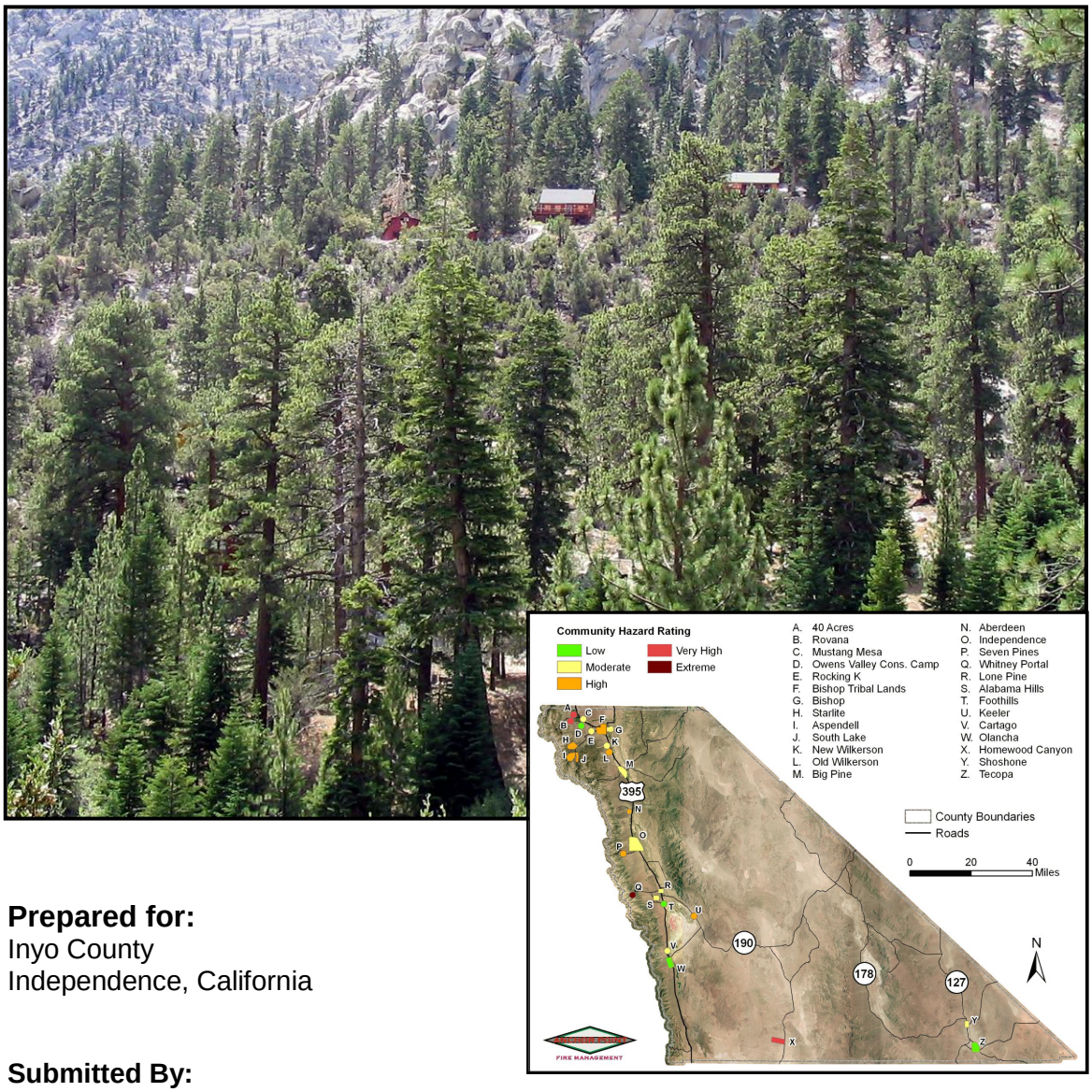
INYO COUNTY, CALIFORNIA

Community Wildfire Protection Plan



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ANCHOR POINT
FIRE MANAGEMENT

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES

PURPOSE

This document has the following primary purposes:

1. To provide a comprehensive, scientifically-based analysis of wildfire related hazards and risks in the Wildland Urban Interface (WUI) areas of Inyo County, California.
2. Using the results of the analysis, generate recommendations designed to prevent and/or reduce the damage associated with wildfire to WUI values in Inyo County.
3. Create a Community Wildfire Protection Plan (CWPP) document for Inyo County which conforms to the standards for CWPPs established by the Healthy Forest Restoration Act (HFRA) and the State of California and local FireSafe Council

INTRODUCTION

The Inyo County CWPP is a result of a county-wide planning effort including extensive field data gathering, compilation of existing documents and GIS data, scientifically based analyses and recommendations designed to reduce the threat of wildfire related damages to Values at Risk. This document incorporates new and existing information relating to wildfire which will be valuable to citizens, policy makers, and public agencies in Inyo County, CA. Participants in this project include the Bureau of Land Management (BLM), the United States Forest Service (USFS), The Paiute Tribe, CalFire, the Los Angeles Department of Water and Power (DWP), local fire departments, FireSafe councils, HOA groups and other stakeholders. This document meets the requirements of the federal Healthy Forest Restoration Act of 2003 for community fire planning.

The assessment portion of this document estimates the hazards and risks associated with wildland fire in proximity to communities. This information, in conjunction with identification of the Values at Risk, defines “areas of concern” for Inyo County and allows for prioritization of mitigation efforts. From the analysis of this data, solutions and mitigation recommendations are offered that will aid homeowners, land managers and other interested parties in developing short-term and long-term fuels and fire management plans.

Wildfire hazard data is derived both from the community Wildfire Hazard Rating system (WHR) and from the analysis of Fire Behavior Potential, which are extensive and/or technical in nature. Detailed findings and methodologies for these analyses are included in their entirety in appendices rather than the main report text. This approach is designed to make the plan more readable, while establishing a reference source for those interested in the technical elements of the Inyo County wildfire hazard and risk assessment.

For the purposes of this report the following definitions apply:

Risk is considered to be the likelihood of an ignition occurrence. This is primarily determined by the fire history of the area.

Hazard is the combination of the WHR ratings of the Wildland-Urban Interface (WUI) neighborhoods and the analysis of Fire Behavior Potential, as modeled from the fuels, weather, and topography of the study area. Hazard attempts to quantify the severity of undesirable

fire outcomes to the Values at Risk. In essence, hazard represents the vulnerability of Values at Risk to negative impacts from wildfire.

Values at Risk are the intrinsic values identified by the citizens and stakeholders as being important to the way of life in the study area (e.g., life safety, property conservation, access to recreation, and wildlife habitat).

THE NATIONAL FIRE PLAN AND THE HEALTHY FOREST RESTORATION ACT

In the year 2000, more than eight million acres burned across the United States, marking one of the most devastating wildfire seasons in American history. One high-profile incident, the Cerro Grande fire at Los Alamos, NM, destroyed more than 235 structures and threatened the Department of Energy's nuclear research facility.

Two reports addressing federal wildland fire management were initiated after the 2000 fire season. The first report, prepared by a federal interagency group, was titled "Review and Update of the 1995 Federal Wildland Fire Management Policy" (2001). This report concluded, among other points, that the condition of America's forests had continued to deteriorate.

The second report, titled "Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000", was issued by the Bureau of Land Management (BLM) and the United States Department of Agriculture Forest Service (USFS). It became known as the National Fire Plan (NFP). This report, and the ensuing congressional appropriations, ultimately required actions to:

- Respond to severe fires
- Reduce the impacts of fire on rural communities and the environment
- Ensure sufficient firefighting resources

Congress increased its specific appropriations to accomplish these goals. 2002 was another severe season: more than 1,200 homes were destroyed and over seven million acres burned. In response to public pressure, congress and the Bush administration continued to designate funds specifically for actionable items such as preparedness and suppression. That same year, the Bush administration announced the HFRA initiative, which enhanced measures to restore forest and rangeland health and reduce the risk of catastrophic wildfires. In 2003, that act was signed into law.

Through these watershed pieces of legislation, Congress continues to appropriate specific funding to address five main sub-categories: preparedness, suppression, reduction of hazardous fuels, burned-area rehabilitation, and state and local assistance to firefighters. The general concepts of the NFP blended well with the established need for community wildfire protection in the study area. The spirit of the NFP is reflected in the Inyo County CWPP.

This CWPP meets the requirements of HFRA by:

1. Identifying and prioritizing fuels reduction opportunities across the landscape (see the "Fuels Modification Projects" section beginning on page 44).

2. Addressing structural ignitability (see pages 35-40 and **Appendix B**)
3. Assessing community fire suppression capabilities (See the “Local Preparedness and Firefighting Capabilities” section on pages 41-43)
4. Collaborating with stakeholders (See **Appendix F**)

GOALS AND OBJECTIVES

Goals for this project include the following:

1. Enhance life safety for residents and responders.
2. Mitigate undesirable fire outcomes to property and infrastructure.

In order to accomplish these goals, the following objectives have been identified:

1. Establish an approximate level of risk (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 Values at Risk into “communities” that represent relatively similar hazard factors.
4. Identify and quantify factors that limit (mitigate) undesirable fire effects to the Values at Risk (hazard levels).
5. Recommend specific actions that will reduce the vulnerability of the Values at Risk.

Other Desired Outcomes

1. To promote community awareness and preparedness:

   Quantifying the community's hazards and risk from wildfire will facilitate public awareness and assist in creating public action to mitigate the defined hazards.
2. To improve wildfire prevention through education:

   Community awareness, combined with education, will help to reduce the risk of unplanned human ignitions.
3. To facilitate and prioritize appropriate hazardous fuel reductions and equipment needs:

   The identification of areas of concern will improve the focus and accuracy of preplanning, and facilitate the implementation of cross-boundary, multi-jurisdictional projects.

COLLABORATION: COMMUNITY / AGENCIES / COUNCILS

The names of the representatives involved in the development of the Inyo County CWPP are included in the **Table 1**, along with their organizations and various roles and responsibilities. For more information on the collaborative process that led to the development of this CWPP see **Appendix F**, *Inyo County CWPP Collaborative Effort*.

