Mammoth Lakes, CA

Community Wildfire Protection Plan Update

2019

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FIGURES

MUTUAL AGREEMENT PAGE

This Community Wildfire Protection Plan developed by the Mammoth Lakes Fire Department:

- Was collaboratively developed. Interested parties, fire management agencies and federal land management agencies managing land in and/or adjacent to the study area have been consulted.
- This plan identifies and prioritizes areas for hazardous fuel reductions treatments and recommends the types and methods of treatment that will aid in protecting communities in the study area.
- This plan recommends measures to reduce ignitability of structures throughout the area addressed by the plan.

The following entities attest the standards listed above have been met and mutually agree with the content of this Community Wildfire Protection Plan:

Mammoth Lakes Fire Protection District, by Frank Frievalt, Chief

GORDON MARTIN

Digitally signed by GORDON MARTIN
Date: 2020.05.13 11:01:55 -07'00'

USFS, Inyo National Forest, by Gordon Martin, District Ranger

Town of Mammoth Lakes, California, by Daniel C. Holler, Town Manager

Dave Easterby

Mammoth Lakes Fire Safe Council, by Dave Easterby, President

Signature: Dave Easteby
Dave Easteby (May 13, 2020)

Email: dave.easterby.ngk3@statefarm.com

INTRODUCTION

This CWPP update was developed by the Mammoth Lakes Fire Department (MLFD) with support from the Town of Mammoth Lakes and the United States Forest Service (USFS). Information in this plan will be provided at the level of specificity determined by the community and appropriate agencies.

This document is the result of a study to identify and quantify changes in conditions or values at risk that could affect fire protection planning and response in the Wildland-Urban Interface (WUI) and Wildland Intermix (WI) portions of the study area. The WUI is also known as the Urban Edge Ember Zone. It is the area where encroaching wildland fuels could create a fire hazard to what would, in a different setting, be an urban development. The WI consists of communities where homes are surrounded by wildland fuels. This report neither replaces nor intends to duplicate information found in the 2017 joint Mono County and Town of Mammoth Lakes Local Hazard Mitigation Plan (LHMP). This study provides a more detailed analysis of the Town of Mammoth Lakes and the area included in the Mammoth Lakes Fire Protection District (MLFPD) boundary. As such, it should be considered an addendum to the LHMP. It focuses on the areas of greatest residential density and deals primarily with life safety and structural ignitability. Future updates may be useful should the need arise to focus on unpopulated or sparsely populated areas or other values at risk and areas of special interest.

This report updates information regarding MLFPD found in the 2009 Mono County CWPP. This includes a current analysis of the probability of a severe fire occurrence and expected severity of fire effects using updated technology as well as a detailed discussion of structural ignitability. New information on values at risk and progress on past projects has also been captured. This information allows for the prioritization of mitigation efforts. From an analysis of this data, solutions and mitigation recommendations are offered that will aid land managers, residents, fire officials and other collaborators in planning and implementation. This format is designed to help communities clarify and refine priorities for the protection of life, property, and critical infrastructure in the WUI/WI. It can also lead community members through valuable discussions regarding management options and implications for any areas of special interest.

For the purposes of this report the following definitions apply:

FireShed - No-HARM divides the landscape into units based on topography. FireSheds tend to correlate to the vegetation and the direction fires will burn in the absence of wind. FireSheds are useful for dividing the landscape into planning units and providing data in a spatial context that matches fire behavior. FireShed units tend to be roughly 150 to 200 acres in size.

Frequency - A simulation-based prediction of the probability of future wildfire occurrences derived from No-HARM. No-HARM assigns a numeric value of 1-50 where 1 is the least likely for a wildfire occurrence and 50 is the most likely. Frequency is different from probability of ignition in that frequency only considers ignitions likely to develop into fires large enough to create a significant threat to Values at Risk.

Hazard - The combination of the Wildfire Hazard Ratings (WHR) of the WUI/WI neighborhood surveys and the analysis of fire behavior potential, which is derived from No-HARM Severity analysis outputs. The principle elements of the WHR analysis have been integrated into the No-HARM model in this report to provide a single measure of hazard in the developed portions of the study area. Hazard attempts to quantify the severity of undesirable outcomes to the values at risk.

No-HARM - The National Hazard and Risk Model (No-HARM) is a decision support tool for wildfire hazard assessment. No-HARM calculates relative fire danger ratings by taking the predicted severity and the predicted frequency of wildfire in a given location and incorporating elements that affect the vulnerability of structures in and around communities. No-HARM gives a comprehensive view of the threat context a structure, or group of structures, is exposed to during a wildland fire.

Probability - The likelihood of a significant fire occurrence. This is primarily determined by the fire history of the area and a probability model (Frequency) derived from No-HARM.

Risk 50 - The result of the No-HARM composite analysis of Frequency, Severity and other input variables. By combining the likelihood of a significant fire occurrence and the severity of undesirable fire effects to the values at risk, Risk 50 assigns a numeric value to FireSheds where a 1 represents the lowest level of risk and 50 represents the most extreme level of risk.

Severity - An estimate derived from No-HARM of how severe fire behavior would be in the event of an ignition. No-HARM assigns a numeric value of 1-50 where 1 is the lowest severity and 50 is the highest.

Values at Risk - The tangible values identified by citizens and collaborators as being important to sustainable life in the study area (e.g., life safety, property conservation and critical infrastructure.)

Web Map Interface (WMI) - This web-based application provides capabilities for stakeholders within and adjacent to the Mammoth Lakes Fire Protection District to define and maintain information related to the CWPP. This includes capabilities to digitize planning boundaries and fuels reduction projects using interactive mapping tools. These tools provide stakeholders a way to easily update and maintain information regarding mitigation planning activities and achievements. This site is available at www.to be determined.org.

Wildfire Hazard Rating (WHR) - A model designed to evaluate communities within the Wildland Urban Interface/Wildland Intermix (WUI/WI) for their relative wildfire hazard. WHR focuses on structural ignitability and suppression factors and uses a different rating system from No-HARM which focuses on the Frequency and Severity of fire in the wildland fuels of the FireSheds. The analysis in this report incorporates the principle elements of the WHR model into the No-HARM model to provide a complete analysis in one rating system.

Wildland Intermix (WI) – Areas of concentrated residential development (communities) where homes are surrounded by wildland fuels. Homes in these areas exist in the context of natural fuels rather than as typical urban development.

Wildland-Urban Interface (WUI) – (AKA Urban Edge Ember Zone). The area where encroaching wildland fuels could create a fire hazard to structures that would in a different setting be considered a traditional urban development.

COLLABORATION: COMMUNITY AND AGENCIES

Organizations involved in the development of the Mammoth Lakes CWPP are listed below with their roles and responsibilities.

Mammoth Lakes Fire Department

Primary development of the CWPP and community outreach. Provides information support for hazard assessment, suppression capabilities and defensible space. Provides information regarding community values. Provides information regarding fuels treatment projects on non-federal land. Coordinates the development of community protection priorities and community input regarding the feasibility and desirability of mitigation project areas and methods.

US Forest Service

Provides input and expertise on federal lands, forestry, fire and fuels. Provides information regarding current and planned fuels treatment project areas and methods.

Town of Mammoth Lakes California

Aids in the planning and approval of the CWPP process regarding current and planned fuels management on Town owned parcels. Provides information regarding critical infrastructure and future development.

Mammoth Lakes Fire Safe Council

Aids in community outreach and input to the CWPP. Provides information regarding current and planned fuels treatment project areas covered by their grant funding.

GOALS AND OBJECTIVES

Strategic goals for this project include the following:

1. Enhance life safety of the residents, visitors, and responders.
2. Present methods to mitigate undesirable fire effects to property, infrastructure and the environment.
3. Enhance previous and existing efforts.

To accomplish these goals the following objectives have been identified for this report:

1. Establish an approximate level of probability (the likelihood of a significant wildfire event in the study area).
2. Provide a scientific analysis of the fire behavior potential of the study area.
3. Group relatively densely populated areas into residential "Hazard Zones" that represent relatively similar hazard factors.
4. Identify and quantify factors that limit (mitigate) undesirable fire effects to the Values at Risk and recommend actions to reduce those hazards.
5. Discuss existing mitigation efforts.
6. Quantify any significant changes related to hazards or Values at Risk that have taken place since the Mono County CWPP was written in 2009.

MLFD recognizes the potential for complex problems associated with the mission of achieving fire safety and healthy forest management and a need to balance this mission with environmental and economic concerns of the residents.

Study Area Overview

Introduction

Figure 1 shows the study area boundary and the ½ mile buffer used for No-HARM calculations. The study area is located entirely in Mono County and the town of Mammoth Lakes is the county's only incorporated community.[1] Administration of USFS lands in and adjacent to the study area is the responsibility of the Inyo National Forest. There are no State Responsibility Areas (SRA) in or adjacent to the Mammoth Lakes Fire Protection District, so in the study area all fire response and management outside of federal lands is the responsibility of MLFD.

The town of Mammoth Lakes lies at the edge of the Long Valley Caldera at an elevation of 7,880 feet. The town is surrounded by mountains and elevation increases sharply in the study area traveling north, south or west from the center of town, rising to 11,059 feet at the top of Mammoth Mountain Ski Area.[2]

The study area has a dry-summer, humid continental climate that normally averages 23 inches of rain and 206 inches of snow per year.[3] The wettest month is usually January and the driest, August. The average summer high temperature is 77.7 degrees F in July and the average winter low is 14.8 degrees F in January.[4]

The majority of the study area falls within the upper montane ecosystem. The most common conifer species are lodgepole pine, red fir and Jeffery pine. (**Figure 2**). The most common riparian deciduous species are aspen, mountain alder and willow.[5] In the lower elevations to the southeast of the town of Mammoth Lakes small to medium height shrub stands consisting principally of manzanita and ceanothus are dominant in the undeveloped areas. (**Figure 3**).

Residential Hazard Zones

The study area has been divided into ten "hazard zones" which comprise the most densely populated portions of the WUI/WI (**Figure 4**). These zones are not based on political or traditional neighborhood boundaries, but rather on factors relating to wildfire propagation and impacts. In the case of Mammoth Lakes, the hazard zones are divided principally by WUI vs WI, changes in topography and vegetative density and changes in structure construction types, materials and density. These boundaries are somewhat different from the "community" boundaries described in the 2009 CWPP due to physical changes caused by fuels treatment and additional development, improvements in hazard and probability analysis methodology and additional information provided by No-HARM.

Hazard Zone A incorporates a portion of what was described as the North Mammoth Lakes community in the 2009 CWPP, which includes the area of concentrated development north of Main Street and East of Minaret Road. Hazard Zone B incorporates parts of the North Mammoth Lakes, Bridges/Greyhawk and Juniper Ridge communities described in the 2009 CWPP. Hazard Zone C had little residential development and consisted of primarily golf course in 2009. Hazard Zone D consists primarily of the areas described as the Valley Vista and Snow Creek communities in the 2009 CWPP. Hazard Zone E includes the area described as Sierra Valley Estates in the 2009 plan. Hazard Zone F includes the area described as The Trails in the 2009

plan. Hazard Zone G includes a portion of the Old Mammoth/Bluffs community and Hazard Zone H includes the remainder of the Old Mammoth/Bluffs community described in the 2009 CWPP. Hazard Zone I contains the Ranch Road community and additional residential development completed since 2009. Hazard Zone J incorporates the residential portions of the Lakes Basin, which was described in the 2009 CWPP as the Lake Mary Area community.

Primary access is via CA 203 from US 395, however it's also possible to access the town of Mammoth Lakes from US 395 via the Mammoth Scenic Loop. CA 203 (Minaret Road) is closed west of Mammoth Mountain Ski Area in winter. The study area has two MLFD Stations. MFLD Station 1 is located at 3150 Main Street and Station 2 is located at 1574 Old Mammoth Road. The Inyo National Forest (USFS) maintains a Ranger Station at 2510 Main Street in Mammoth Lakes and operates a seasonal mitigation crew.

