanned ignitions.

Protected Species: State- and federally listed Endangered or Threatened species of flora or fauna, and non-listed species otherwise protected by state and/or federal statutes.

Pruning: To selectively cut dead or live branches from trees, brush, or shrubs to reduce the total volume of flammable vegetation from a plant.

Pulaski: A firefighting tool used for digging out roots and soil to construct fire line. The head has one side with an axe blade and the other side with a hoe blade.

Rate of Spread (ROS): The speed at which a fire extends its horizontal dimensions, expressed in terms of distance per unit area of time. Generally thought of in terms of a fire's forward movement or head fire rate of spread.

Remote Automatic Weather Station (RAWS): A weather station at which the services of an observer are not required. A RAWS unit measures selected weather elements automatically and is equipped with telemetry apparatus for transmitting the electronically recorded data via radio, satellite or by a landline communication system at predetermined times on a user-requested basis.

Red Flag Warning Conditions: A **Red Flag Warning** is a forecast warning issued by the United States National Weather Service to inform area firefighting and land management agencies that conditions are ideal for wildland fire ignition and propagation. After drought conditions, and when humidity is very low, and especially when high or erratic winds that may include lightning are a factor, the Red Flag Warning becomes a critical statement for firefighting agencies, which often alter their staffing and equipment resources dramatically to accommodate the forecast risk.

Responsibility Area: That area for which a particular fire protection organization has the primary responsibility for attacking an uncontrolled fire and for directing the suppression action. Such responsibility may develop through law, contract, or personal interest of the fire protection agent. Several agencies or entities may have some basic responsibilities without being known as the fire organization having direct protection responsibility.

Riparian: An area of land adjacent to a stream, river, lake or wetland that contains vegetation that, due to the presence of water, is distinctly different from the vegetation of adjacent upland areas.

Sensitive Species: A plant or animal species with a special status listing from federal, state, or local regulatory agencies.

Slope: The variation of terrain from the horizontal; the number of feet rise or fall per 100 feet measured horizontally, expressed as a percentage.

Smoke: (1) The visible products of combustion rising above a fire; (2) term used when reporting a fire or probable fire in its initial stages.

Spotting: The ignition of unburned fuels ahead of the fire front as a result of ignition by firebrands. Spotting enhances the spread of wildfires.

Structure: A constructed object, usually a free-standing building above ground.

Structure Fire: Fire originating in and burning any part of all of any building, shelter, or other structure.

Suppression: The most aggressive fire protection strategy, it leads to the total extinguishment of a fire.

Surface Fuel: Fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.

Thinning: To reduce the total volume of trees, brush or shrubs within an area by completely cutting out dead and live plants from the area or to reduce the size or volume of an individual plant by cutting out dead and live branches.

Tree Crown: The primary and secondary branches growing out from the main stem, together with twigs and foliage.

Uncontrolled Fire: Any fire that threatens to destroy life, property, or natural resources and that (a) is not burning within the confines of firebreaks or (b) is burning with such intensity that it could not be readily extinguished with ordinary, commonly available tools.

Understory: Low-growing vegetation (herbaceous, brush or reproduction) growing under a stand of trees. Also, that portion of trees in a forest stand below the overstory.

Vegetation Management: The practice of reducing and/or rearranging both the green and dead biomass (vegetation) to reduce fire hazard, to reduce the potential damage associated with wildfire, and to improve environmental habitat. Vegetation management is synonymous with the term "vegetation or fuel reduction". Many different vegetation management methods may be used to reduce and/or rearrange both green and dead biomass.

Vegetation Management Unit: Delineated property unit based on parcel, topography, vegetation or other features used for vegetation management planning.

Weed: A plant species that interferes with a desired management objective. This term does not denote the native or non-native status of a plant species. Both native and non-native plants have the ability to interfere, depending on the objective.

Wildfire/Wildland Fire: A fire occurring that burns through vegetation, either in the urban interface or undeveloped areas

Wildland: An area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered.

Wildland Urban Interface (WUI): The area where structures and other human developments meet or intermingle with undeveloped wildland.

Source: www.firewise.org, Los Angeles County Fire Department, 2020, NWCG 2020