Table 1. Inyo County CWPP Development Team

Name	Organization	Roles / Responsibilities
Ray Seguine	Fire Chief City of Bishop Inyo Co Emergency Services Coordinator	Local contact Report review Technical Specialist
Don Leavitt	Eastern Sierra Region Fire Safe Council	President Establish Fire Safe Councils for Inyo and Mono Counties Grant sponsor for FSC
Kenna Schoenherr	So. Fork Bishop Creek FSC	Secretary SFBC Home Owners Grant request writer
Debra Hein	Inyo N.F.- BLM Bishop Field Office	Interagency Fire Mitigation Specialist – Contract Coordinator
Bob Rooks	Mammoth Lakes Fire Department	Division Chief – Contract Coordinator
Chuck Hamilton	Inyo County	County Manager – Contract Coordinator and Facilitator
Mark McDonnald Chris White Dr. Mark McLean Rod Moraga	Core Anchor Point Staff	Project Implementation and Management Fire Behavior Analysis Geographic Information

STUDY AREA OVERVIEW

Inyo County is located in east central California. The study area for this project includes the entire county and, for the purposes of the fire behavior analysis, an additional buffer which combined encompasses an area of 6,872,430 acres (approximately 10,738 square miles), and has approximately 17,945 residents (2000 census data). The primary access to the study area is via US Highway 395 and California State Routes 190, 178 and 127.

Inyo County is defined by extremes. The study area includes the highest (Mt. Whitney 14,495') and the lowest (Badwater Flats 282' below sea level) points in the continental United States. Some of the higher elevations of the eastern Sierra Nevada average 385 inches (32 feet) of snowfall per year[1] and Death Valley (2.5 inches of precipitation annually, July average temperature of 115°F)[2] is one of the hottest and driest places in the western hemisphere. The lowest humidity ever recorded anywhere on earth is found in the White Mountains, seven miles east of Bishop.[3] It is obvious that many different climate and life zones are encompassed by this large and diverse county. Vegetation and coverage ranges from the heavy mixed-conifer timber of the Sierra Nevada to the sparse desert shrubs and grasses of Death Valley and the Amargosa Desert. There is a remarkable diversity of plant and animal species in this area, with profound topographic diversity. Each of the natural plant communities has its own record of historic fires and intervals between fires.

Figure 1 shows the neighborhoods that define the Wildland-Urban Interface (WUI) study area. As a part of this project, the most populated areas in the WUI were divided into 26 communities. The defined WUI for the County is defined by a five mile buffer around each community. For the purpose of this report, land beyond the five mile buffer is not considered interface. Each of the 26 communities represents certain dominant hazards from a wildfire perspective. Fuels, topography, structural flammability, availability of water for fire suppression, egress and navigational difficulties, as well as other natural and manmade hazards, are considered in the overall hazard ranking of these communities. The methodology for this assessment uses the WHR community hazard rating system that was developed specifically to evaluate communities within the WUI for their relative wildfire hazard.[4] The WHR model combines physical infrastructure (structure density, roads, etc.) and Fire Behavior Components (fuels, topography, etc.) with the field experience and knowledge of wildland fire experts. For more information on the WHR methodology please see **Appendix B**.

[1] http://www.sfgate.com/cgi-bin/document.cgi?file=/sports/skiing/pages/resorts/mammoth.DTL
[2] http://www.nps.gov/archive/deva/weather.htm
[3] http://www.bishopvisitor.com/chamber/relocation.php3
[4] White, C. "Community Wildfire Hazard Rating Form." *Wildfire Hazard Mitigation and Response Plan*. Colorado State Forest Service. Ft. Collins, CO. 1986.

Figure 1. Inyo County Community Hazard Rating Map

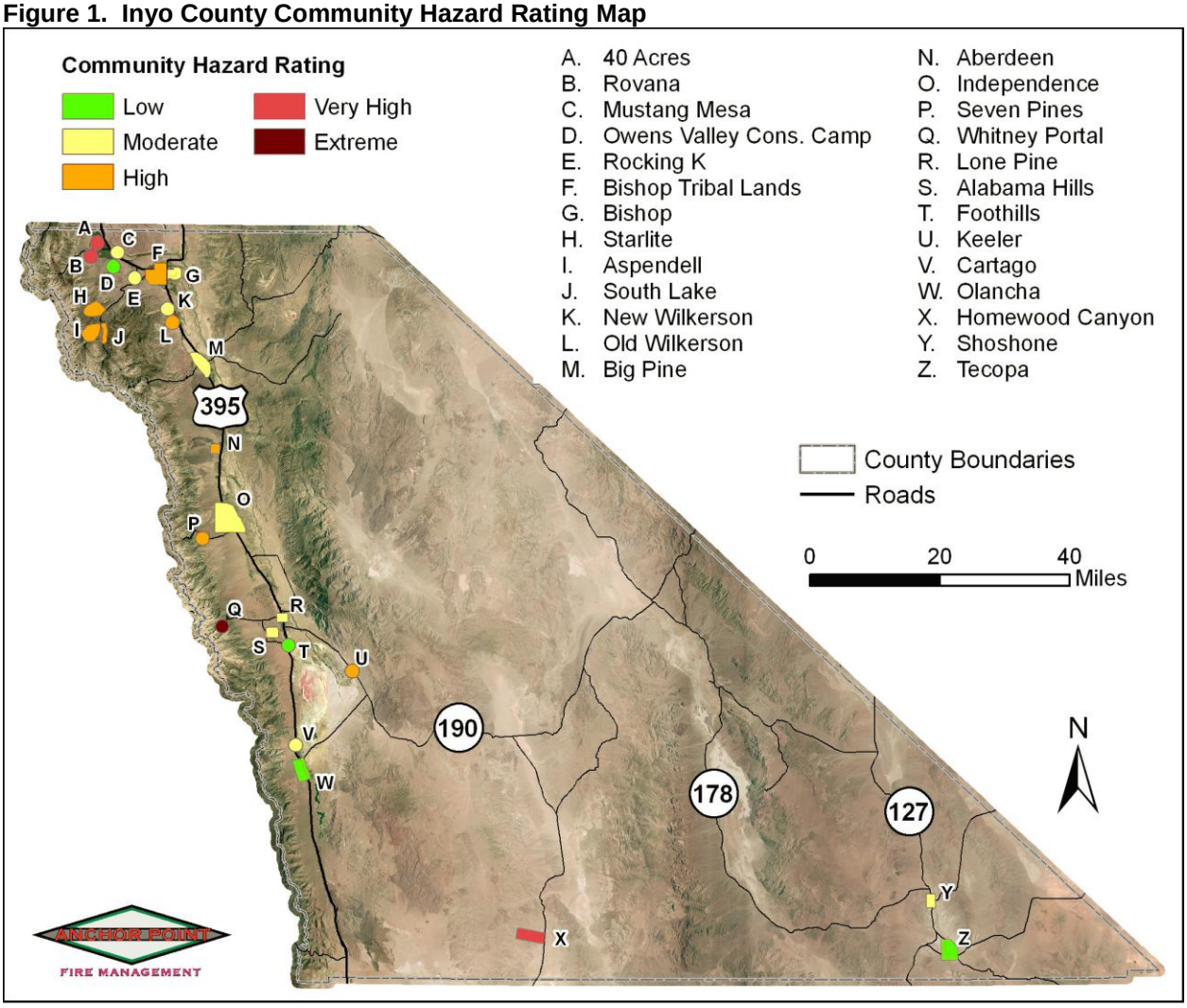
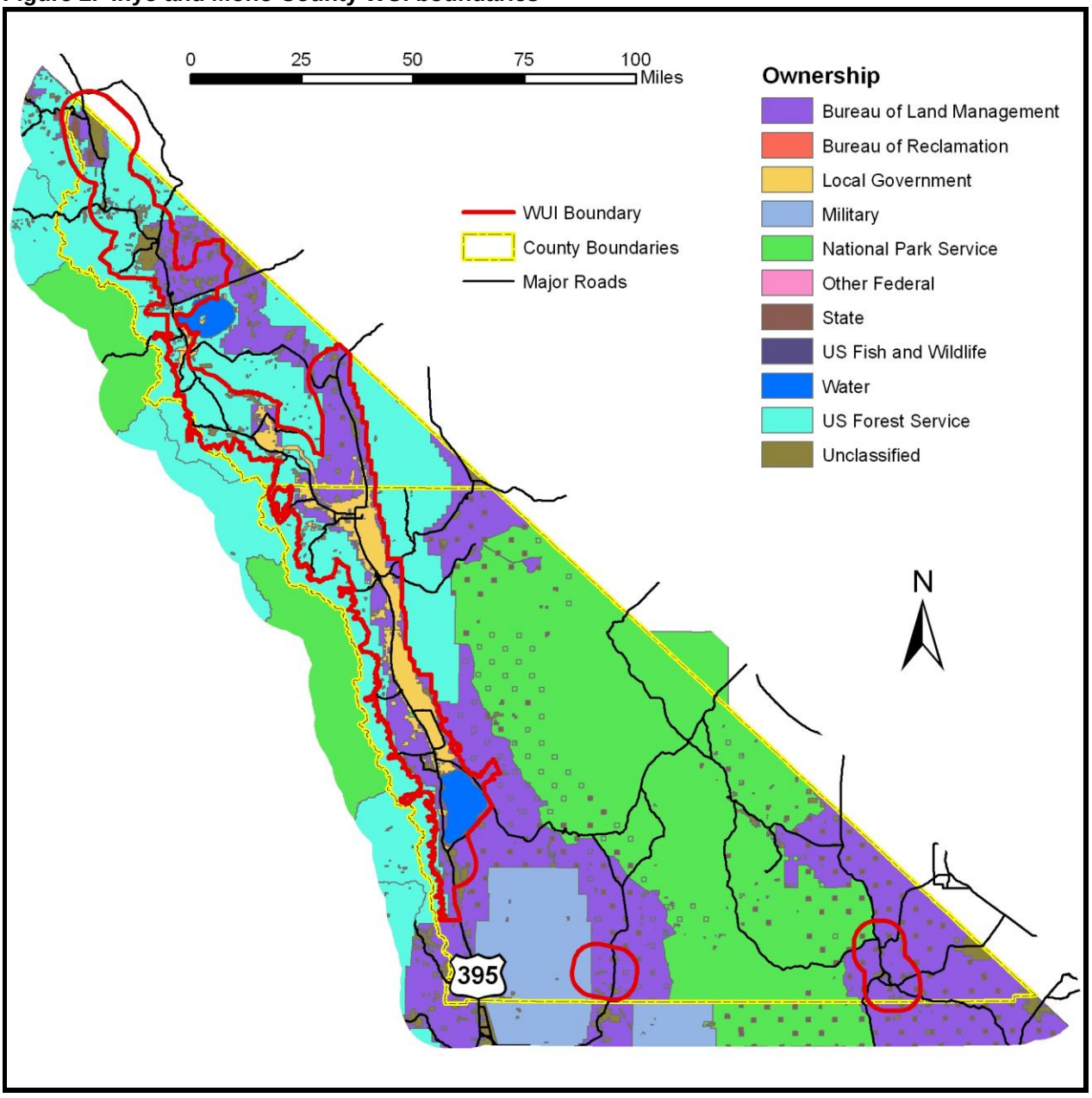


Figure 2. Inyo and Mono County WUI boundaries



The defined Wildland Urban Interface boundary for Inyo County was determined by buffering the defined communities by 5 miles. This accounts for some of the disbursed development surrounding defined communities. Although homesteads and ranches may lie outside of the defined UWI, they are not considered communities and therefore not within the scope of a CWPP.