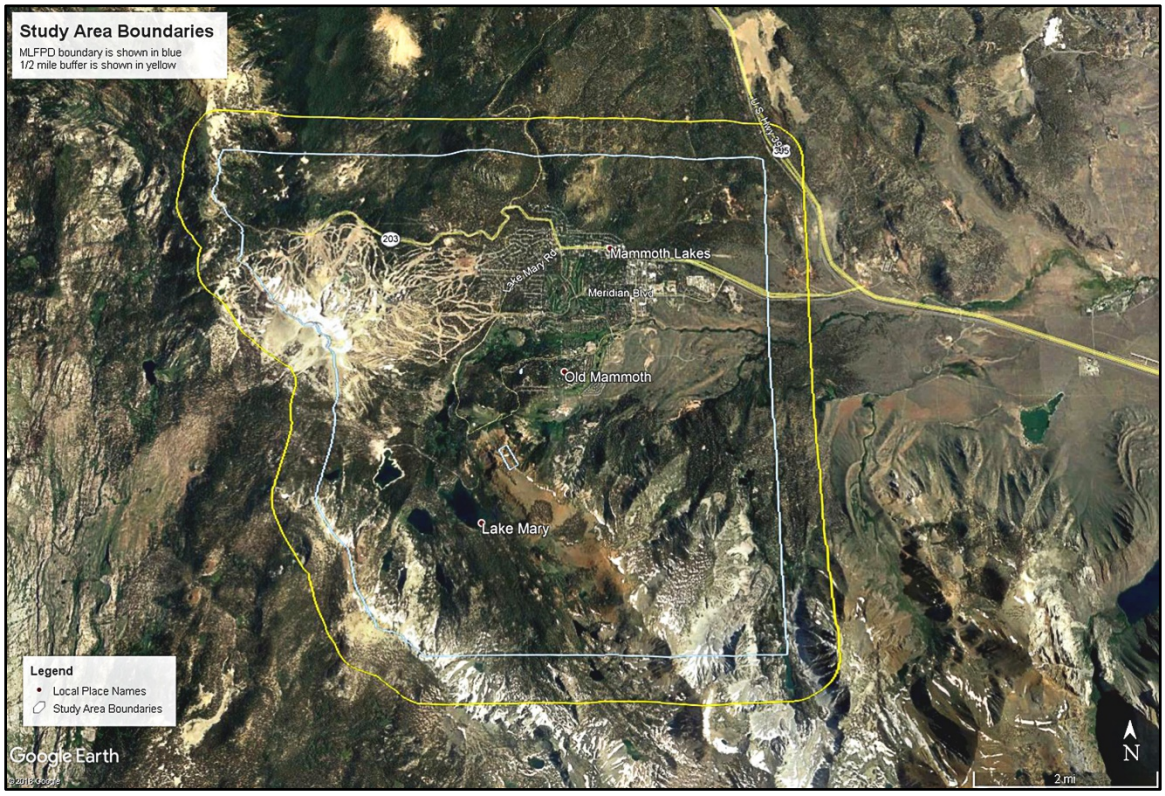

Figure 1 Study Area Overview

Figure 2 Typical vegetation in the upper montane zone surrounding Mammoth Lakes

Figure 3 Typical vegetation in the shrub-dominated areas

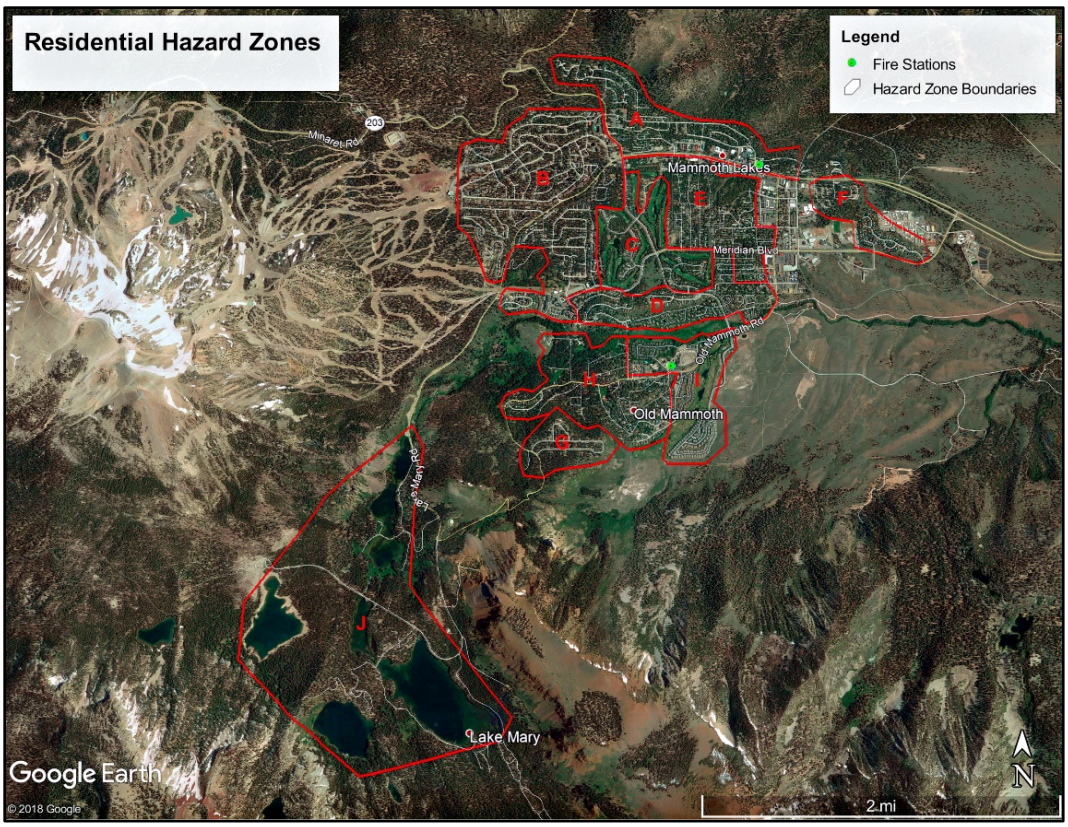

Figure 4 Residential Hazard Zones

VALUES AT RISK

Life Safety, Homes, and Commerce

Mammoth Lakes has an estimated population of 8,132 according to the most recent United States census estimates. Although this is a 14.65% increase from the 7,093 residents reported by the 2000 census, it's a 1.20% decrease from the 8,231 residents reported by the 2010 census, indicating growth in this area has been relatively flat in the current decade.[6] Of the 9,934 housing units reported only 2,820 are occupied by full-time residents. Of those, 1,106 are reported to be owner occupied and 1,722 renter occupied.[7] These statistics indicate that as many as 71% of the residential structures may be uninhabited or occupied only for seasonal, recreation or occasional use. This is supported by a www.neighborhoodscout.com report of a vacancy rate of 71.6% for homes in the area.[8]

The economy of the study area is heavily dependent on tourism. Wikipedia reports 4,599 rental units in Mammoth Lakes, or approximately 54% of all residential units. These rental units and the lodging industry are reported to represent approximately two-thirds of the gross revenue of Mammoth Lakes.[9] Mammoth Mountain Ski Area is one of California's top ski resorts.[10] In addition to snow sports, other recreational draws include natural hot springs, alpine lakes, extensive camping, backpacking and hiking opportunities. The study area is the gateway to the Ansel Adams and John Muir Wilderness areas. Mammoth Lakes also provides the primary access route to the Devil's Postpile National Monument.

Areas of Special Interest

Areas of Special Interest (ASI) are non-residential areas considered to contain physical properties or values likely to have considerable effect on people, property or the environment of the study area in the event of damage from a significant wildfire. The following five ASIs were identified in the study area:

- Valentine Reserve (UC Santa Barbara)
- Lakes Basin Water Treatment Plant
- Mammoth Mountain Ski Village
- Camp High Sierra
- Town-owned vacant parcels

The importance of these areas and specific recommendations regarding them are discussed in the *Areas of Special Interest* section of this document.

PROBABILITY SITUATION

For the purposes of this report, Probability is the likelihood of a significant fire occurrence. This is primarily determined by the fire history of the area and No-HARM Frequency modeling.

This portion of the eastern Sierra Nevada Mountains has a moderately active fire history. The only large fire (greater than 100 acres) to burn within three miles of the study area from 2000 to 2017 was the Sherwin fire (2008), however other large fires including the Owens fire (2018), Lions fire (2018), Owens River fire (2016), Clark fire (2016), and the McLaughlin fire (2001) all burned within ten miles of the study area. These five fires burned over 24,000 acres. The Lions fire alone burned 13,347 acres in the Inyo National Forest and burned to within seven miles of Mammoth Lakes. At least five smaller fires have burned within ten miles of the study area during the same period. Although further away, smoke from the 62,883 acre Ferguson fire, which resulted in closures in Yosemite National Park, impacted the study area in the summer of 2018. **Figure 5** shows the perimeters of some of the most significant fires in the general area from 2000 to 2018.

To predict the likelihood of a significant wildfire event No-HARM inputs 300,000 points of ignition. These simulated fires are run across three weather scenarios. Areas where fires stack (modeling shows repeated fires in the same area) indicate an increased likelihood of a significant fire occurrence. No-Harm assigns a value between one and 50 to each FireShed based on an aggregation of all the pixels in that FireShed. A value of one indicates the lowest probability of significant wildfire and 50 the highest. Adjective ratings in No-HARM are as follows: 10 or less = Low, 11-20 = Moderate, 21-30 = High, 31-40 = Very High and >40 = Extreme.

Throughout the study area No-HARM rates Frequency between one and nine out of 50. This range of ratings indicates the likelihood of a significant fire occurring is low. It is important to note; however, this rating is based on a historical analysis and the trend over the last two years is toward an increasing number of large fires in this part of the eastern Sierras. For more detailed information regarding the Frequency analysis please see the WMI.

Based on the fire history and the No-HARM Frequency assessment, the study area should currently be considered at a moderate risk for significant fires, but if the trend of increasing numbers of large fires continues in this part of the eastern Sierras the probability of a significant wildfire occurrence in the study area could also increase.

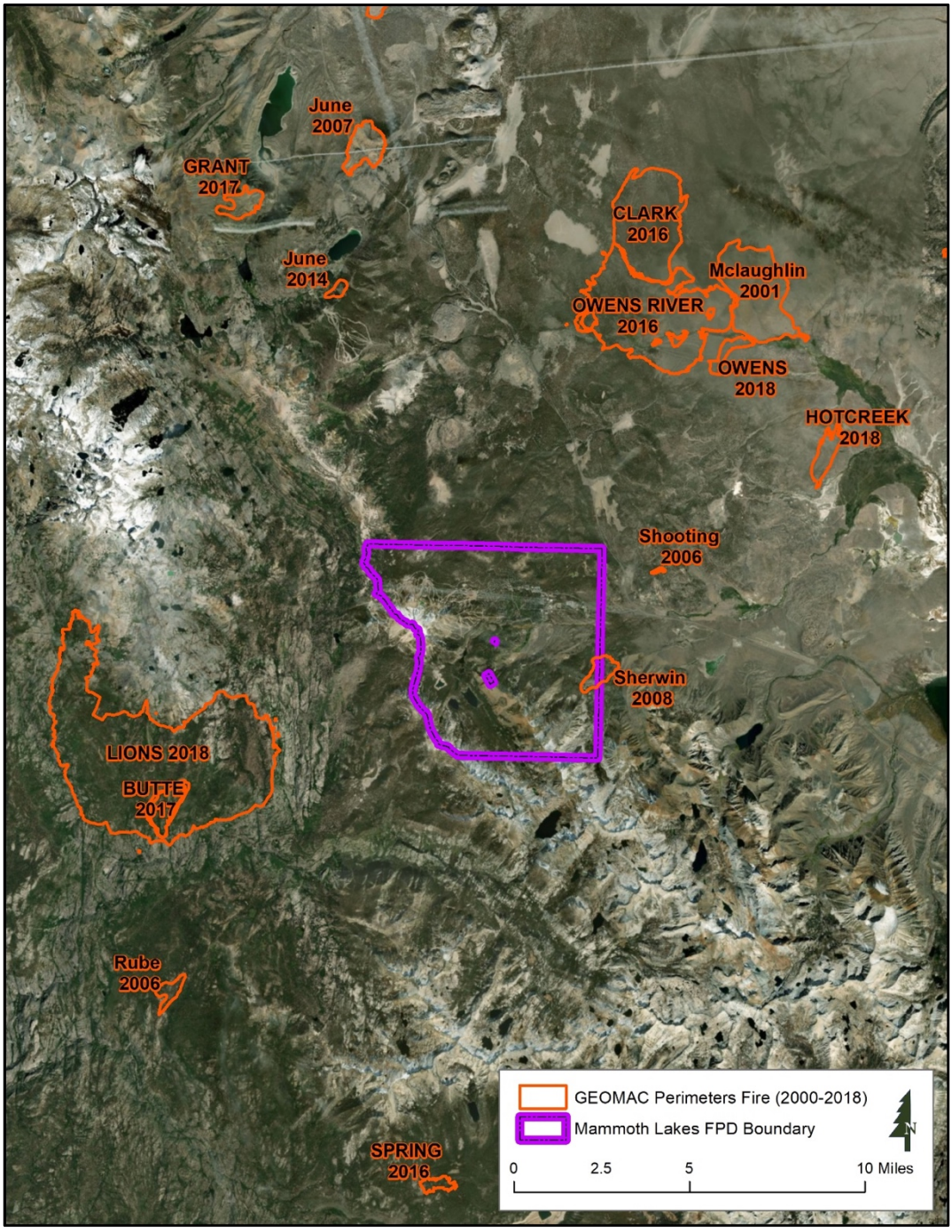

Figure 5 Significant Fire Perimeters 2000-2018

No-HARM Ratings

No-HARM Severity ratings attempt to quantify the severity of fire effects on values at risk and the ecosystem by combining flame length and crown fire development into a single rating. Like other numeric ratings generated by No-HARM, Severity assigns a value between 1 and 50 to each FireShed based on an aggregation of all the pixels in that FireShed. A value of one indicates the lowest severity of damaging fire effects and 50 the highest. It is important to understand the Severity model may under-predict the effects of ember cast, especially under extreme weather conditions.

The No-HARM Risk 50 rating is a mathematical model combining Severity with Frequency. That is to say the model takes into account both the likelihood of a significant fire developing within the rated FireShed and the severity of damaging fire effects to create a composite rating of fire risk in that FireShed. Although the majority of the weighting in the model is in these two elements, other factors are included in the Risk 50 rating and vary depending on whether FireSheds are located in the Wildland-Urban Interface (WUI), Wildland Intermix (WI) or wildland. As with other No-HARM ratings, a value of one indicates the lowest risk and 50 the highest.