Figure 3 and **Figure 4** show the general topography of the area. These graphic representations of the landforms of the study area (elevation and slope) will be helpful in interpreting other maps in this report. Please refer to these figures as necessary while reading this document.

Figure 3. Inyo County Slopes

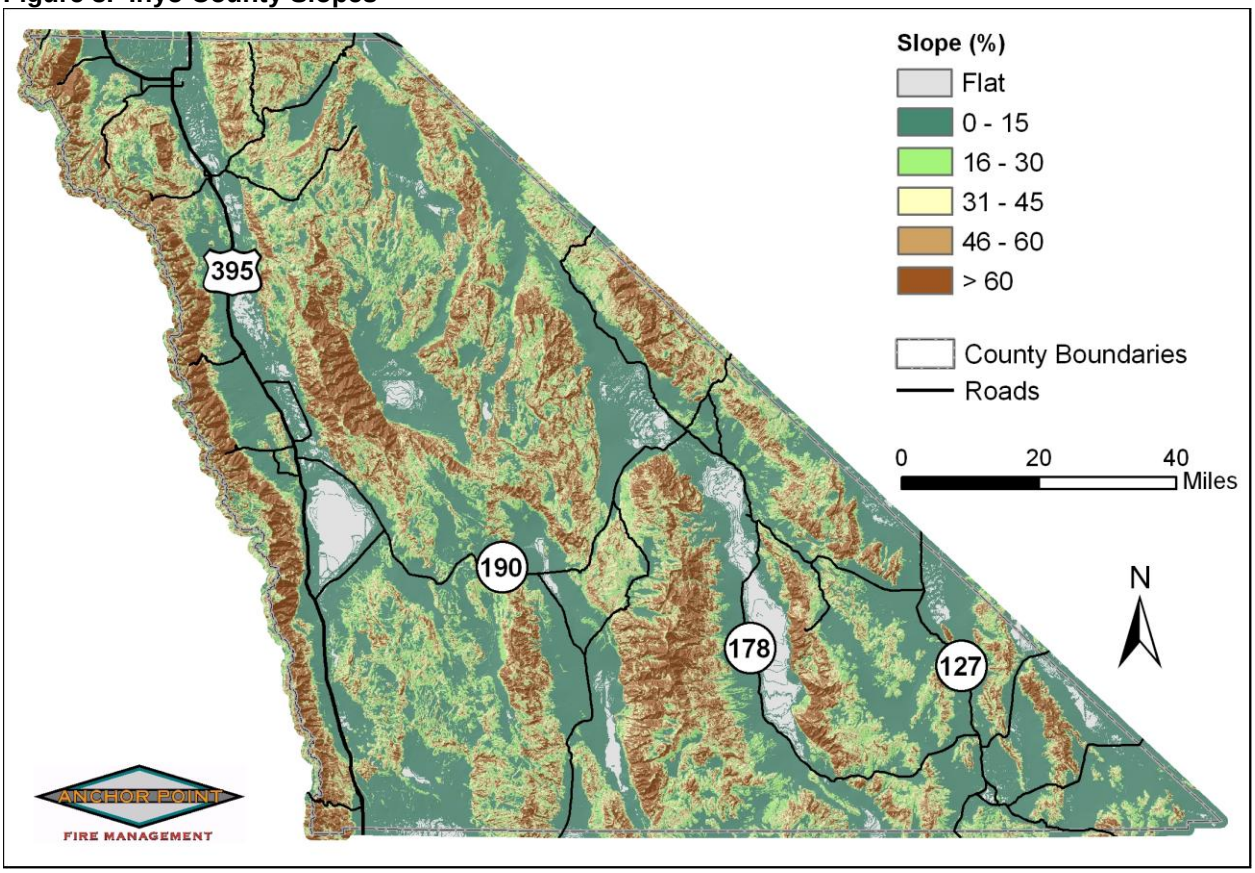
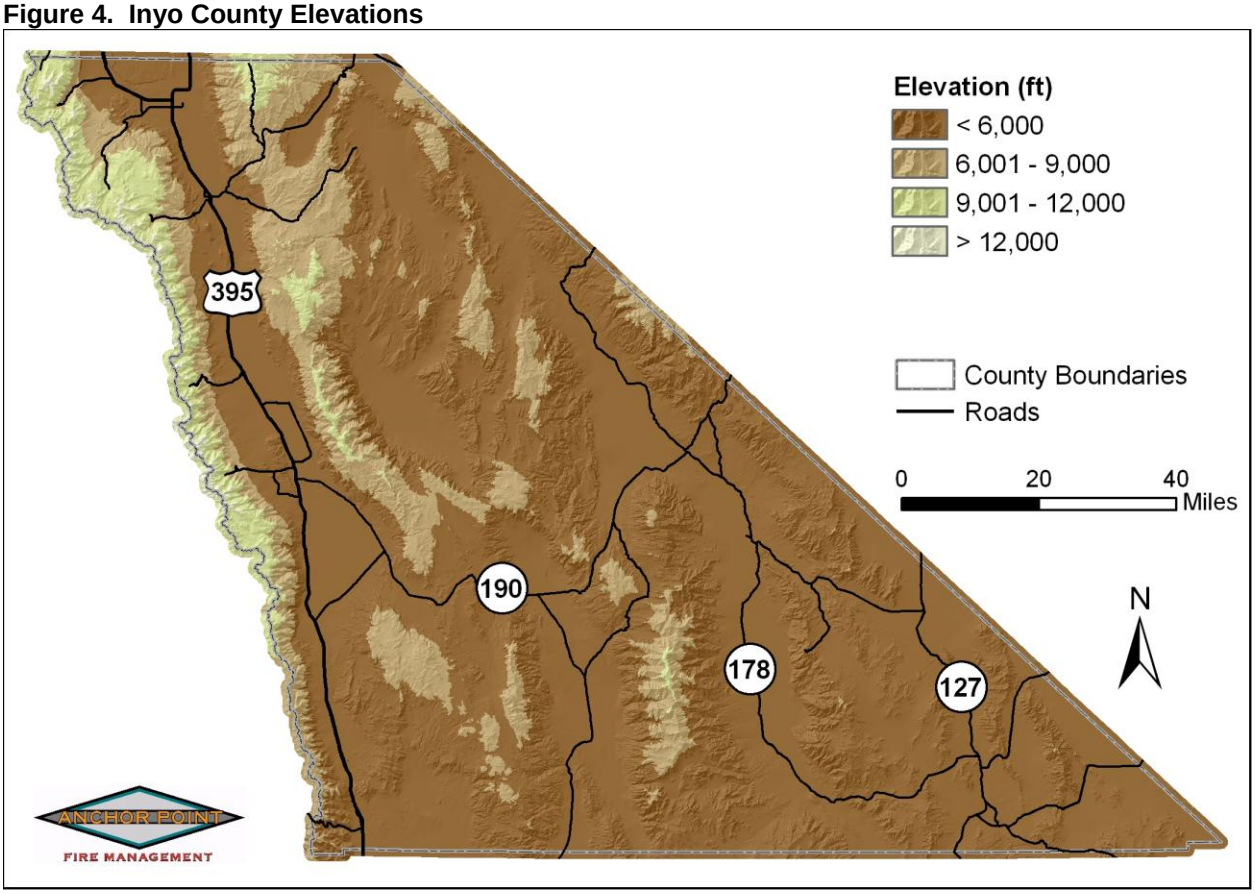


Figure 4. Inyo County Elevations



VALUES

Inyo County is a land of magnificent natural diversity. Mount Whitney is the highest peak in the lower 48 states. Death Valley is the lowest point in the U.S. And the Great Basin bristlecone pines are the oldest life forms in the world.[5]

Public lands account for over 98% of Inyo County, offering a full spectrum of adventure and involvement from the absolute stillness and peace of the desert, through the meadows blanketed with wildflowers, over the rushing mountain streams of the forest, to the wind whipped granite peaks.

According to 2005 statistics approximately 18,156 residents reside within 9,071 households in Inyo County.[6] Its 2004 population was 18,247, ranking it 52nd in the state. Maintaining Inyo County's natural environment and rural quality of life is a priority. "The Vision of Inyo County

[5]Official Inyo County Website, http://www.countyofinyo.org/ , Accessed 2-2007
[6] US Census Bureau, http://quickfacts.census.gov/qfd/states/06/06027.html, Accessed 2-2007

Government for its public is to provide responsive decision making while supporting cultural and historical values, the natural environment and rural quality of life."[7]

Of the 26 WUI communities in Inyo County, one was found to represent an extreme hazard, three were rated as very high hazard and eight as high hazard (see **Figure1**). Construction type, condition, age, the fuel loading of the structure/contents, and position are contributing factors in making homes more susceptible to ignition under even moderate burning conditions. Under extreme burning conditions, there is a likelihood of rapid fire growth and spread in these areas, due to steep topography, flammable construction types, natural or manmade hazards, fast burning or flashy fuel components, and topographic features that contribute to channeling winds and promotion of extreme fire behavior. These areas may also represent a high threat to life safety due to poor egress, the likelihood of heavy smoke and heat, and extended response times.