No-HARM is based on an analysis of wildland fire behavior and, other than the exclusion of non-burnable areas, does not take structural flammability into consideration. In order to provide a complete analysis in a single rating scale the principle elements of the WHR model of structural ignitibility and operational response factors have been incorporated into the No-HARM Risk 50 rating for the residential hazard zones described in this study.

WHR was developed specifically to evaluate communities within the WUI/WI for their relative wildfire hazard. The WHR model combines physical infrastructure such as structure density and roads, and the fire behavior Severity modeling of No-HARM, with the field experience and knowledge of wildland fire experts. It has been proven and refined by use in rating thousands of neighborhoods throughout the United States. Much of NFPA 1144 has been integrated into this methodology to ensure compatibility with national standards. Additionally, aspects of NFPA 1142 regarding water supply for rural and suburban firefighting are included in the assessments by looking at proximity and capacity of the water supply.

This model was developed from the perspective of performing structural triage on a threatened community in the path of an advancing wildfire with No-HARM predicted fire behavior for average conditions on a fire season day. The WHR survey and fuel model ground-truthing are accomplished by field surveyors with WUI/WI fire experience. WHR ratings are related to what's customary for the area. For example, a high-hazard area on the plains of Kansas may not look like a high-hazard area in the Sierra Nevada. The system creates a relative ranking of community hazards in relation to the other communities in the study area. For the No-HARM analysis of the residential Hazard Zones described in the *Community Ignitability Analysis* section of this report WHR ratings have been incorporated into the No-HARM Risk 50 rating for each Hazard Zone.

Firefighting Capabilities and Local Preparedness

Fire suppression services in the study area are provided by the Mammoth Lakes Fire Protection District (MLFPD) and the Mammoth Ranger District of the Inyo National Forest. The Mammoth Lakes Fire Protection District (MLFPD) covers approximately 24 square miles, however only 4.6 square miles of this area is not on federal land. Visitation to the area can result in as many as 40,000 people in the district on peak weekends and holidays.[11] There are no State Responsibility Areas (SRA) in, or adjacent to, MLFPD. All fire response and management outside of federal lands is the responsibility of MLFD.

MLFD is a combination department with eight full-time and 45 part-time personnel. MLFD has two fire stations located in the study area. Initial response is provided by full-time firefighters working out of MLFD Station 1 at 3150 Main Street. Additional resources are available at MLFD Station 2 located at 1574 Old Mammoth Road; however, this station is usually unmanned.

Wildland fire responsibilities within the Inyo National Forest are managed by the USDA Forest Service (USFS). USFS maintains a ranger station at 2510 Main Street in Mammoth Lakes and operates a seasonal mitigation crew.

CAL FIRE occasionally provides manpower for fuels mitigation projects conducted by MLFD on town-owned undeveloped parcels; however, since there are no SRAs in or adjacent to MLFPD CAL FIRE does not participate in wildfire operations or mitigation planning in the study area.

In high severity periods agreements with the California Military Department allow for California National Guard resources to provide aid in wildfire response including their Modular Airborne Fire Fighting System (MAFFS), helicopters, support personnel, communications equipment and other resources.[12]

Recommendations

Apparatus/Equipment

- Consider purchasing an additional Type VI engine to be housed at Station 2. This engine would provide a rapid response rig for wildfires originating in Old Mammoth or the Lakes Basin. It could also serve as an additional initial attack vehicle and backup for the primary Type VI engine housed at Station 1.
- Consider purchasing an additional water tender to be housed at Station 2. This apparatus could be used to provide quick water support for fires in the Lakes Basin or on Valentine Reserve.
- Ensure all firefighters have adequate wildland personal protective equipment (PPE) including radios and new generation fire shelters.
- Acquire additional wildland fire packs fitted for new generation fire shelters and retire from service any wildland fire pack designed for the older fire shelters as these are not compatible with new generation shelters.

- Be sure enough additional PPE is on hand to outfit new recruits.
- Pursue grants and other funding opportunities to purchase additional wildland PPE and equipment, such as the Federal Emergency Management Agency (FEMA) Assistance to Firefighters Grant Program.[13]

Training

Some, perhaps all, of the recommendations below may already be in practice by MLFD, therefore, the following recommendations focus on maintenance of policy as well as providing a guideline of recommended minimum standards.

- Require, or continue to require, S130/190 for all firefighters.
- Require, or continue to require, an annual refresher and certification for all firefighters similar to how CAL FIRE annually certifies their fire season readiness with their Fire Preparedness Exercise every spring.
- Encourage personnel to take additional beneficial courses including; S-215 *Fire Operations in the Urban Interface*, S-290 *Intermediate Fire Behavior*, L-380 *Fireline Leadership* as well as I-200 *Basic ICS.*
- Encourage personnel to seek higher qualifications and participate in out-of-district assignments.
- Consider agreements that allow for cooperative training between volunteers (Paid Call Firefighters), MLFD professional firefighters and USFS wildfire responders. Joint training exercises are desirable and recommended in other plans.

COMMUNITY IGNITABILITY ANALYSIS

Purpose

The purpose of dividing residential areas into hazard zones is to perform a structural ignitability analysis in order to sort residential areas into hazard categories for prioritization of recommendations. This is accomplished by the use of No-HARM ratings weighted with the Wildfire Hazard Rating (WHR) tool, which is intended to analyze Wildland Urban Interface and Wildland Intermix (WUI/WI) development.

Methodology

No-HARM Risk 50 ratings, weighted with the WHR model as described above, have been included in the description of the residential Hazard Zones presented below. Adjective ratings in No-HARM are as follows: 10 or less = Low, 11-20 = Moderate, 21-30 = High, 31-40 = Very High and >40 = Extreme. For an introduction to the methodology behind these ratings please see the *No-HARM Ratings* section of this report. For a more complete understanding of No-HARM ratings and their context in this study area please see the Web Map Interface (WMI).

Introduction

There are ten residential hazard zones in the study area. No-HARM calculates a Risk 50 score that sorts these zones into one of five adjective rating categories: low, moderate, high, very high and extreme. These residential hazard zone boundaries are somewhat different from the "community" boundaries described in the 2009 CWPP due to physical changes caused by fuels treatment and additional development, improvements in hazard and probability analysis methodology and additional information provided by No-HARM.

Hazard Zone A incorporates a portion of what was described as the North Mammoth Lakes community in the 2009 CWPP, which includes the area of concentrated development north of Main Street and East of Minaret Road. Hazard Zone B incorporates parts of the North Mammoth Lakes, Bridges/Greyhawk and Juniper Ridge communities described in the 2009 CWPP. Hazard Zone C had little residential development and consisted of primarily golf course in 2009. Hazard Zone D consists primarily of the areas described as the Valley Vista and Snow Creek communities in the 2009 CWPP. Hazard Zone E includes the area described as Sierra Valley Estates in the 2009 plan. Hazard Zone F includes the area described as The Trails in the 2009 plan. Hazard Zone G includes a portion of the Old Mammoth/Bluffs community and Hazard Zone H includes the remainder of the Old Mammoth/Bluffs community described in the 2009 CWPP. Hazard Zone I contains the Ranch Road community and additional residential development completed since 2009. Hazard Zone J incorporates the residential portions of the Lakes Basin, which was described in the 2009 CWPP as the Lake Mary Area community.

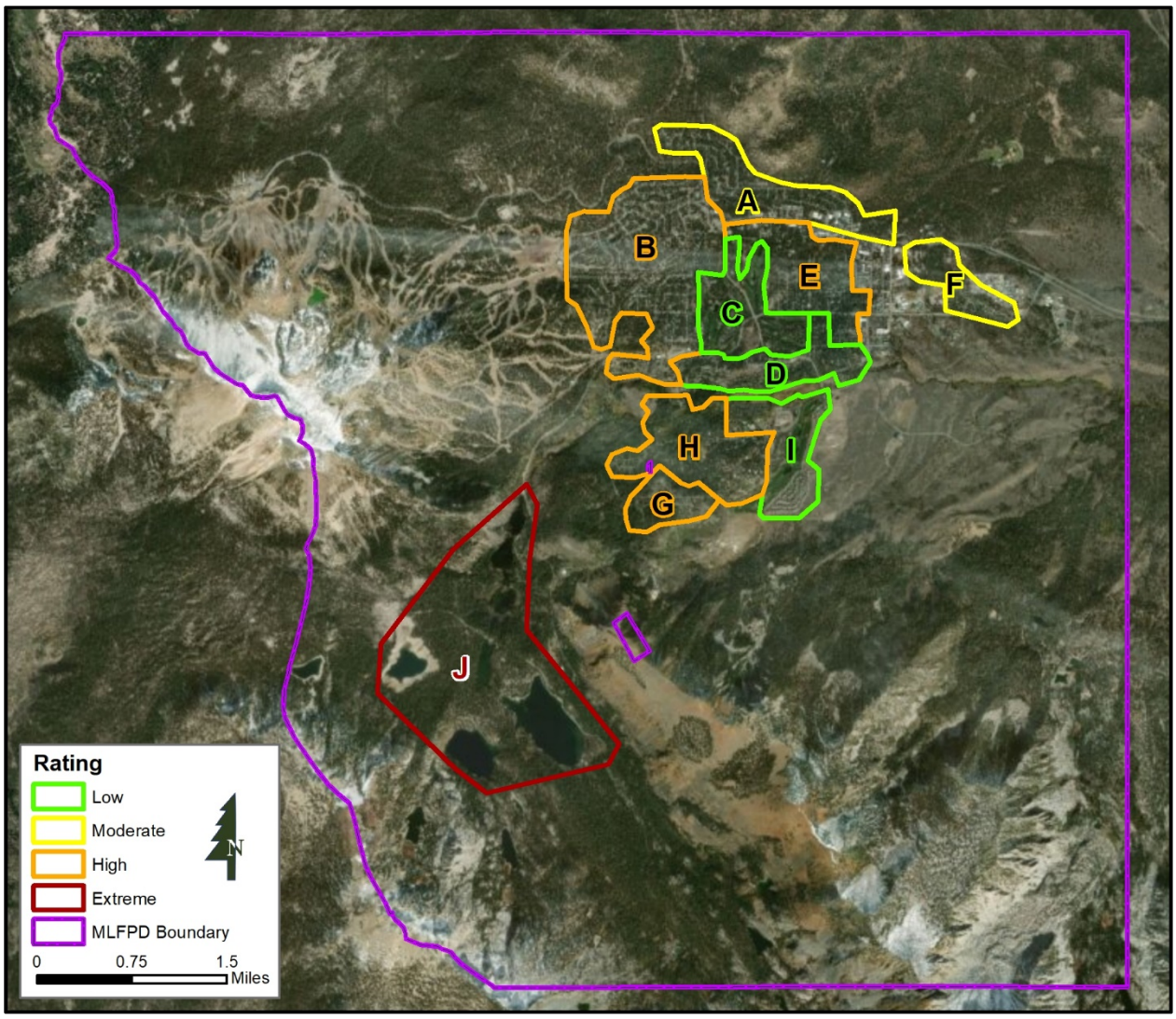

Figure 6 Hazard Zones with No-HARM Ratings

Structural Ignitability Discussion – Hazard Zone A

Figure 7 Hazard Zone A

Hazard Rating:	**Moderate**
Utilities Above or Below Ground:	Mixed
General Construction:	Wood siding with ignition resistant roofs
Average Lot Size:	< 1 acre
Dual Access Roads:	Yes
Road Widths, Slope and Surface:	Variable, but generally good
Water Supply:	Hydrants
Proximity to Fire Station:	< 1 mile

Zone Characteristics and Hazards

Single-family homes, and small apartment/condo buildings on small lots are the dominant structures. The average lot size is 0.22 acres. Most residences are older construction and generally small to medium size. Most homes have combustible siding with an asphalt shingle or metal roof, but there are some shake roofs in this zone. Many homes have flammable decks, projections or fences and most have flammable ornamental plantings or native vegetation too close to the structure. This is an urban edge community and is completely surrounded by moderate to heavy conifer forest on the north side. Some areas have underground electric and others have powerlines. Most homes have propane tanks. Water supply for this zone is provided by the municipal hydrant system. The terrain is gently rolling with an average slope of five degrees. The average slope aspect is east. The average road grade in this area is 5%. Roads are generally good and of adequate width, but there are a few dead-end roads and long driveways. These are areas where apparatus access and turnaround could be difficult.

Structural Ignitability Discussion – Hazard Zone B

Figure 8 Hazard Zone B

Hazard Rating:	**High**
Utilities Above or Below Ground:	Primarily underground
General Construction:	Primarily combustible siding with mixed roofs
Average Lot Size:	<1 acre
Dual Access Roads:	Yes, but see text
Road Widths, Slope and Surface:	Variable
Water Supply:	Hydrants
Proximity to Fire Station:	1.7 miles

Zone Characteristics and Hazards

This high-density area is composed of mostly small to medium size homes, but there are some larger homes and many apartment/condo buildings. The average lot size is 0.12 acres. Most residences are older construction with combustible siding and an asphalt shingle or metal roof, but there are more shake roofs in this zone than Zone A. Many homes have flammable decks, projections or fences and most have flammable ornamental plantings and/or native vegetation too close to the structure. Although this area has a high density of structures, moderate to heavy fuel loads exist throughout. Camp High Sierra is located on the southwest border of this zone. It has little development and is a significant natural fuel island. Most areas have underground electric but there are homes with above ground propane tanks. Water supply for this zone is provided by the municipal hydrant system. Slopes are low to moderate in the northern portion but become steeper further south and west with ravines and chimneys. The average slope is 6º and the average aspect is southeast. The average road grade in this area is 6%. Roads are generally good and of adequate width, but there are some narrow roads and steep sections. Most of this area has multiple access, however the Juniper Road area is one way in and out.

Structural Ignitability Discussion – Hazard Zone C

Figure 9 Hazard Zone C

Hazard Rating:	**Low**
Utilities Above or Below Ground:	Above ground
General Construction:	Primarily combustible siding with ignition resistant roofs
Average Lot Size:	<1 acre
Dual Access Roads:	Yes, see text
Road Widths, Slope and Surface:	Good
Water Supply:	None
Proximity to Fire Station:	1.25 miles

Zone Characteristics and Hazards

This area is composed of mostly small to moderate size, single-family homes, townhouses and condo buildings. There are, however, some larger homes in the south end of this zone. Although homes are close together and the average lot size is 0.12 acres, this is a much lower density area than Zone B. Homes are built along golf course fairways. The golf course runs throughout this area and provides significant fuel breaks between neighborhoods. There is a mix of older and newer construction. Most homes are built with flammable siding and an ignition resistant roof. Some homes have flammable decks, projections or fences. Some have defensible space, but most have flammable ornamental plantings and/or native vegetation too close to the structure. Natural vegetation in this zone exists as stringers and islands with moderate fuel loads. There are large sections of irrigated grass because of the golf course. Most utilities are underground in this zone. Water supply for this zone is provided by the municipal hydrant system. This area is mostly flat with an average slope of 2º and an average road grade of 3%. Slopes are generally north facing. Roads are generally good and of adequate width. Although this area can be accessed from the north, south and east, there are some long dead end roads and cul-de-sacs.

Structural Ignitability Discussion – Hazard Zone D

Figure 10 Hazard Zone D

Hazard Rating:	**Low**
Utilities Above or Below Ground:	Underground
General Construction:	Primarily combustible siding with ignition resistant roofs
Average Lot Size:	<1 acre
Dual Access Roads:	Yes, but see text
Road Widths, Slope and Surface:	Variable
Water Supply:	Hydrants
Proximity to Fire Station:	1.3 miles

Zone Characteristics and Hazards

Although there are some moderate size single-family homes, this area is dominated by townhouses and apartment/condo buildings. There are also several trailer and modular homes in the northern part of this zone. This is a high-density area and the average lot size is 0.13 acres. Most home construction is older with combustible siding and an asphalt shingle or metal roof. Many structures have flammable decks, projections or fences and most have flammable ornamental plantings and/or native vegetation too close to the structure. Some also have firewood stacked up against the structure. Tree and shrub vegetation is thinner here, but still exists as light to moderately heavy loads near homes and in stringers and islands broken by grasses and development. Most areas have underground utilities. Water supply for this zone is provided by the municipal hydrant system. This area is mostly flat with slightly greater slope on the west side. This zone has an average slope of 3º and an average road grade of 4%. Slopes are generally northeast facing. Roads are good and of adequate width. Although there are several dead-end roads, most end in large parking lots that would be more than adequate for apparatus access and turnaround.

Structural Ignitability Discussion – Hazard Zone E

Figure 11 Hazard Zone E

Hazard Rating:	**High**
Utilities Above or Below Ground:	Above ground
General Construction:	Primarily combustible siding with mixed roof types
Average Lot Size:	<1 acre
Dual Access Roads:	Yes
Road Widths, Slope and Surface:	Variable, see text
Water Supply:	Hydrants
Proximity to Fire Station:	< 1 mile

Zone Characteristics and Hazards

This zone is dominated by small homes and small apartment buildings. This is a high-density area and the average lot size is 0.12 acres. Most home construction is older with combustible siding. Many structures have wood shake roofs, flammable decks, projections and/or fences. Some have wood shake siding and architectural features. There are many flammable outbuildings. Flammable native vegetation is too close to most structures. There are many wood burning fireplaces and many buildings have firewood stacked up against the structure. Moderate to heavy loads of natural fuels exist throughout this zone. Above ground power lines and propane tanks exist throughout this zone. Water supply for this zone is provided by the municipal hydrant system. This area is mostly flat with an average slope of 2º and an average road grade of 4%. Slopes are generally northeast facing. Roads are narrow and some dead-ends and driveways are not paved. There are areas where apparatus access and turnaround could be difficult.

Structural Ignitability Discussion – Hazard Zone F

Figure 12 Hazard Zone F

Hazard Rating:	**Moderate**
Utilities Above or Below Ground:	Underground
General Construction:	Primarily combustible siding with ignition resistant roofs
Average Lot Size:	<1 acre
Dual Access Roads:	No, see text
Road Widths, Slope and Surface:	Good
Water Supply:	Hydrants
Proximity to Fire Station:	< 1 mile

Zone Characteristics and Hazards

This zone is dominated by moderate size homes on small lots in the south end and a trailer park in the north end. The average lot size is 0.26 acres. Most of the single-family home construction appears to be 20 to 40 years old with combustible siding and an asphalt shingle or metal roof. Many structures have flammable decks, projections or fences and most have flammable ornamental plantings and/or native vegetation too close to the structure. Tree and shrub vegetation is thinner in the southern part of this zone and a large commercial development provides a significant fuel break to the east. The trailer park is surrounded by moderate fuel loads of trees and shrubs. Utilities are underground in this zone. Water supply is provided by the municipal hydrant system. This area is mostly flat with an average slope of 2º and an average road grade of 3%. Slopes are generally southeast facing. Roads are good and of adequate width. Although Wagon Wheel Road is a loop, both ends connect to Meridian Boulevard which is the only way in and out of the south side of this zone. The trailer park on the north side can only be accessed from Main Street.

Structural Ignitability Discussion – Hazard Zone G

Figure 13 Hazard Zone G

Hazard Rating:	**High**
Utilities Above or Below Ground:	Mixed, see text.
General Construction:	Primarily combustible siding with ignition resistant roofs
Average Lot Size:	<1 acre
Dual Access Roads:	No, see text
Road Widths, Slope and Surface:	Variable, see text
Water Supply:	Hydrants
Proximity to Fire Station:	3.1 miles

Zone Characteristics and Hazards

This zone has two distinct areas, The Bluffs and The Mill City Tract. Homes in The Bluffs tend to be large to moderate size and newer construction. They have a mixture of wood siding and masonry. Roofs in this area are ignition resistant. The average lot size is 0.47 acres. The Mill City Tract consists of seasonal cabins mostly abandoned due to toxic metal contamination. Construction in the Mill City Tract tends to be combustible siding with an asphalt roof. Throughout this zone many structures have flammable decks, projections or fences. A few have defensible space, but most have flammable ornamental plantings and/or native vegetation too close to the structure. This zone is surrounded by heavy fuel loads to the north and west. The Lost Lane fuels reduction project was designed to slow fires moving from the west into this zone. Utilities are underground in The Bluffs and above ground in the Mill City Tract. Some of the abandoned structures in the Mill City Tract still have propane tanks connected. Water supply is provided by the municipal hydrant system, however there is only one hydrant in the Mill City Tract. As the name suggests The Bluffs are located on a plateau surrounded by steep cliffs. This zone has an average slope of 11º and an average road grade of 7%. Roads are good and of adequate width in the Bluffs. The dead-end access into the Mill City Tract is narrow and unpaved. Mill Street and LeVerne Street form a loop which is the only access into The Bluffs. They both connect back into Old Mammoth Road less than 200 feet from each other.

Structural Ignitability Discussion – Hazard Zone H

Figure 14 Hazard Zone H

Hazard Rating:	**High**
Utilities Above or Below Ground:	Above ground
General Construction:	Primarily combustible siding with ignition resistant roofs
Average Lot Size:	<1 acre
Dual Access Roads:	No, see text
Road Widths, Slope and Surface:	Generally good, see text
Water Supply:	Hydrants
Proximity to Fire Station:	<2 miles

Zone Characteristics and Hazards

Single-family homes, and small apartment/condo buildings are the dominant structures. The average lot size is 0.37 acres. Most homes are older construction with combustible siding and asphalt shingle or metal roofs. Many structures have flammable decks, projections and/or fences and most have native vegetation too close to the structure. Very few have adequate defensible space. Moderate to heavy fuel loads are continuous throughout this zone. Valentine Reserve, a large natural fuel island, is located immediately west and downslope of this zone. There are many wood burning fireplaces and many buildings have firewood stacked up against the structure. Moderate to heavy loads of natural fuels exist throughout this zone. Above ground powerlines and propane tanks exist throughout this zone. The terrain in this zone is slightly hilly with an average slope of 5º and an average road grade of 5%. Slopes are generally south facing. Roads are generally good and of adequate width for apparatus. There are, however, some dead-ends and long driveways that may be difficult for apparatus access or turn-around. Although it connects in several spots, Old Mammoth Trail is the only access to homes in this zone.

Structural Ignitability Discussion – Hazard Zone I

Figure 15 Hazard Zone I

Hazard Rating:	**Low**
Utilities Above or Below Ground:	Underground
General Construction:	Primarily combustible siding with ignition resistant roofs
Average Lot Size:	<1 acre
Dual Access Roads:	No, see text
Road Widths, Slope and Surface:	Good
Water Supply:	Hydrants
Proximity to Fire Station:	1.75 miles

Zone Characteristics and Hazards

This zone is still being developed. It is currently dominated by small to moderate size detached and semi-detached homes, however, there are a few apartment/condo buildings in the north part of this zone. The average lot size is 0.14 acres. Most homes are newer construction with a mix of combustible and rock veneer siding. Most roofs are asphalt shingle. Some structures have flammable decks or projections, and many have flammable ornamental plantings and/or native vegetation too close to the structure. Natural fuel loads are light throughout this zone and several ponds separate development. Utilities are below ground. Water supply is provided by the municipal hydrant system. This terrain in this zone is flat with an average slope of 2º and an average road grade of 3%. Roads are good and generally of adequate width for apparatus. Although it connects in several spots, Old Mammoth Trail is the only access to homes in this zone.

Structural Ignitability Discussion – Hazard Zone J

Figure 16 Hazard Zone J

Hazard Rating:	**Extreme**
Utilities Above or Below Ground:	Above ground
General Construction:	Primarily combustible siding with various roofs
Average Lot Size:	<1 acre
Dual Access Roads:	No
Road Widths, Slope and Surface:	Mixed, see text
Water Supply:	Hydrants
Proximity to Fire Station:	>4 miles

Zone Characteristics and Hazards

This zone is dominated by seasonal lease cabins. The average lot size is 0.49 acres. Most homes are old construction with heavy timber or flammable siding and a mix of roofs. Some roofs are asphalt shingle, some tar paper and some wood shake. Some structures have flammable decks or projections and most have native vegetation too close to the structure. There is little or no defensible space around the structures in this zone. Natural fuel loads are heavy throughout this zone. Power lines and propane tanks are above ground. There are no hydrants, but there are lakes that provide dip and draft water. The nearest fire station is almost five miles away. The average slope is 8º and the average road grade is 6.5%. Is should be noted, however, the terrain in this zone is complex with multiple aspects and steep slopes. Lake Mary Road is the only access to this area. It is paved and of adequate width, however many of the spurs that access these cabins are unpaved and some are narrow. There are some cabins on Lake George that can only be accessed by boat.

DEFENSIBLE SPACE AND GENERAL RECOMMENDATIONS

Defensible space is defined as an area around a structure that has been modified to reduce fire hazards. Both natural and manmade fuels are treated, cleared, reduced and/or substituted with ignition resistant species to slow the spread and intensity of fire. Development of defensible space involves zones in which different techniques are deployed. Every structure on the property including detached garages, storage sheds, barns, etc. as well as the home should be considered when creating defensible space zones. Specific design depends on many factors including, but not limited to, the size and shape of buildings, construction materials, topography and vegetation.

The State of California provides literature regarding creating defensible space in the different ecosystems that present wildfire hazards in the state. This information is targeted toward protecting homes in the WUI. It should be used to supplement the information contained in this report and is included as *Appendix A*. Some of this information will not be directly applicable to the residential areas in Mammoth Lakes due to the various ecosystems that are represented; however, this information is valuable and well-reviewed. Although this information was accurate at the time it was written, the latest defensible space requirements should be reviewed by visiting www.readyforwildfire.org.

All properties in Mono County must comply with the California Public Resource Code 4291, to achieve defensible space. Enforcement of this code and adherence to nationally recognized defensible space recommendations such as those provided by the California Fire Safe Council are critical to limiting damage and possible loss of life throughout the study area should a large fire move through the populated areas. Continued maintenance and development of the Mammoth Lakes Fire Safe Council is recommended to help promote fire safe building, maintenance and defensible space messages to property owners in the study area.

Along with the reduction of flammable fuels and the creation of defensible space around structures, ignition resistant, native re-vegetation should be considered at least as far as the 100-foot perimeter of the reduced fuels zone (Zones 1 and Zone 2).[14] In areas where it is practical and desirable, replanting with fire-wise, native species and implementing proper planting practices will provide the following benefits:

- Reduce the fire risk by limiting the ability of invasive and flammable species to return.
- Protect bare soils from erosion.
- Promote natural beauty and ecological stability without sacrificing adequate wildland fire protection.