COMMERCE AND INFRASTRUCTURE

In 2004 Inyo had a per capita personal income (PCPI) of $27,488. This PCPI ranked 29th in the state and was 78 percent of the state average, $35,219, and 83 percent of the national average, $33,050. In 1994 the PCPI of Inyo was $19,505 and ranked 26th in the state.

The earnings of persons employed in Inyo increased from $305,729 in 2003 to $329,068 in 2004, an increase of 7.6 percent. The 2003-2004 state change was 7.3 percent and the national change was 6.3 percent. The average annual growth rate from the 1994 estimate of $225,216* to the 2004 estimate was 3.9 percent. The average annual growth rate for the state was 6.1 percent and for the nation was 5.5 percent.[8] This growth trend will continue to increase the wildland urban interface complexity of the county.

RECREATION AND LIFE STYLE

Inyo County offers some of the best recreational opportunities such as backcountry skiing, alpine climbing, hang gliding, horseback riding, and mountain biking in the world. Damage by wildfire could threaten the recreational and scenic value of Inyo County.

With over two million acres, the Inyo National Forest is home to many natural wonders, including Mt. Whitney, Mono Lake, Mammoth Lakes Basin, and the Ancient Bristlecone Pine Forest, as well as seven Congressionally-designated Wildernesses comprising over 650,000 acres of land.

The Bishop Field Office of the BLM cares for a unique vestige of wild California, emphasizing conservation, education and partnerships Their mission is to sustain the health, diversity and productivity of the 750,000 acres of BLM public lands they are entrusted to manage.
Death Valley National Park covers over 3 million acres of western desert terrain. Approximately 1.2 million people a year (1999 numbers) come to Death Valley to experience the stark and lonely vastness of the valley. Telescope Peak, the highest peak in the Park and in the Panamint

[7] Official Inyo County Website, http://www.countyofinyo.org/Admin/vision_statement.htm, Accessed 2-2007
[8] U.S. Bureau of Economic Analysis, http://www.bea.gov/regional/bearfacts/action.cfm?fips=06027&areatype=06027&yearin=2004, Accessed 2-2007

Mountains, rises 11,049 feet above sea level and lies only 15 miles from the lowest point in the United States in the Badwater Basin salt pan, 282 feet below sea level.

To support the vast amount of recreational opportunities within Inyo County well over 60 public campgrounds and countless private campgrounds exist. Nationally campgrounds are threatened and damaged every year by wildfire.

ENVIRONMENTAL RESOURCES

Countless animal and plant species thrive within Inyo County, a few of which are categorized as threatened and/or endangered.[9] Wildfire produces more than just a visual alteration to the landscape. Habitat disturbance and frequent fires encourage invasion of non-native short-lived plant species, particularly Mediterranean grasses which increase flammable biomass and tend to decrease natural fire intervals. These frequent fires cause a replacement of native species, many of which are adapted to recover naturally from fires, and loss of native vegetation tends to displace native herbivorous animals and their predators.

Some plant communities such as Pinyon-Juniper Woodlands are not fire adapted and natural replacement takes hundreds of years. Intense or frequent fires not only displace native plants and animals, but also encourage erosion. Loss of soil not only interferes with natural recovery but it also increases sedimentation in water courses, influencing water quality and habitat for aquatic animals.

CURRENT RISK SITUATION

For the purposes of this report the following definitions apply:

Risk is considered to be the likelihood of an ignition occurrence. This is primarily determined by the fire history of the area.

Hazard is determined by combining the WHR ratings of the WUI neighborhoods with Fire Behavior Potential, as modeled from the fuels, weather, and topography of the study area.

Most of the northern and western portions of the county are at a high risk for WUI fires. Most of the populated areas of the southern and eastern portions of the county are at a moderate risk for WUI fires. In addition to this report's analysis, the following communities are listed on the Federal Register as communities at risk from wildfire.

- (http://www.forestsandrangelands.gov/resources/documents/351-358-en.pdf): Aberdeen, Aspendell, Bishop, Big Pine, Cartago, Mustang Mesa, Starlite, South Lake, Whitney Portal, Lone Pine, Homewood Canyon and Olancha.

[9] Inyo National Forest Website, http://www.fs.fed.us/r5/inyo/projects/muiradamswildplan/chapter4.pdf, page 19, Accessed 2-2007.

FIRE REGIME CONDITION CLASS

Fire Regime Condition Class (FRCC) is a landscape evaluation of expected fire behavior as it relates to the departure from historic norms. The data used for this study is from a national-level map. The minimum mapping unit for this data is one square kilometer. FRCC should not be confused with BEHAVE and FlamMap fire behavior models (detailed in the fire behavior section of this report), which provide the fire behavior potential analysis for expected flame length, rate of spread, and crown fire development.

FRCC is an expression of the departure of the current condition from the historical fire regime. It is used as a proxy for the probability of severe fire effects such as the loss of key ecosystem components (soil, vegetation structure, species) or alteration of key ecosystem processes (nutrient cycles, hydrologic regimes). Consequently, the FRCC is an index of hazards to the status of many components (e.g., water quality, fish status, wildlife habitats, etc.). **Figure 5** displays graphically the return interval and condition class of the study area.

FRCC is derived by comparing current conditions to some estimate of the historical range that existed prior to substantial settlement by Euro-Americans. The departure of the current condition from the historical baseline serves as a proxy to likely ecosystem effects. The condition class concept assumes that historical fire regimes accurately represent the conditions under which the ecosystem components within a fire-adapted ecosystem naturally evolved. Thus, if it is projected that fire intervals and/or fire severity have changed from the historical conditions, then one would expect that fire size, intensity, and burn patterns would also be subsequently altered if a fire occurred. Furthermore, it is assumed that if these basic fire characteristics have changed, then it is likely that there would be subsequent effects to those ecosystem components that had adapted to the historical fire regimes. As used here, the potential of ecosystem effects reflects the probability that key ecosystem components may be lost if a fire were to occur within the study area. It should be noted that key ecosystem components can be represented by virtually any attribute of an ecosystem (for example, soil productivity, water quality, floral and faunal species, large-diameter trees, snags, etc.).[10]

The following categories of condition class are used to qualitatively rank the potential of effects to key ecosystem components:

[10] Fire Regime Condition Class, website, http://www.frcc.gov/, July 2005.

Table 2. Condition Class Descriptions

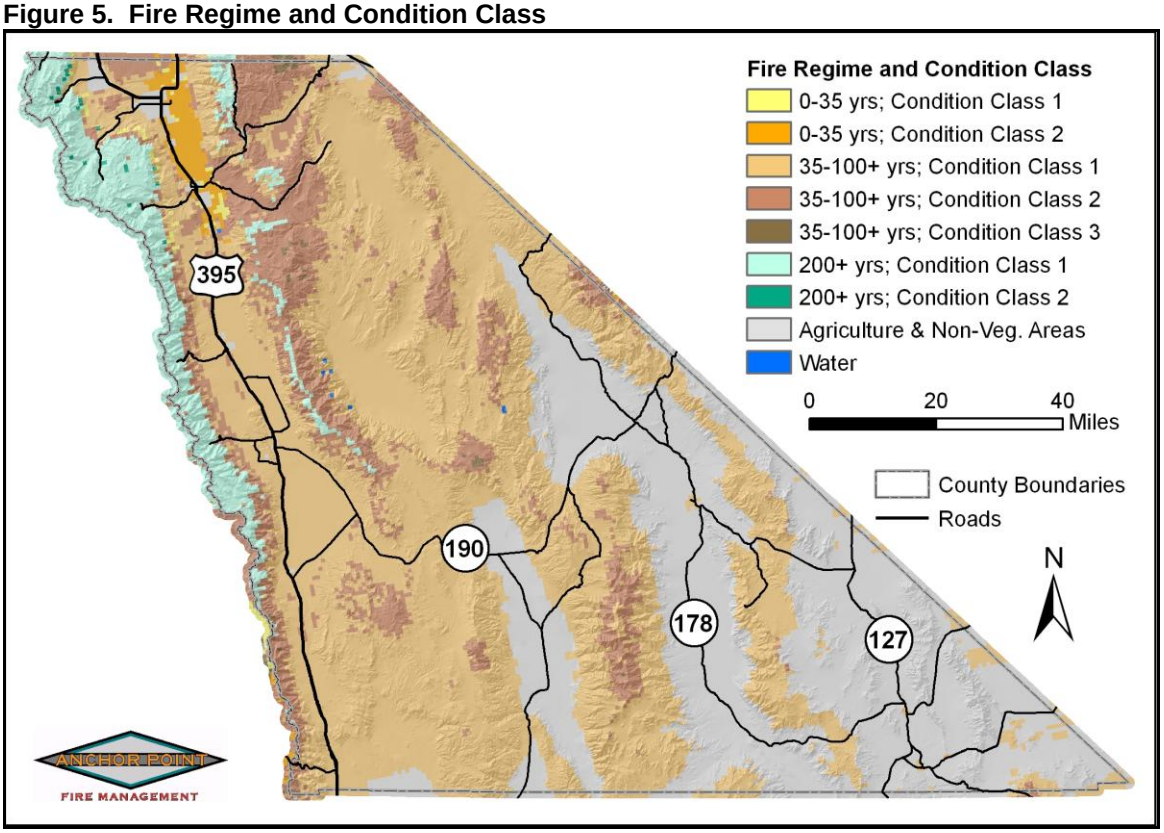
Condition Class	Condition Class Description
1	Fire regimes are within their historical range and the risk of losing key ecosystem components as a result of wildfire is low. Vegetation attributes (species composition and structure) are intact and functioning within a historical range. Fire effects would be similar to those expected under historic fire regimes.
2	Fire regimes have been moderately altered from their historical range. The risk of losing key ecosystem components as a result of wildfire is moderate. Fire frequencies have changed by one or more fire-return intervals (either increased or decreased). Vegetation attributes have been moderately altered from their historical range. Consequently, wildfires would likely be larger, more intense, more severe, and have altered burn patterns than that expected under historic fire regimes.
3	Fire regimes have changed substantially from their historical range. The risk of losing key ecosystem components is high. Fire frequencies have changed by two or more fire-return intervals. Vegetation attributes have been significantly altered from their historical range. Consequently, wildfires would likely be larger, more intense, and have altered burn patterns from those expected under historic fire regimes.