Examples of fire-wise planting practices would be to space trees widely to interrupt the continuity of aerial fuels, plant low-fuel volume shrubs (usually no greater than 18 inches in height) and integrate decorative rocks and non-combustible natural features into the landscape architecture design. Deep watering trees through the summer and fall and during dry winters will keep trees alive and deter insects. Emphasis should be placed on the use of native drought-resistant plants and irrigation systems in newly planted areas. Existing native plants that are fire adapted do not have to be replaced in order to reduce the fire risk. They just need to be maintained at a “natural” fuel level and arrangement. Healthy, well-irrigated plants are less

flammable and irrigation systems can be used to reduce the intensity and spread of surface fires. Vegetation within a fire-wise landscape must be maintained to continue to provide protection from undesirable fire effects. On-going maintenance should include the removal of dead material, weed control, cutting of grasses to four inches or less in height, and tree and shrub pruning as necessary to prevent the buildup of ladder fuels and fuel jackpots that could contribute to spotting during fires.

It is clearly not possible to develop fully conforming individual defensible space where homes are spaced close together on small lots; however, it is possible to develop linked defensible space by building defensible perimeters around clusters of homes and replacing flammable ornamental plantings near and between structures with ignition resistant native plantings. For the purposes of this report when we use the term "linked defensible space" it is meant to refer to extending Zone 2 (30 to 100 feet from the structure, also known as the "reduced fuel zone") and Zone 3 (forest health maintenance extending from 100 feet from the structure to the property line, where such distances exist) treatments so they overlap between parcels forming a continuous buffer of modified fuels around a perimeter. (**See Figure 17**). Cooperation between neighbors and MLFD to promote development of linked defensible spaces is encouraged to protect homes throughout the study area.

The general measures listed below should be practiced throughout the study area. Some of these recommendations may already be in place on some properties.

1. Remain aware of the current fire danger in the area.
2. Clean roofs and gutters at least twice a year. It is especially important to remove pine needles and other flammable litter from the roof.
3. Don't store firewood or other combustibles under decks or wooden projections.
4. Maintain an irrigated greenbelt or other non-combustible ground cover around buildings.
5. Maintain and clean spark arresters on any chimneys.
6. Connect and have available a minimum of 50 feet of garden hose near all buildings to extinguish small fires before they spread. For large buildings two or more hoses may be required to provide adequate coverage.
7. Trees, large shrubs and other vegetation along roads and driveways should be pruned as necessary to maintain a minimum of 15 feet of vertical clearance for emergency vehicle access. Ladder fuels (low-lying branches allowing fire to climb from the ground into trees) should be removed to a height of at least 15 feet above the ground or no more than 1/3 the tree height, whichever is less. This includes both conifers and deciduous trees.
8. Maintain the defensible space around buildings by:
    a. Mowing grass and weeds to a height of four inches or less
    b. Removing any branches overhanging roofs or chimneys.
    c. Removing all trash, debris and cuttings from the defensible space. Debris and cuttings should be completely removed from the area and never dumped into adjacent wildlands or vacant lots.

It is very important to remember creating defensible space is not a one-time job. Defensible space should be maintained year-round. For more information, please see *Appendix A, Creating Defensible Space*.

Figure 17 Defensible Space Examples

STRUCTURE HARDENING RECOMMENDATIONS

One of the most important recommendations in this report is for any new structures in the study area to be built in accordance with California's Wildland-Urban Interface Code and for existing structures to be fire hardened to the greatest extent practical.
Structure hardening is critically important in areas where homes are built with flammable materials on small lots. Most of the homes in the study area are on lots of less than 1/3 of an acre. In such areas house-to-house transmission could become the primary carrier of fire, especially during high wind events. The authors and stakeholders of this report recognize the difficulty involved in coordinating the significant number of owners, many of them non-resident; however, the creation and maintenance of defensible space combined with structure hardening will produce the greatest benefits for the protection of life and the conservation of property from the effects of wildfire. MLFD and the Mammoth Lakes Fire Safe Council may be able to assist property owners in obtaining grants to aid with outfitting existing homes with ignition resistant siding and roofs. Further information regarding California's Wildland-Urban Interface Code can be found on this website:
http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_codes

In their 2013 publication *How Risk Management Can Prevent Future Wildfire Disasters in the Wildland-Urban Interface* David E. Calkin, Jack D. Cohen, Mark A. Finney, and Matthew P. Thompson come to the following conclusion:

"The demonstrated inability to suppress wildfires under extreme weather conditions and the fact that many homes are not destroyed when exposed to these wildfires indicates that reducing home ignition potential is key to effectively reducing home destruction. Because home ignitions are

primarily determined by conditions on private property, the principal authority, and thus, primary responsibility for preventing WUI home destruction lies with homeowners rather than public land managers."[15]

Individual home hazard assessments can provide a road map for home owners to reduce the ignition potential of the Home Ignition Zone (**Figure 18**); however individual assessments rely heavily on the evaluation of conditions existing from the structure to a minimum of 100 feet out. As such, they are most effective when lot sizes are 1 acre or greater. As mentioned earlier, most of the homes in the study area are on lots of less than 1/3 of an acre. In general, these homes are too close together and lots too small for individual parcel assessments to yield much actionable information. For that reason, we recommend individual parcel assessments only for areas where the average lot size is one acre or greater. In the areas of residential development in MLFPD dominated by small lots, we recommend focusing on reducing HIZ ignition potential through linked defensible space and structure hardening tactics which are discussed in this section and the previous one.

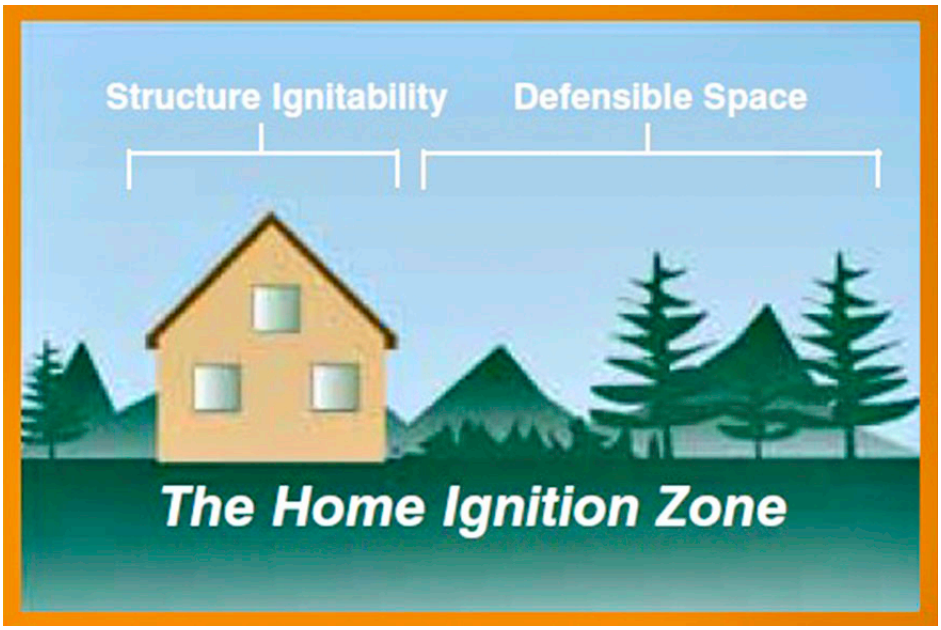

Figure 18 The Home Ignition Zone

Although some of the factors impacting the survivability of structures are best addressed before the home is built, there are still steps that should be taken to improve the survivability of existing homes.

The role of embers in structure losses cannot be overstated. Embers are generated by burning materials and lofted by wind and/or convective heat ahead of the main fire front. Structures are vulnerable to ember penetration in numerous ways. Some of the more common weaknesses are outlined below.

Flammable roofs still exist in the study area, especially in Hazard Zone E. In some cases, cedar shake extends from the building siding to the roof. (see **Figure 19**). The roof of a home has a significant impact on its ignitability as well as the likelihood of house-to-house spread. Class A roofing materials such as asphalt shingles, metal and tile roofs are all considered ignition resistant. We highly recommend any roofing added or replaced to new or existing structures, including outbuildings and other non-residential structures, be constructed of Class A materials.

Figure 19 Wood Shake Roof and Chimney Covering

Some homes in the study area have flammable wooden decks, exterior stairs or other projections. The shape of decks and outdoor stairs makes them excellent traps for heat and embers. Nothing flammable should ever be stored under decks or projections because of this. We recommend that as wooden decks and projections become in need of repair or replacement, non-flammable materials, such as non-combustible composites or aluminum decking, should be strongly encouraged. The quality and number of choices for wood substitute building materials has grown exponentially in the last decade and homeowners are no longer limited to materials with an inferior look and finish. In addition to reducing fire hazards, these materials usually require much less maintenance than wood. In areas where fire behavior predictions call for low to moderate intensities it's helpful to isolate existing wooden decks from the energy of fires by building a non-combustible patio and wall below the deck to limit the heat trap effect. The best design is to enclose the deck completely to create a solid form.

Windows quickly fail when exposed to the radiant heat of a wildfire. Once windows have failed, they provide a direct path for embers and heat to enter the home and ignite the inside. Although some homes may have newer, more heat resistive windows, such as low E Thermopane (double glazed), and tempered glass patio doors, most of the residences in the more hazardous areas are older constructions which are more likely to have conventional single pane window glass. We

recommend replacing single pane windows with modern double pane windows that will improve the resistance to breakage from heat exposure by as much as double the exposure time.[16] Homes near heavy fuels should consider installing heavy, non-flammable window coverings that will afford the home some additional protection from embers in the event windows break. Homes in these areas should also consider replacing large windows (2 feet or more wide or tall) with smaller panes more likely to stay in place even if fractured by heat.

Vents are another location where embers can enter the structure. Vents, especially vents on the downhill side of the home, should have flammable vegetation removed as per applicable Zone 1 defensible space standards for the community and be protected by non-flammable landscaping features such as stone or brick that will block the heat path of the fire. Vents in eves and soffits should be covered with a non-combustible mesh with openings ¼" or smaller. Any open eves should be enclosed to prevent them from becoming a trap for heat and embers. When enclosing an open eve, a flat soffit is preferred over a sloping soffit to limit the heat trap effect.

To reinforce the message of the research quoted at the beginning of this section, historic fire events have proven that flammable construction is linked directly to structure loss. The Insurance Institute for Business and Home Safety (IBHS) wildfire research center has developed a series of videos demonstrating how various home constructions burn (https://www.youtube.com/watch?v=IvbNOPSYyss).

More information regarding structure hardening can be found at the following links:

- http://www.firesafemarin.org/hardening-your-home/siding
- https://disastersafety.org/wildfire/ibhs-wildfire-research/ (IBHS videos on embers)
- https://www.fema.gov/media-library-data/20130726-1652-20490-4085/fema_p_737.pdf
- https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1141 (National Fire Protection Association (NFPA) 1141, Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas.)

CPAW Recommendations

In 2018 MLFD contracted with Community Planning Assistance for Wildfire to produce a study to reduce wildfire risks through improved land use planning.[17] The resulting report outlined four key recommendations:

1. **Adopt a New Wildfire Hazard Assessment.** The CPAW study recommended the Town of Mammoth Lakes define the wildland urban interface and integrate a risk assessment map. Both of those objectives are addressed in this study. The CPAW report also recommended incorporating parcel-level assessment information to support existing and new development. See the previous sections for our recommendations regarding defensible space and parcel level assessments.
2. **Adopt New Fire Mitigation Policies in the General Plan.** The CPAW study recommended the Town of Mammoth Lakes General Plan Safety Element be updated to

conform to new legislative requirements. The authors and stakeholders of this CWPP update are in agreement with this recommendation.

3. **Update and Align Site and Structure Requirements and Guidelines.** The CPAW study recommended MLFD and the government of the Town of Mammoth Lakes collaborate to address gaps and streamline the permit approval process as it pertains to wildland fire mitigation structure and landscaping requirements. The authors and stakeholders of this CWPP update are in agreement with this recommendation.
4. **Develop a Local CWPP to Identify and Coordinate Mitigation Activities.** The CPAW study pointed out the current CWPP covers all of Mono County and was adopted in 2009. Their study recommended an updated CWPP focusing on Mammoth Lakes be created. A fundamental purpose of this document and the Mammoth Lakes WMI is to comply with this recommendation.

Areas of Special Interest Recommendations

Introduction

Areas of Special Interest (ASI) are non-residential areas considered to contain physical properties or values likely to have considerable effect on people, property or the environment of the study area in the event of damage from a significant wildfire. The following five ASIs were identified in the study area:

- Valentine Reserve (UC Santa Barbara)
- MCWD Water Treatment Plant
- Mammoth Mountain Ski Village
- Camp High Sierra
- Town-owned vacant parcels

Figure 20 shows the location and boundaries of these ASIs.

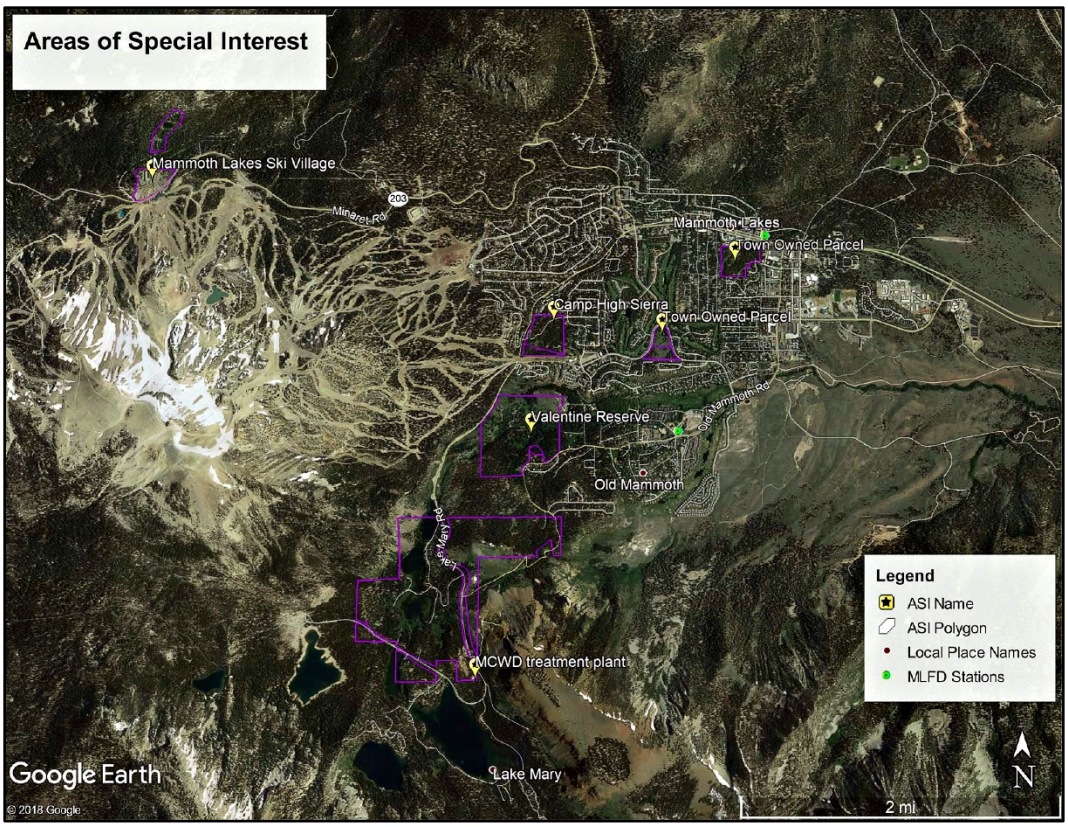

Figure 20 Areas of Special Interest

Valentine Reserve (UC Santa Barbara)

Valentine Reserve is a large parcel operated by UCSB for educational purposes. Although none of the structures are permanent habitations, most experience extensive use in the summer and fall. Although some mitigation work has been done, especially around the structures, the reserve represents a large natural fuel island between the Lakes Basin and Old Mammoth. Most structures on the reserve are heavy timber construction with a metal roof, but some have flammable decks and projections and a few have flammable vegetation too close to the structure. Roads are dirt and there has been little or no roadside thinning. For the latest and most complete information regarding this ASI, please visit the WMI.

Figure 21 Valentine Reserve

Recommendations

Management of the reserve should consider collaborating with MLFD to plan and coordinate roadside thinning for access roads in the reserve.

The defensible space and structure hardening recommendations in this report should be implemented wherever practical for all structures on the reserve.

MLFD should partner with Valentine Reserve to ensure evacuation plans exist for the cabins and day use areas in the reserve. These plans should be reviewed on an annual basis to ensure they remain accurate.

Responder pre-attack planning should be coordinated between MLFD and USFS for the reserve property if there isn't a plan already in place. These plans should be reviewed every two to five years to ensure they remain relevant and accurate.

MCWD Water Treatment Plant

The MCWD Water Treatment Plant serves the entire study area. Although the plant is located on a large parcel, most of the critical infrastructure is located in the southeast corner of the MCWD parcel. Access to the plant is good and the ignition resistant building does have defensible space, however thinning of the lodgepole pine surrounding the plant would be desirable. For the latest and most complete information regarding this ASI, please visit the WMI.

Figure 22 MCWD treatment plant

Recommendations

The plant building is ignition resistant construction, has Zone 1 defensible space and good access; however implementing fuels management recommendations for Zone 2 and Zone 3 discussed in the *Defensible Space and General Recommendations* section and *Appendix A, Creating Defensible Space* may help reduce the intensity of fires moving from the Lakes Basin into the area where critical infrastructure is located.

Because the MCWD parcel is so large and located southwest of residential Hazard Zones G and H, we recommend roadside thinning be considered along Lake Mary Road and Twin Lakes Road from Twin Lakes to the treatment plant. Properly implemented roadside thinning would not only protect access to the treatment plant, but also provide a shaded fuel break between the Lakes Basin and residential Hazard Zones G and H.

Mammoth Mountain Main Lodge

Mammoth Mountain Ski Resort is one of the most popular ski resorts in the state of California. The Main Lodge, located at the top of the mountain along Minaret Road, is not only the location of visitor lodging and several shops, there is also a group of rental cabins known as “The Chalets” in the forest directly across Minaret Road from the ski resort lodge. These cabins all have combustible siding and some have combustible roofs. Most have flammable decks and/or projections.

There are three hydrants located at the Main Lodge and dip/draft water is available at two ponds located north of the ski village, however, it is a long drive for responders to this area from MLFD Station 1. For the latest and most complete information regarding this ASI, please visit the WMI.

Figure 23 Mammoth Mountain Main Lodge

Figure 24 The Chalets

Recommendations

While most of the Main Lodge structures have ignition resistant construction as mentioned previously, cabins in The Chalets do not. The defensible space and structure hardening recommendations in this report should be implemented wherever practical for all these structures.

At the time of this writing Minaret Road had reasonable clearings, however since this is the only road access to this ASI, it should be evaluated annually for any roadside thinning necessary to maintain safe access for responders and evacuating residents and visitors.

Although the forest is thinner in this area due to the high elevation, the dead-end road that serves as access to The Chalets should be evaluated annually and if necessary, treated according to the roadside thinning recommendations in this report in order to maintain safe access for responders and occupants.

Camp High Sierra

Camp High Sierra is a public campground operated by Mammoth Mountain Ski Area (MMSA). Although some mitigation work has been done here the camp is a significant fuel island ringed by residential areas. There is a high percentage of mortality in the conifer stands and an increased likelihood of ignition posed by large numbers of campers and campsite fire pits. For the latest and most complete information regarding this ASI, please visit the WMI.

Figure 25 Camp High Sierra

Recommendations

Mammoth Mountain personnel responsible for the management of Camp High Sierra should collaborate with MLFD to limb, thin and remove dead vegetation from this area to convert the camp to a shaded fuel break in order to slow the spread of fire into the neighboring residential areas and reduce fire intensity in the event of an ignition. See the following section *Landscape Scale Recommendations* for a discussion of shaded fuel breaks.

Consider removing the existing fire rings and allow only camp stoves instead of open fires.

Town-Owned Undeveloped Parcels

There are two large undeveloped parcels owned by the Town of Mammoth Lakes and slated for future development. One is known locally as the "bell-shaped parcel" and the other as "The Parcel (formerly Shady Rest Tract)." They are shown on the map in **Figure 20**. Both of these parcels are surrounded by residential development. In the case of the "bell-shaped parcel" fire hazards are somewhat lower due to lower fuel density and its location near golf fairways. However, as with any unoccupied parcel in WI/WUI there is an increased risk of ignition due of both legitimate and unauthorized human use.

Figure 26 "The Parcel (formerly Shady Rest Tract"

Recommendations

Since both of these parcels are located in the interior of the Town of Mammoth Lakes it is important they be patrolled for unauthorized camp fires and other human caused hazards during the fire season.

Until these parcels are developed, the Town of Mammoth Lakes should collaborate with MLFD and Mammoth Lakes Fire Safe Council (MLFSC) to limb, thin and remove dead vegetation from these areas to convert these parcels to shaded fuel breaks in order to slow the spread of fire into neighboring residential areas and reduce fire intensity in the event of an ignition. This is especially important in the "Newly Acquired Parcel" due to its heaver fuel load and position near residential Hazard Zones A and E. See the following section *Landscape Scale Recommendations* for a discussion of shaded fuel breaks.

LANDSCAPE SCALE RECOMMENDATIONS

When most people think of a fuel break they envision a line usually 10 to 30 feet wide where all vegetation has been removed to mineral soil; however, the concept of a fuel break can describe any area where fuels have been manipulated to strategically reduce the spread and intensity of wildfire. Since the concept of a fuel break is more nebulous than the specific definitions of "fireline" and "firebreak" as used by wildland firefighters, the effectiveness of fuel breaks has been the subject of debate among fire scientists and forest managers for many years. The concept of a "shaded fuel break" is most applicable to forested areas (**Figure 27).** Unlike firebreaks, which imply the removal of all vegetation down to mineral soil, shaded fuel breaks are created by altering the surface fuels, increasing the height to base of the live crown and opening the canopy by removing trees.[18] It is important to note the purpose of a fuel break is not to stop a fire, but to give firefighters a higher probability of successfully attacking the fire.[19] Once installed, fuel breaks require regular maintenance to ensure they will perform the task of altering the behavior of fire entering the treated area. Some of the concepts of shaded fuel break creation and maintenance may also be applicable to shrub lands, depending on the type, canopy height and density of shrubs.

There is much discussion as to how far fuels modifications must extend for fuel breaks to be effective. In this report when distances are given they are intended as minimums. Depending on the fuels and topography, larger treatment areas may be necessary. The recommendations in this report are general in nature and the specific design of any fuel break should be referred to qualified experts familiar with both the vegetation and fire behavior of the area.

Figure 27 Shaded fuel break (Lost Lane Fuels Reduction Project)

Current and Planned Projects

Figure 28 shows an overview of exiting fuels reduction projects in and near the study area. These projects are managed by MLFD and/or the USFS. In some instances, CAL FIRE has provided manpower for these projects; however, since there are no state responsibility areas (SRA) in or adjacent to MLFPD, CAL FIRE does not participate in planning or management of fuels management projects in the study area.

The principal recent landscape scale fuels management projects include:

- Lost Lane Fuels Modification
- Lakes Basin Fuels Modification
- Panorama Dome Fuels Reduction
- Mammoth Scenic Loop Roadside Thinning (USFS)

For the most current information regarding these projects see the WMI.

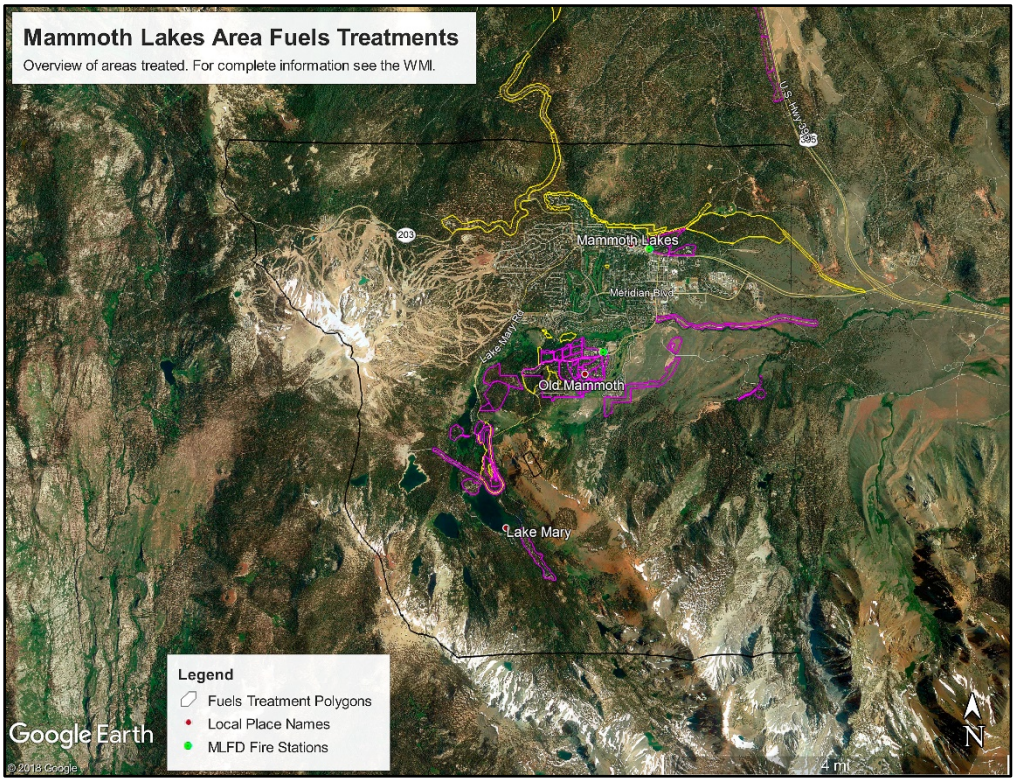

Figure 28 Overview of fuels treatments near Mammoth Lakes Fire Protection District

Recommendations

In order to protect an important secondary access to Mammoth Lakes the roadside thinning project initiated by the USFS along the Mammoth Scenic Loop should be completed. As of the time of this writing some sections of this road had not been treated. Fuels should be monitored along the Mammoth Scenic Loop between Main Street and CA-395 to be sure vegetation does not encroach the roadway. Limbing and thinning should be conducted in any section where fuels

are found near the road. Hazardous trees and shrubs should be removed within 10 feet of the roadway and any grasses mowed to a height of no greater than four inches. Trees should be trimmed to at least a height of eight feet for trees 25 feet or taller and 1/3 the tree height for smaller trees within 30 feet of the roadway to prevent surface fires from laddering into the canopy near the road.