The WUI portions of the study area are dominantly classified under Condition Class 1. By definition, fire regimes are within their historic range and the risk of losing key ecosystem components to fire is low. Consequently, **fire effects are expected to be similar to those experienced under historic fire regimes.**

The Fire Regime and Condition Class (FRCC)[11] assessment of the study area reveals a moderate departure from reference condition vegetation (historic norms), and relatively short return intervals (less than 35 years) in the most populated areas of the northern portion of the study area. In general the northern and western portions of the study area show the most significant areas of departure from historic norms. Departure from reference conditions is much less severe in the southern portion of the district where moderate departures are primarily confined to the higher elevations where few people live. Throughout most of the southern portion of the district vegetative fire regimes and condition classes are within historic norms (condition class 1). This information is displayed graphically in **Figure 5** below.

[11] FRCC is an interagency, standardized tool for determining the degree of departure from reference condition vegetation, fuels, and disturbance regimes. For more information on FRCC please see http://www.frcc.gov/.

Figure 5. Fire Regime and Condition Class



The surrounding federally managed lands report an active fire history. Fire statistics for the Mt. Whitney and White Mountain Ranger Districts (USFS) were extracted from Personal Computer Historical Analysis (PCHA) data for the 20-year period from 1986-2006. These areas represent all USFS managed lands in and near the study area, but do not include any data from areas that are exclusively the responsibility of local or state (CalFire) agencies. **Figure 6** on the next page shows the data extent for this analysis. The results are graphed and summarized on pages 16-18.

Figure 6. Data Extent for Inyo County Fire History

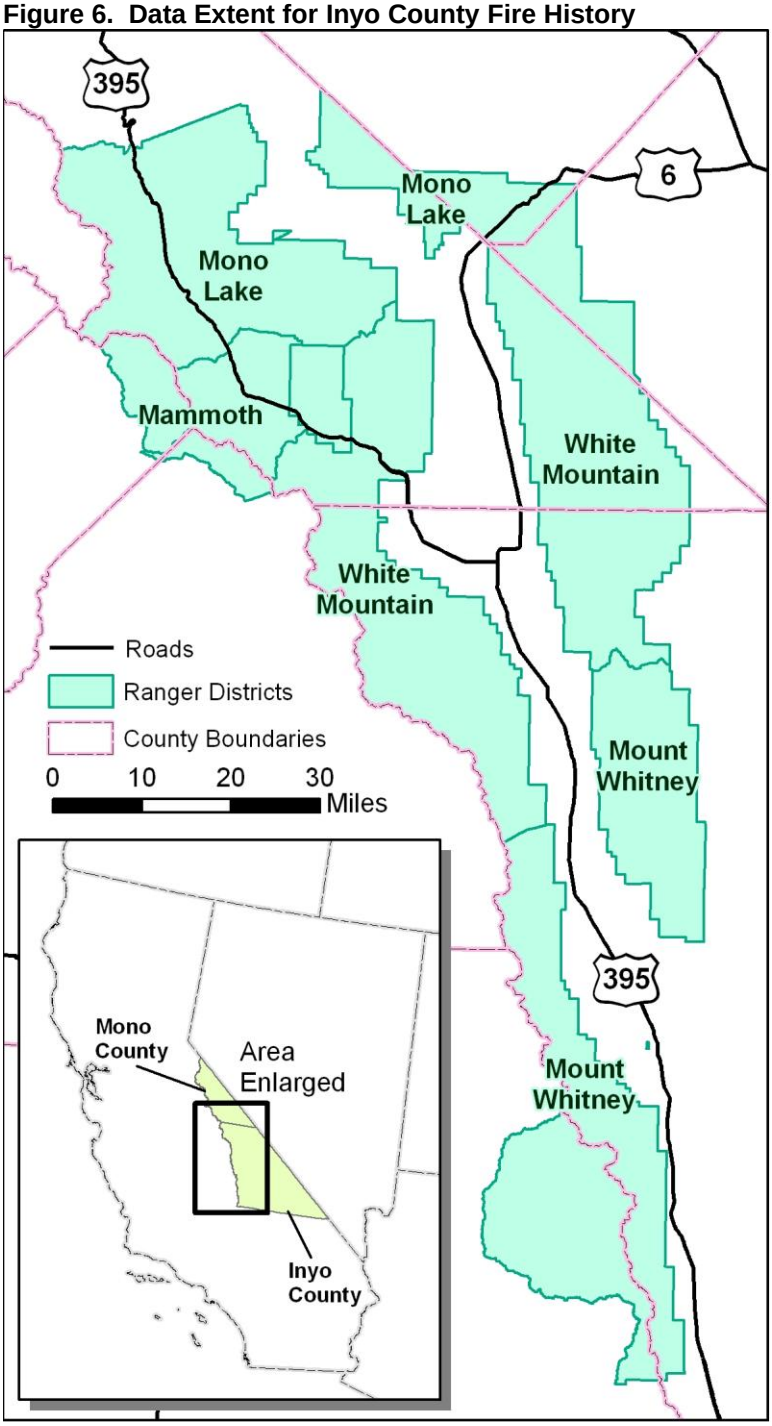


Figure 7 shows the number of fires in the Mt. Whitney and White Mountain Ranger Districts between 1986 and 2006. The number of annual fires ranges from approximately 10 to over 80 per year, with significant variation from year to year. Similarly, there is a large degree of variability in the annual number of acres burned, ranging from too few to appear on the graph, to more than 9,000 acres burned per year.

Figure 7. Number of Fires by Year (1986-2006)

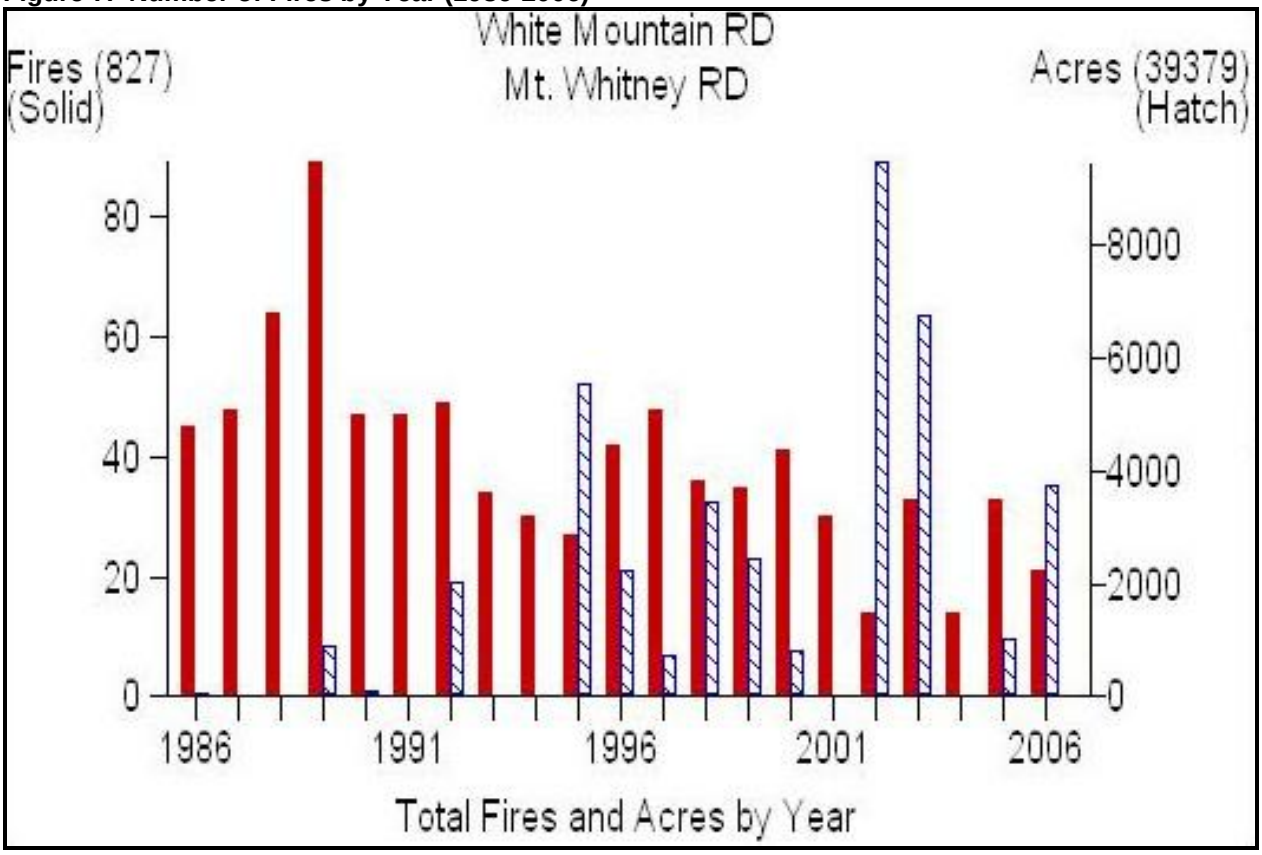


Figure 8 shows the size class distribution of fires. Of the 827 fires recorded between 1986 and 2006, only 17 were major fires (fires of 100 acres or more). 96% of the reported fires (793 fires) were extinguished before reaching 10 acres in size. These statistics reflect the norm throughout the western US, where the majority of fires are controlled on initial attack.