According to a 2018 article MLFSC received a grant from the Sierra Nevada Conservancy (SNC) for $500,000 for mechanical and hand thinning, fuel breaks, roadside and campground fuels reduction, forest restoration and meadow aspen release treatments on a minimum of 406 acres and up to 632 acres on Inyo National Forest land over a two to three year period.[20] It is important for MLFSC to coordinate these efforts with existing treatments and treatments in planning by MLFD and USFS. The use of the WMI as a coordinated planning tool is highly recommended.

Work with property owners adjacent to USFS lands to create defensible space to their property lines. (See the linked defensible spaces description). If this could be accomplished MLFD and MLFSC could request fuels reduction on forest lands under the Good Neighbor Authority that could be used to create a shaded fuel break bordering the most hazardous edges of the residential Hazard Zones.

Fuels reduction work that has been completed by USFS and MLFD can be seen in the WMI. Revisiting existing treatments is important as fine fuels and ladder fuels grow back quickly. Additional projects can tie into existing work, to create larger fuel breaks and landscape scale treatments. Please see the WMI for the most current information regarding existing and planned fuels treatments.

Access/Egress Routes & Evacuation Recommendations

US 395, CA 203, Minaret Road, Old Mammoth Road and Lake Mary Road provide the primary access in the study area. Significant alternative access roads include:

- Mammoth Scenic Route
- Saw Mill Road
- Sherwin Creek Road

Recommendations

Especially along the alternative access roads mentioned above missing or inadequate street and address markers may be an issue. All the primary and alternative roads should be inspected periodically at junctions to be sure they have reflective markers with at least 4” tall characters. If the structure is not visible from the street, an address marker should be located at the entrance of the driveway.

There are many homes in MLFPD that do not have an address marker visible from the street. Where address markers do exist, they vary in size, reflectivity and position. Although mapping applications such as Google Map and Waze have made it easier for responders to locate specific structures, reflective addressing visible from the street is still desirable. Most applications relying

on GPS technology have some difficulty pinpointing addresses from time to time. While some residents may consider reflective address signage to be unattractive, it is a desirable aid for quick and effective response. The value to responders, especially at night and under difficult conditions, is not to be underestimated. This is especially true during large wildland fires where poor addressing will create an additional challenge for outside responders who do not have local knowledge and training regarding access.

Although consistent, reflective address markers seem less important with today's technology it's important to remember that technology does fail and a program of improving address markers throughout the study area is still desirable. We recommend MLFD, MLFSC, town government, and property owners work together to create and implement a consistent system of reflective address markers.

The access road vegetation management recommended for the Mammoth Lakes Scenic Route in the *Landscape Scale Recommendations* section of this report is applicable to all the primary and alternate routes described in this section. Fuels should be monitored along all these routes to be sure flammable vegetation does not compromise their use during wildfire events. Limbing and thinning should be conducted in any section where fuels are found near the road. Hazardous trees and shrubs should be removed within 10 feet of the roadway and any grasses mowed to a height of no greater than four inches. Trees should be trimmed to at least a height of eight feet for trees 25 feet or taller and 1/3 the tree height for smaller trees within 30 feet of the roadway to prevent surface fires from laddering into the canopy near the road.

Evacuation is the first priority for homes, camps and visitor lodging throughout the study area threatened by wildfire. MLFD and MLFSC should partner with USFS to ensure evacuation plans exist for all the camps and rental lodging in the Mammoth Lakes area. Emergency evacuation plans should have redundant solutions considering the evacuation of thousands of visitors could become necessary. These plans should be reviewed on an annual basis to ensure they remain accurate.

The WMI should be utilized to be sure information regarding evacuation routes is updated frequently during the fire season and remains current.

Shelter-in-Place

Traditionally in the United States the preferred method of protecting the public from an advancing wildfire is evacuation and involves relocation of the threatened population to a safer area. When this tactic is impractical or too hazardous another possibility is to instruct people to remain inside ignition resistant buildings until the danger passes. This concept is controversial regarding wildfire in the United States, but not for hazardous materials incident response where time, hazards, and sheer logistics often make evacuation impossible. This concept is the dominant modality for public protection from wildfires in Australia where fast moving, non-persistent fires in light fuels make evacuation impractical. The success of this tactic depends on a detailed preplan that takes into account the construction type and materials of the building used, topography, depth and type of the fuel profile, as well as current and expected weather and fire behavior.

Shelter–in-place should only be considered when the structure is determined to be "stand alone" in structural triage terms. A combination of access, ignition resistant construction, and fuels reduction is necessary to create an environment safe for emergency service personnel and provide reasonable protection to structures from a wildfire. In order to be "stand alone", buildings need to be of ignition resistant construction and have defensible space.

Ignition resistant construction is necessary for shelter-in-place tactics. Wooden roofs, shake architectural features and old structures with untreated wooden sidings are particularly hazardous and should not be considered. Structures should have ignition resistant roofs and ignition resistant siding such as stucco or concrete, especially close to the ground. Eves should be enclosed and any holes in the foundation, siding, or eves should be covered to prevent embers from entering. Buildings with large areas of non-burnable surfaces adjacent to them, such as paved parking lots and bare earth are desirable.

Although evacuation would be preferred under most conditions there may be some areas where high numbers of people attempting to evacuate on residential streets may create a more dangerous situation than pre-planning shelter-in-place safety zones for residents and visitors. Schools and other public buildings may work well for this purpose. We recommend MLFD, town government and law enforcement work together to identify neighborhoods where pre-planning shelter-in-place locations could be a desirable alternative to evacuation.

Water Supply Recommendations

Most of the study area is serviced by a good municipal hydrant system. The exceptions are the cabins in Hazard Zone J (Lakes Basin) and some of the ASIs including, Valentine Reserve, Camp High Sierra, the MCWD parcel and the undeveloped town-owned parcels described in the *Areas of Special Interest Recommendations* section. Although there are dip/draft water sources in some of these areas the following recommendations are worth consideration.

Recommendations

As mentioned previously in the recommendations in the *Firefighting Capabilities and Local Preparedness* section, consider purchasing an additional water tender to be housed at MLFD Station 2. This apparatus could be used to provide quick water support for fires in the Lakes Basin or on Valentine Reserve.

Consider locating a cistern or water tank with the appropriate apparatus connections at the MCWD treatment plant. Although there are dip/draft water sources in the Lakes Basin a feature such as this would provide initial attack and extended attack responders with access to additional water without the need to set up draft operations.

CONCLUSION

The scientific and historical analysis performed during the preparation of this report shows an increasing potential for wildfires to affect the study area. Due to high numbers of visitors, fires in this area have a notable potential for loss of life and damage to property. This is especially true in light of the popularity of this area as a summer getaway. In addition to the residents, literally thousands of visitors could be endangered by wildfire. The following summary is a distillation of what we think should be the highest priority actions to preserve life and property:

- Individual property owners must realize the survival of their homes will rely heavily on their ability and willingness to create defensible space and harden their structures to the greatest extent practical against ignitability from embers and firebrands.
- MLFD, MLFSC, the Town of Mammoth Lakes and USFS should support mitigation efforts of residents by advising and assisting those efforts wherever possible and by ensuring the existing statutes regarding fire hazard abatement are enforced, even if property owners are not residents of the area.
- Coordination of fuels mitigation efforts between MLFD, USFS and MLFSC will be critical to produce the most efficient fuels management in the study area. The WMI should be utilized to assist in coordinating and tracking evolution of fuels management projects.
- Comprehensive evacuation and pre-attack plans with redundant solutions should be developed, not only for the residents and visitors of the town of Mammoth Lakes, but also lease cabins and camps in the study area. Existing evacuation and pre-attack plans should be reviewed periodically so they remain current.
- Efforts to monitor and remove any dangerous fuel loads along primary and alternative access roads that could threaten access and egress should be a priority. These efforts must continue on an ongoing basis to be effective.

GRANT RESOURCES

One of the biggest obstacles to overcome when trying to implement CWPP recommendations and wildfire mitigation projects is funding. A certified CWPP opens a multitude of funding sources to complete work outlined in the plan. For many mitigation projects, federal, state and county funds are available to begin treatments. The list below is not inclusive, but rather serves as a starting point for the most commonly available sources of funding and outreach.

Federal Emergency Management Agency (FEMA)

- **Assistance to Firefighters Grant Program**
  - Purpose: to improve firefighting operations, purchase firefighting vehicles, equipment and personal protective equipment; fund fire prevention programs; and establish wellness and fitness programs.
  - Necessary information includes a DUNS number, Tax ID number and Central Contractor Registration
  - **https://www.fema.gov/welcome-assistance-firefighters-grant-program**
- **SAFER: Staffing for Adequate Fire and Emergency Response**
  - Purpose: to provide funding directly to fire departments and volunteer firefighter interest organizations in order to help them increase the number of trained, "front line" firefighters available in their communities. The goal of SAFER is to enhance the ability of local fire departments to comply with staffing, response and operational standards established by NFPA and OSHA.
  - **https://www.fema.gov/staffing-adequate-fire-emergency-response-grants**
- **Fire Prevention and Safety Grants (FP&S)**
  - Purpose: FP&S Grants are part of the Assistance to Firefighters Grants and are under the purview of the Grant Programs Directorate in FEMA. Their purpose is to support projects that enhance the safety of the public and firefighters from fire and related hazards.
  - **https://www.fema.gov/fire-prevention-safety-grants**
- **Hazard Mitigation Assistance Grant Program (HMA)**
  - Purpose: to provide grants to state and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The goal of HMA is to reduce the loss of life and property due to natural disasters and enable mitigation measures to be implemented during the immediate recovery from a disaster.
  - **https://www.fema.gov/media-library-data/1441133724295-0933f57e7ad4618d89debd1ddc6562d3/FEMA_HMA_Grants_4pg_2015_508.pdf**

- **Pre-Disaster Mitigation Grant Program (PDM)**
    - Purpose: to provide funds to states, territories, Tribal governments, communities, and universities for hazard-mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces the overall risks to the population and structures.
    - **https://www.fema.gov/pre-disaster-mitigation-grant-program**

CAL FIRE grants

- **California Climate Investment (CCI) Fire Prevention Grant**
    - Purpose: provides funding for projects related to fuel (vegetation) hazard reduction, fire prevention education and training, and fire prevention planning. Projects funded by the grant will reduce the risk of fire ignition and spread in and adjacent to communities, educate owners of habitable structures about wildfire risks, or allow for strategic, long-term planning to reduce the risk of wildfire to communities in the SRA throughout the state.
    - **http://calfire.ca.gov/fire_prevention/firepreventiongrants**

- **California Forest Improvement Program (CFIP)**
    - Purpose: encourage private and public investment in, and improved management of, California forest lands and resources. This focus is to ensure adequate high quality timber supplies, related employment and other economic benefits, and the protection, maintenance, and enhancement of a productive and stable forest resource system for the benefit of present and future generations.
    - **http://www.fire.ca.gov/grants/grants**

Natural Resources Conservation Service (NRCS) Grants

- **Environmental Quality Improvement Program (EQIP)**
    - Purpose: provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land and non-industrial private forestland. EQIP may also help producers meet Federal, State, Tribal, and local environmental regulations.

Firewise Communities

- Purpose: a multi-agency organization designed to increase education of homeowners, community leaders, developers, and others regarding the Wildland-Urban Interface and the actions they can take to reduce fire risk to protect lives, property and ecosystems.
- **http://www.firewise.org**

National Volunteer Fire Council

- Purpose: to support volunteer fire protection districts. Includes both federal and non-federal funding options and grant writing assistance.

- **http://www.nvfc.org/**

National Resources Conservation Service Emergency Watershed Protection Program

- Purpose: to undertake emergency measures including the purchase of flood plain easements for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed.
- **https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/ewp/**

USFS Cooperative Forestry Assistance

- Purpose: to assist in the advancement of forest resources management, the control of insects and diseases affecting trees and forests, the improvement and maintenance of fish and wildlife habitat, and the planning and conduct of urban and community forestry programs.
- **https://www.fs.fed.us/spf/coop/programs/loa/**

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[12] http://calfire.ca.gov/communications/downloads/fact_sheets/CoopResponse.pdf
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[14] Zone 1 extends from the structure out to 30 feet and Zone 2 extends from 30 feet from the structure to 100 feet or the property line if that distance is less than 100 feet.
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Appendix A Creating Defensible Space

Purpose

Throughout this report, the focus has been on the importance and effectiveness of creating and maintaining defensible space. This appendix contains information produced by the state of California focused on creating defensible space in the different ecosystems that pose wildfire hazards in the state. This information should be used to supplement the information contained within the body of the report. There will be some crossover of information and techniques regarding how to protect homes from wildfire. Some of the information in this appendix will not be directly applicable to areas within the study area WUI/WI due to various ecosystems addressed by this literature and some of the specific challenges related to these communities. This information, however, is valuable and well-reviewed. Although this information was accurate at the time it was written, the latest defensible space requirements should be reviewed by visiting www.readyforwildfire.org.