Size Class	Acres
A	< ¼
B	¼ - 9
C	10 – 99
D	100 – 299
E	300 – 999
F	1000 – 4999
G	5000 +

Figure 8. Number of Fires by Size Class (Acres)

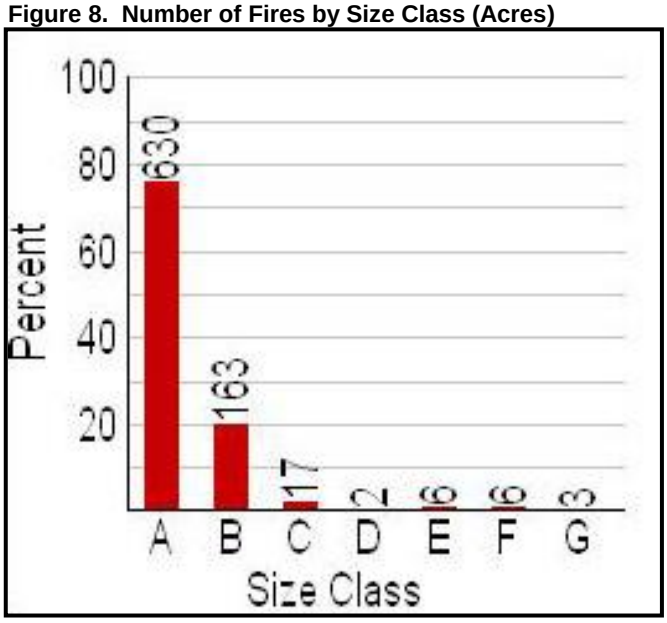


Figure 9 shows the number of fires occurring by each cause class. As shown in the graph, 73% of the fires in the area (605 fires) were caused by lightning. Of the known causes, the next most frequent are campfires (63 fires), and equipment (44 fires). The prominence of naturally occurring (lightning-ignited) fires in the area could be an indicator that fire return intervals are still primarily controlled by natural processes. As large areas of wildland fuels come under pressure through increasing development and recreational use, the causes of wildfires could shift toward human-caused events.

Cause Class	Cause
1	Lightning
2	Equipment
3	Smoking
4	Campfire
5	Debris Burning
6	Railroad
7	Arson
8	Children
9	Miscellaneous

Figure 9. Number of Fires by Cause

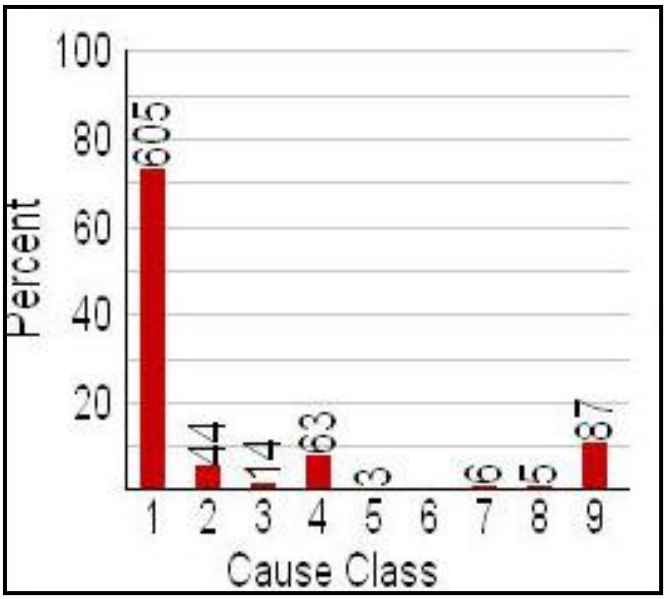
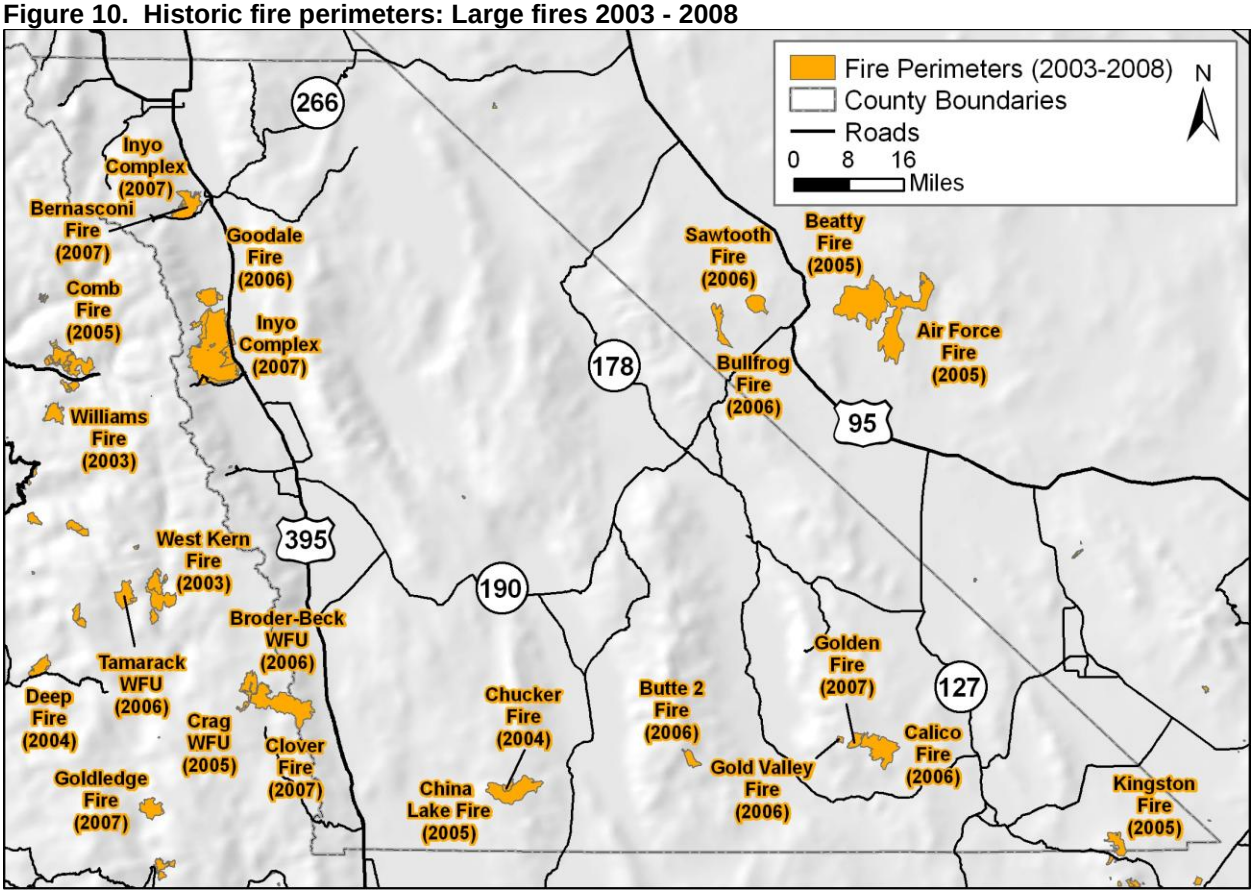


Figure 10. Historic fire perimeters: Large fires 2003 - 2008



FIRE BEHAVIOR POTENTIAL

Weather observations were collected for a 20-year period (1986-2006) and used to define two weather scenarios (moderate and extreme) for modeling fire behavior potential. The moderate conditions fire behavior potential maps (**Figures 11, 13** and **15**) graphically display potential rate of spread, flame length, and crown fire activity given the most common weather conditions existing during the fire season over the last 20 years. The extreme conditions maps (**Figures 12, 14** and **16**) were calculated using ninety-seventh percentile weather data. This means the weather conditions existing on the most severe fire weather days (the top 3% sorted by Spread Component) in each season for the 20-year period were averaged together. These predictions were calculated using the FlamMap 3.0 fire behavior modeling software (see **Glossary**). Other inputs for the fire behavior model include vegetative fuels (type and coverage) and topographical features including slope, elevation and aspect. These inputs were generated for the study area by using a combination of GIS data and field data collection and analysis.

REFERENCE WEATHER USED IN THE FIRE BEHAVIOR POTENTIAL EVALUATION

Inyo County covers an area of over 6,500,000 acres. The study area includes the highest (Mt. Whitney 14,495') and the lowest (Badwater Flats 282' below sea level) points in the continental United States. Some of the higher elevations of the eastern Sierra Nevada average over 380 inches (32 feet) of snowfall per year[12] and Death Valley is one of the hottest and driest places in the western hemisphere (2.5 inches of precipitation annually, July average temperature of 115°F)[13]. No single set of weather inputs can capture the range of variability that exists in the study area and no single weather station is adequate to provide the weather inputs for the fire behavior analysis.

Seasonal percentile weather reports were generated for all of the available Remote Automated Weather Stations (RAWS) and reviewed by our staff Fire Behavior Analyst (FBAN). Sites with poor data or significant errors were eliminated. Data from five RAWS were used to create fire weather zones. After evaluating the RAWS data, three fire weather zones were created for use in the fire behavior potential analysis. Percentile weather observations were calculated from each station using the Fire Family Plus software package to generate the moderate and extreme fire weather conditions classes. For a more complete discussion of the fire behavior potential methodology, please see **Appendix A**.

FIRE BEHAVIOR MODELING LIMITATIONS AND INTERPRETATION

This evaluation is a prediction of likely fire behavior, given a standardized set of conditions and a single point-source ignition in every cell (each 10 x 10 meter area). It does not consider cumulative impacts of increased fire intensity over time and space. The model does not calculate the probability a wildfire will occur. It assumes an ignition occurrence for every cell. These calculations may be conservative (under predict) compared to observed fire behavior.

This model can be conceptually overlaid with the Community Wildfire Hazard Ratings (WHR) or other Values at Risk identification to generate current and future "areas of concern," which are useful for prioritizing mitigation actions. This is sometimes referred to as a "values layer." One possibility is to overlay the fire behavior potential maps with the community hazard map (**Figure 1**) in order to make general evaluations of the effects of the predicted fire behavior in areas of

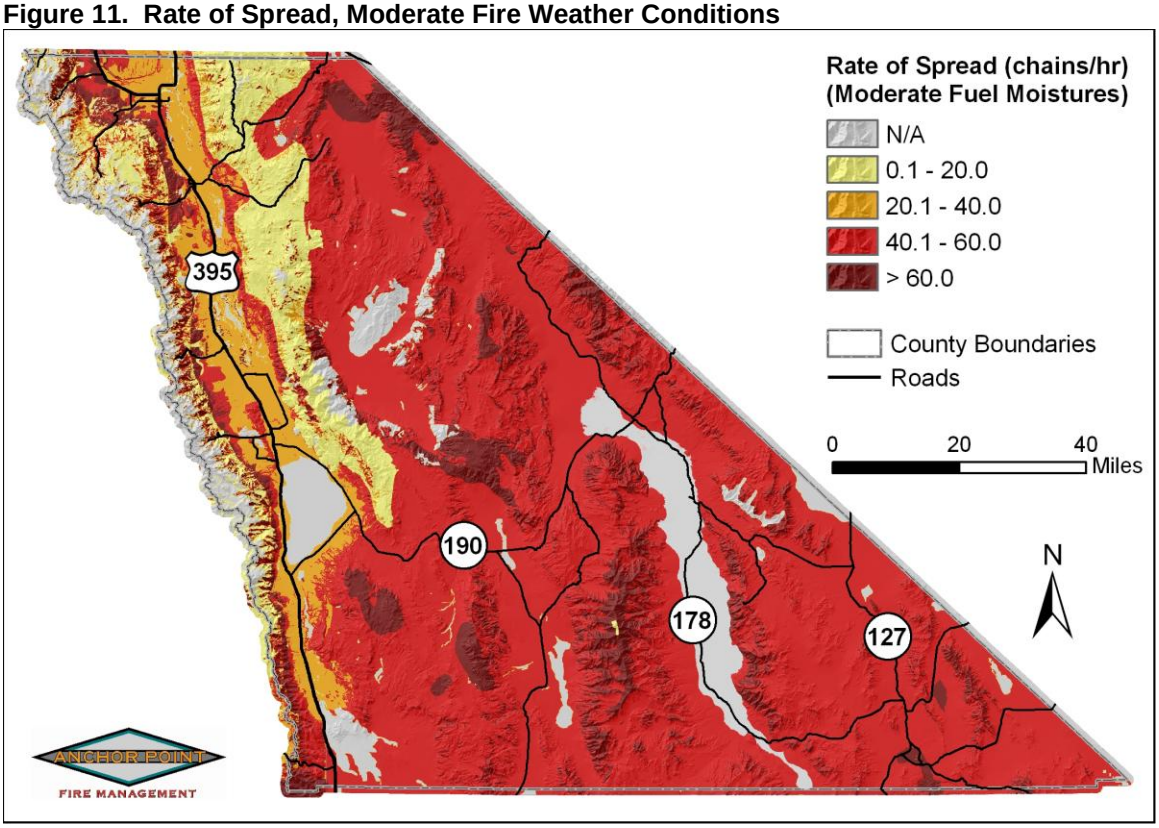
[12] http://www.sfgate.com/cgi-bin/document.cgi?file=/sports/skiing/pages/resorts/mammoth.DTL
[13] http://www.nps.gov/archive/deva/weather.htm

high hazard value (that is, areas where there are concentrations of residences and other man-made values). However, it is best to remember that the minimum mapping unit used for fire behavior modeling is one acre; therefore fine-scale fire behavior and effects are not considered in the model. Additionally, weather conditions are extremely variable and not all combinations are accounted for. The fire behavior prediction maps are best used for pre-planning and not as a stand-alone product for tactical planning. If this information is used for tactical planning, fire behavior calculations should be done with actual weather observations during the fire event. For greatest accuracy, the most current Energy Release Component (ERC) values should be calculated and distributed during the fire season to be used as a guideline for fire behavior potential.

RATE OF SPREAD

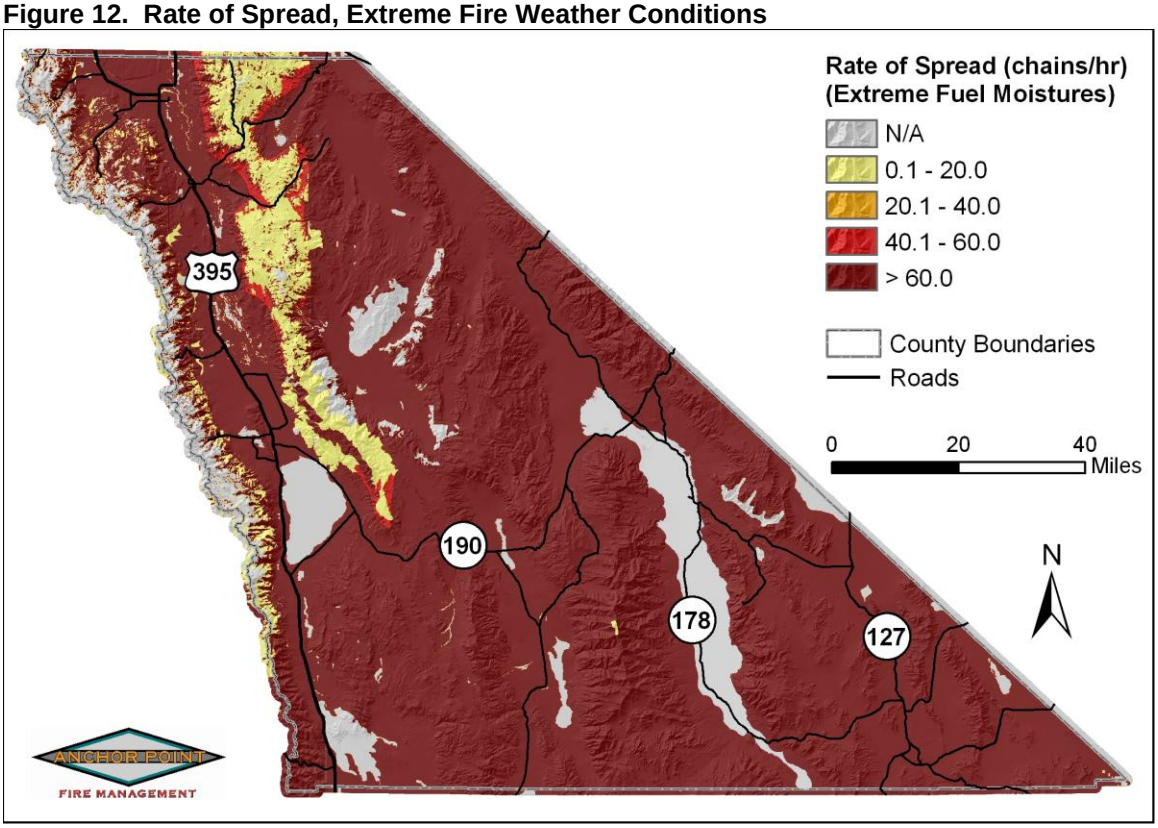
Figures 11 and **12** show the predicted rates of spread for the moderate fire weather and extreme fire weather scenarios respectively.

Figure 11. Rate of Spread, Moderate Fire Weather Conditions



Rates of spread are expressed in chains/hour (CPH). A chain is a unit of measure commonly used by loggers and firefighters. It is equal to 66 feet; therefore one mile equals 80 chains. Rates of fire spread are influenced primarily by the wind, slope steepness, fuel type/continuity and fuel sheltering from the wind. Fire is the only force of nature which moves faster uphill than downhill. When all other factors are equal, fire moves twice as fast uphill on a slope of 30% than it does on flat terrain. In areas where high to extreme rates of spread are predicted (ROS of >40 CPH or ½ mile per hour) it is possible fires could spread faster than humans can escape, creating extremely dangerous conditions for firefighters and evacuating residents. High rates of spread also make suppression efforts less effective and increase the tactical complexity of the incident.

Figure 12. Rate of Spread, Extreme Fire Weather Conditions



In the moderate fire weather scenario, moderate to extreme rates of spread are predicted throughout the populated areas of the Owens Valley. High rates of spread (>40 CPH or ½ mile per hour) are predicted throughout the southern and eastern portions of the study area where desert grasses and shrubs with little sheltering from the wind are the dominant fuels. Rates of spread increase to extreme levels where these conditions are combined with increasing slopes, most notably in the lower slopes of the eastern Sierra and the mountain ranges of the desert areas in the eastern and southern portions of the study area.

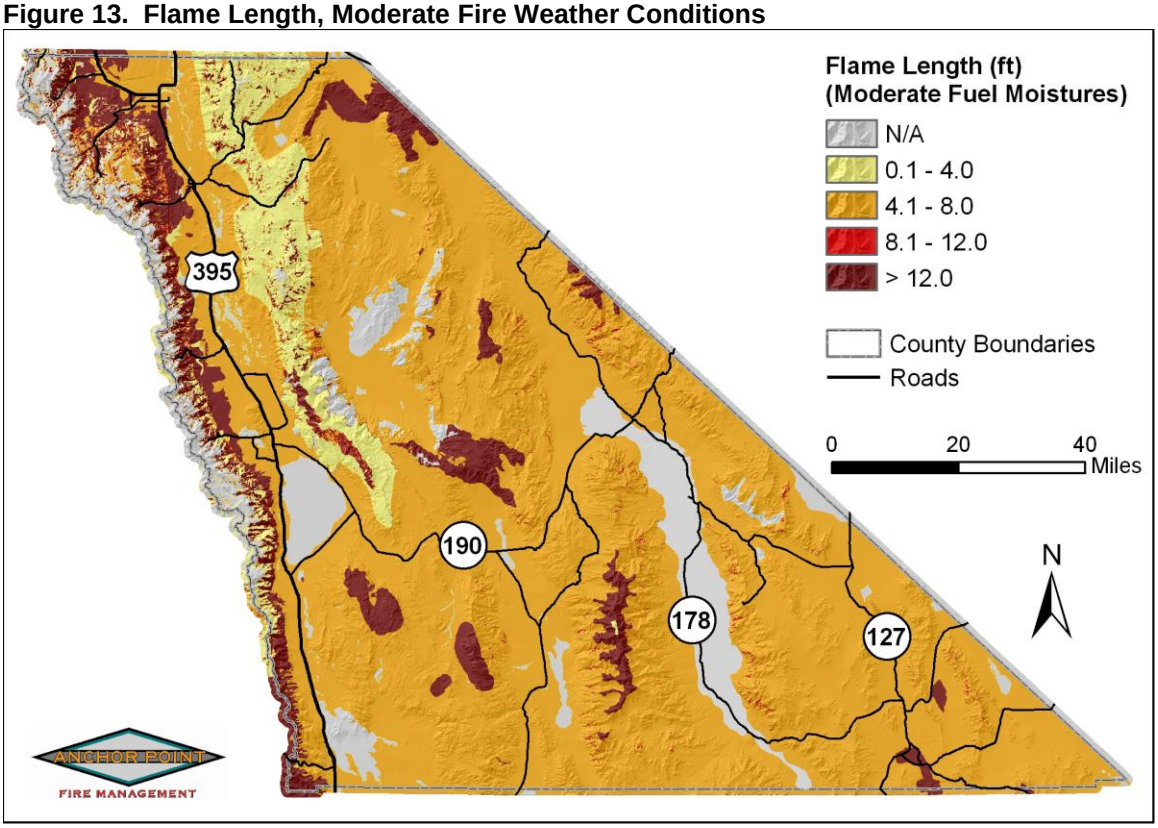
In the extreme fire weather scenario, extreme rates of spread are predicted for all of the populated portions of the study area with the exception of the higher elevations of the Sierra and White Mountains and areas where combustible fuels are sparse or not present (such as Death Valley, and the Owens Lake dry lake bed).