General Guidelines for Creating Defensible Space

State Board of Forestry and Fire Protection (BOF)
California Department of Forestry and Fire Protection

Adopted by BOF on February 8, 2006
Approved by Office of Administrative Law on May 8th, 2006

Contents

A. Purpose of Guidelines

Effective defensible space

Recent changes to Public Resources Code (PRC) 4291 expand the defensible space clearance requirement maintained around buildings and structures from 30 feet to a distance of 100 feet. These guidelines are intended to provide property owners with examples of fuel modification measures that can be used to create an area around buildings or structures to create defensible space. A defensible space perimeter around buildings and structures provide firefighters a working environment that allows them to protect buildings and structures from encroaching wildfires as well as minimizing the chance that a structure fire will escape to the surrounding wildland. These guidelines apply to any person who owns, leases, controls, operates, or maintains a building or structure in, upon, or adjoining any mountainous area, forest-covered lands, brush-covered lands, grass-covered lands, or any land that is covered with flammable material, and located within a State Responsibility Area.

The vegetation surrounding a building or structure is fuel for a fire. Even the building or structure itself is considered fuel. Research and experience have shown that fuel reduction around a building or structure increases the probability of it surviving a wildfire. Good defensible space allows firefighters to protect and save buildings or structures safely without facing unacceptable risk to their lives. Fuel reduction through vegetation management is the key to creating good defensible space.

Terrain, climate conditions and vegetation interact to affect fire behavior and fuel reduction standards. The diversity of California's geography also influences fire behavior and fuel reduction standards as well. While fuel reduction standards will vary throughout the State, there are some common practices that guide fuel modification treatments to ensure creation of adequate defensible space:

- Properties with greater fire hazards will require more clearing. Clearing requirements will be greater for those lands with steeper terrain, larger and denser fuels, fuels that are highly volatile, and in locations subject to frequent fires.

- Creation of defensible space through vegetation management usually means reducing the amount of fuel around the building or structure, providing separation between fuels, and or reshaping retained fuels by trimming. Defensible space can be created removing dead vegetation, separating fuels, and pruning lower limbs.

- In all cases, fuel reduction means arranging the tree, shrubs and other fuels sources in a way that makes it difficult for fire to transfer from one fuel source to another. It does not mean cutting down all trees and shrubs, or creating a bare ring of earth across the property.

- A homeowner's clearing responsibility is limited to 100 feet away from his or her building or structure or to the property line, which ever is less, and limited to their land. While individual property owners are not required to clear beyond 100 feet, groups of property owners are encouraged to extend clearances beyond the 100 foot requirement in order to create community-wide defensible spaces.

- Homeowners who do fuel reduction activities that remove or dispose of vegetation are required to comply with all federal, state or local environmental protection laws and obtain permits when necessary. Environmental protection laws include, but are not limited to, threatened and endangered species, water quality, air quality, and cultural/archeological resources. For example, trees removed for fuel reduction that are used for commercial purposes require permits from the

California Department of Forestry and Fire Protection. Also, many counties and towns require tree removal permits when cutting trees over a specified size. Contact your local resource or planning agency officials to ensure compliance.

The methods used to manage fuel can be important in the safe creation of defensible space. Care should be taken with the use of equipment when creating your defensible space zone. Internal combustion engines must have an approved spark arresters and metal cutting blades (lawn mowers or weed trimmers) should be used with caution to prevent starting fires during periods of high fire danger. A metal blade striking a rock can create a spark and start a fire, a common cause of fires during summertime.

Vegetation removal can also cause soil disturbance, soil erosion, regrowth of new vegetation, and introduce non-native invasive plants. Always keep soil disturbance to a minimum, especially on steep slopes. Erosion control techniques such as minimizing use of heavy equipment, avoiding stream or gully crossings, using mobile equipment during dry conditions, and covering exposed disturbed soil areas will help reduce soil erosion and plant regrowth.

Areas near water (riparian areas), such as streams or ponds, are a particular concern for protection of water quality. To help protect water quality in riparian areas, avoid removing vegetation associated with water, avoid using heavy equipment, and do not clear vegetation to bare mineral soil.

B. Definitions

Defensible space: The area within the perimeter of a parcel where basic wildfire protection practices are implemented, providing the key point of defense from an approaching wildfire or escaping structure fire. The area is characterized by the establishment and maintenance of emergency vehicle access, emergency water reserves, street names and building identification, and fuel modification measures.

Aerial fuels: All live and dead vegetation in the forest canopy or above surface fuels, including tree branches, twigs and cones, snags, moss, and high brush. Examples include trees and large bushes.

Building or structure: Any structure used for support or shelter of any use or occupancy.

Flammable and combustible vegetation: Fuel as defined in these guidelines.

Fuel Vegetative material, live or dead, which is combustible during normal summer weather. For the purposes of these guidelines, it does not include fences, decks, woodpiles, trash, etc.

Homeowner: Any person who owns, leases, controls, operates, or maintains a building or structure in, upon, or adjoining any mountainous area, forest-covered lands, brush-covered lands, grass-covered lands, or any land that is covered with flammable material, and located within a State Responsibility Area.

Ladder Fuels: Fuels that can carry a fire vertically between or within a fuel type.

Reduced Fuel Zone: The area that extends out from 30 to 100 feet away from the building or structure (or to the property line, whichever is nearer to the building or structure).

Surface fuels: Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branches and downed logs.

C. Fuel Treatment Guidelines

The following fuel treatment guidelines comply with the requirements of 14 CCR 1299 and PRC 4291. **All persons using these guidelines to comply with CCR 1299 and PRC 4291 shall implement General Guidelines 1., 2., 3., and either 4a or 4b., as described below.**

General Guidelines:

1. Maintain a firebreak by removing and clearing away all flammable vegetation and other combustible growth within 30 feet of each building or structure, with certain exceptions pursuant to PRC §4291(a). Single specimens of trees or other vegetation may be retained provided they are well-spaced, well-pruned, and create a condition that avoids spread of fire to other vegetation or to a building or structure.

2. Dead and dying woody surface fuels and aerial fuels within the Reduced Fuel Zone shall be removed. Loose surface litter, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches, shall be permitted to a depth of 3 inches. This guideline is primarily intended to eliminate trees, bushes, shrubs and surface debris that are completely dead or with substantial amounts of dead branches or leaves/needles that would readily burn.

3. Down logs or stumps anywhere within 100 feet from the building or structure, when embedded in the soil, may be retained when isolated from other vegetation. Occasional (approximately one per acre) standing dead trees (snags) that are well-space from other vegetation and which will not fall on buildings or structures or on roadways/driveways may be retained.

4. Within the Reduced Fuel Zone, one of the following fuel treatments (4a. or 4b.) shall be implemented. Properties with greater fire hazards will require greater clearing treatments. Combinations of the methods may be acceptable under §1299(c) as long as the intent of these guidelines is met.

4a. Reduced Fuel Zone: Fuel Separation

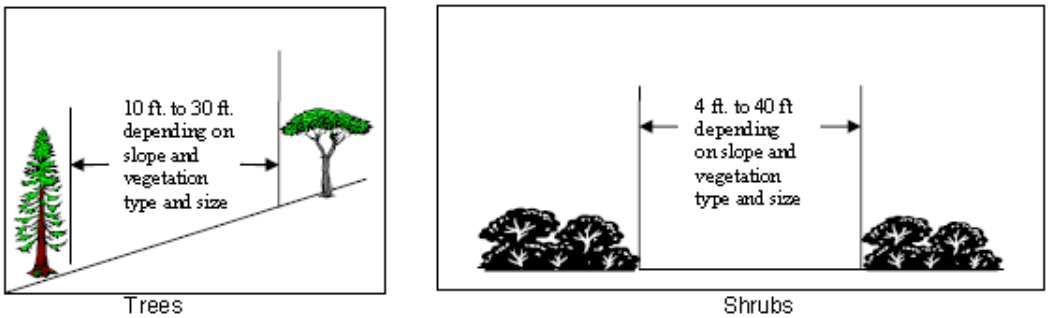
In conjunction with General Guidelines 1., 2., and 3., above, minimum clearance between fuels surrounding each building or structure will range from 4 feet to 40 feet in all directions, both horizontally and vertically.

Clearance distances between vegetation will depend on the slope, vegetation size, vegetation type (brush, grass, trees), and other fuel characteristics (fuel compaction, chemical content etc.). Properties with greater fire hazards will require greater separation between fuels. For example, properties on steep slopes having large sized vegetation will require greater spacing between individual trees and bushes (see Plant Spacing Guidelines and Case Examples below). Groups of vegetation (numerous plants growing together less than 10 feet in total foliage width) may be treated as a single plant. For example, three individual manzanita plants growing together with a total foliage width of eight feet can be "grouped" and considered as one plant and spaced according to the Plant Spacing Guidelines in this document.

Grass generally should not exceed 4 inches in height. However, homeowners may keep grass and other forbs less than 18 inches in height above the ground when these grasses are isolated from other fuels or where necessary to stabilize the soil and prevent erosion.

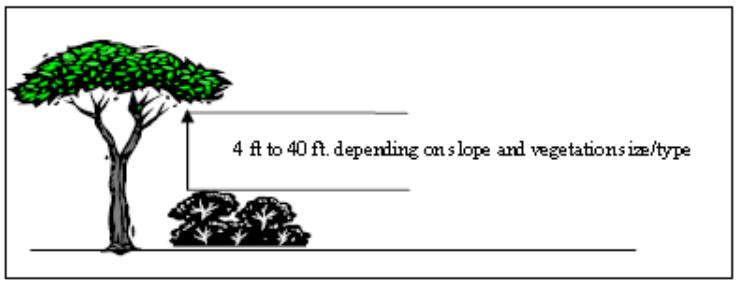
Clearance requirements include:

- Horizontal clearance between aerial fuels, such as the outside edge of the tree crowns or high brush. Horizontal clearance helps stop the spread of fire from one fuel to the next.



Horizontal clearance between aerial fuels

- Vertical clearance between lower limbs of aerial fuels and the nearest surface fuels and grass/weeds. Vertical clearance removes *ladder fuels* and helps prevent a fire from moving from the shorter fuels to the taller fuels.



Vertical clearance between aerial fuels

Effective vertical and horizontal fuel separation
Photo Courtesy Plumas Fire Safe Council.

Plant Spacing Guidelines Guidelines are designed to break the continuity of fuels and be used as a "rule of thumb" for achieving compliance with Regulation 14 CCR 1299.		
Trees	**Minimum horizontal space from edge of one tree canopy to the edge of the next**	
	Slope	Spacing
	0% to 20 %	10 feet
	20% to 40%	20 feet
	Greater than 40%	30 feet
Shrubs	**Minimum horizontal space between edges of shrub**	
	Slope	Spacing
	0% to 20 %	2 times the height of the shrub
	20% to 40%	4 times the height of the shrub
	Greater than 40%	6 times the height of the shrub
Vertical Space	**Minimum vertical space between top of shrub and bottom of lower tree branches:** 3 times the height of the shrub	

Adapted from: Gilmer, M. 1994. California Wildfire Landscaping

Case Example of Fuel Separation: Sierra Nevada conifer forests

Conifer forests intermixed with rural housing present a hazardous fire situation. Dense vegetation, long fire seasons, and ample ignition sources related to human access and lightning, makes this home vulnerable to wildfires. This home is located on gentle slopes (less than 20%), and is surrounded by large mature tree overstory and intermixed small to medium size brush (three to four feet in height).

Application of the guideline under 4a. would result in horizontal spacing between large tree branches of 10 feet; removal of many of the smaller trees to create vertical space between large trees and smaller trees and horizontal spacing between brush of six to eight feet (calculated by using 2 times the height of brush).

Case Example of Fuel Separation: Southern California chaparral

Mature, dense and continuous chaparral brush fields on steep slopes found in Southern California represents one of the most hazardous fuel situations in the United States. Chaparral grows in an unbroken sea of dense vegetation creating a fuel-rich path which spreads fire rapidly. Chaparral shrubs burn hot and produce tall flames. From the flames come burning embers which can ignite homes and plants. (Gilmer, 1994). All these factors results in a setting where aggressive defensible space clearing requirements are necessary.

Steep slopes (greater than 40%) and tall, old brush (greater than 7 feet tall), need significant modification. These settings require aggressive clearing to create defensible space, and would require maximum spacing. Application of the guidelines would result in 42 feet horizontal spacing (calculated as 6 times the height of the brush) between retained groups of chaparral.

Case Example of Fuel Separation: Oak Woodlands

Oak woodlands, the combination of oak trees and other hardwood tree species with a continuous grass ground cover, are found on more than 10 million acres in California. Wildfire in this setting is very common, with fire behavior dominated by rapid spread through burning grass.

Given a setting of moderate slopes (between 20% and 40%), wide spacing between trees, and continuous dense grass, treatment of the grass is the primary fuel reduction concern. Property owners using these guidelines would cut grass to a maximum 4 inches in height, remove the clippings, and consider creating 20 feet spacing between trees.

4b. Reduced Fuel Zone: Defensible Space with Continuous Tree Canopy

To achieve defensible space while retaining a stand of larger trees with a continuous tree canopy apply the following treatments:

- Generally, remove all surface fuels greater than 4 inches in height. Single specimens of trees or other vegetation may be retained provided they are well-spaced, well-pruned, and create a condition that avoids spread of fire to other vegetation or to a building or structure.
- Remove lower limbs of trees ("prune") to at least 6 feet up to 15 feet (or the lower 1/3 branches for small trees). Properties with greater fire hazards, such as steeper slopes or more severe fire danger, will require pruning heights in the upper end of this range.

Defensible Space retaining continuous trees

Photo Courtesy Plumas Fire Safe Council.

Defensible space with continuous tree canopy by clearing understory and pruning

Authority cited: Section 4102, 4291, 4125-4128.5, Public Resource Code. Reference: 4291, Public Resource Code; 14 CCR 1299 (d).