FLAME LENGTH

Flame length is used as a proxy for fire intensity. It is important to note that flame length represents the entire distance from the base of the flame to the tip, irrespective of angle – not simply the flame height above the ground. In high wind conditions, it is possible to have very intense flames (high flame lengths) which are relatively close to the fuel bed.

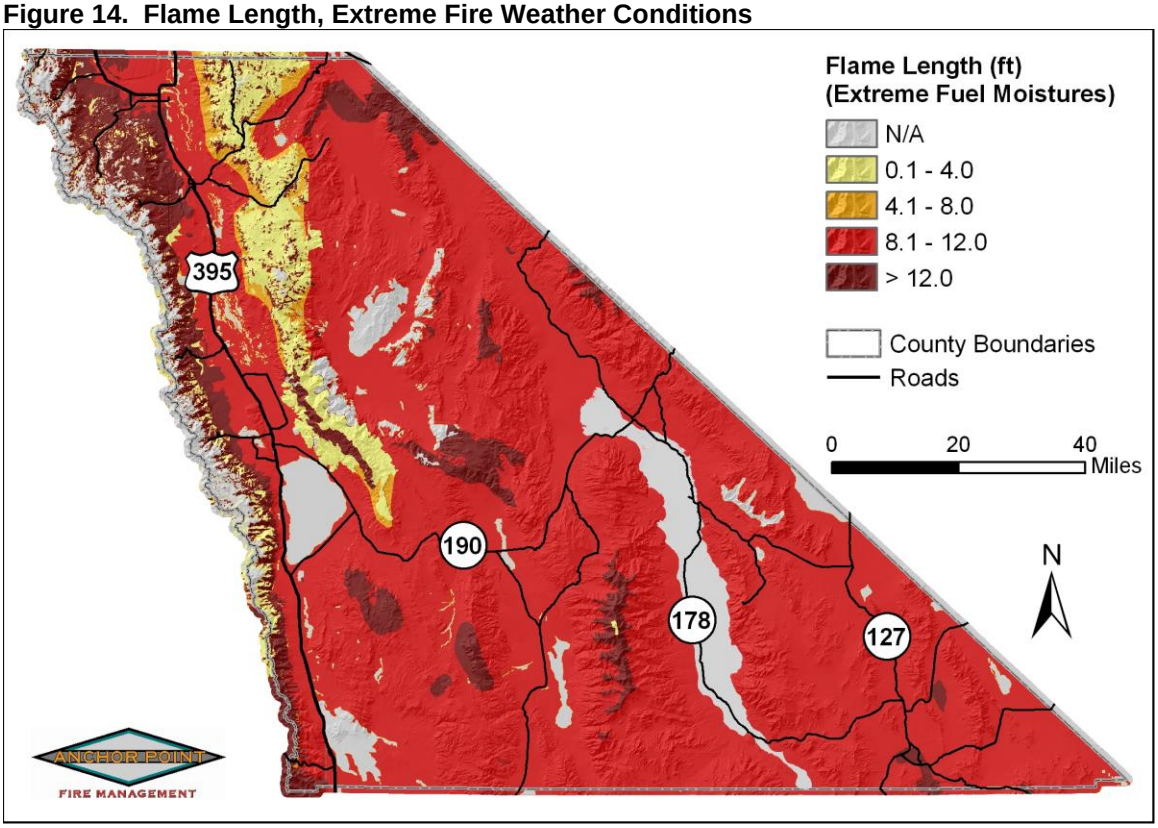
Figures 13 and **14** display flame length in ranges that are meaningful and useful to firefighters. Flame lengths of four feet and less are deemed low enough intensity to be suitable for direct attack by hand crews and represent the best chances of direct extinguishment and control. Flame lengths of less than eight feet are suitable for direct attack by equipment such as bull-dozers and tractor plows. Flame lengths of 8 to 12 feet are usually attacked by indirect methods and aircraft. In conditions where flame lengths exceed 12 feet, the most effective tactic is fuel consumption ahead of the fire by burnouts or mechanical methods. Although indirect fire line and aerial attack are also used for such fires, as flame lengths increase the effectiveness of these tactics decrease. Their use is this case is generally intended to slow rates of spread and reduce fire intensity, especially in areas where Values at Risk are concentrated.

Figure 13. Flame Length, Moderate Fire Weather Conditions



In the moderate fire weather scenario, continuous areas of low intensity flame lengths (< 4') are only predicted for the higher elevations of the White Mountains, which are very sparsely populated and do not contain any of the WUI communities. Small pockets of low flame lengths are predicted for higher elevations of the Sierra and areas where fuels are sparse or not present (such as the Owens Lake dry lake bed), however it is important to note in most of the areas where communities exist on the eastern slope of the Sierra moderate to extreme flame lengths are predicted.

Figure 14. Flame Length, Extreme Fire Weather Conditions



Throughout most of the populated areas of the Owens Valley and the eastern portion of the study area, the predicted flame lengths would be too intense for direct attack by hand crews, however hand crews would be vital for structure preparation, triage and the construction of indirect fire line.

Under the extreme fire weather scenario, high to extreme flame lengths are predicted throughout the areas covered by the WUI communities with the exceptions of some small pockets where elevations and/or fuel conditions moderate the large scale conditions. Under extreme weather and fuel moisture conditions, fire intensity is expected to be a serious issue and control will be difficult and complex to establish and maintain.

CROWN FIRE ACTIVITY

The Crown Fire Activity maps (**figures 15** and **16**) display the potential for fires to move from the surface into the canopy of trees and shrubs.

Figure 15. Crown Fire Activity, Moderate Fire Weather Conditions

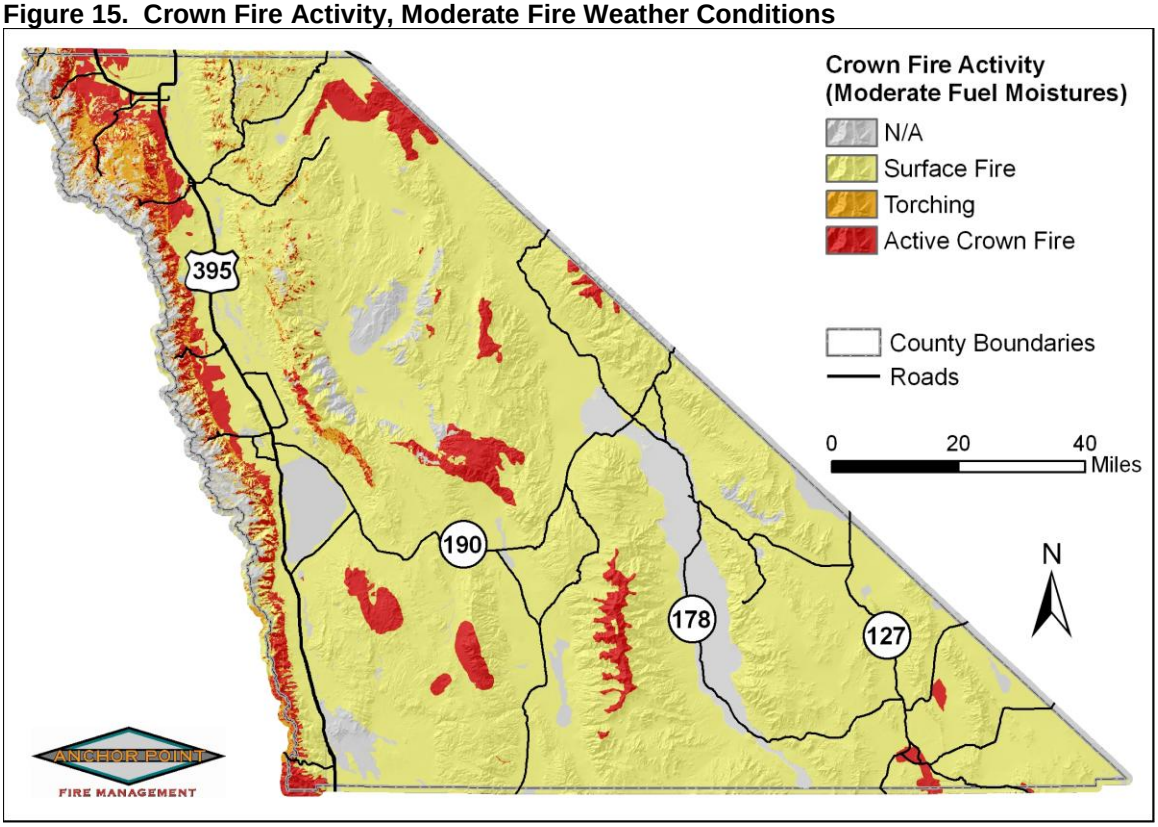
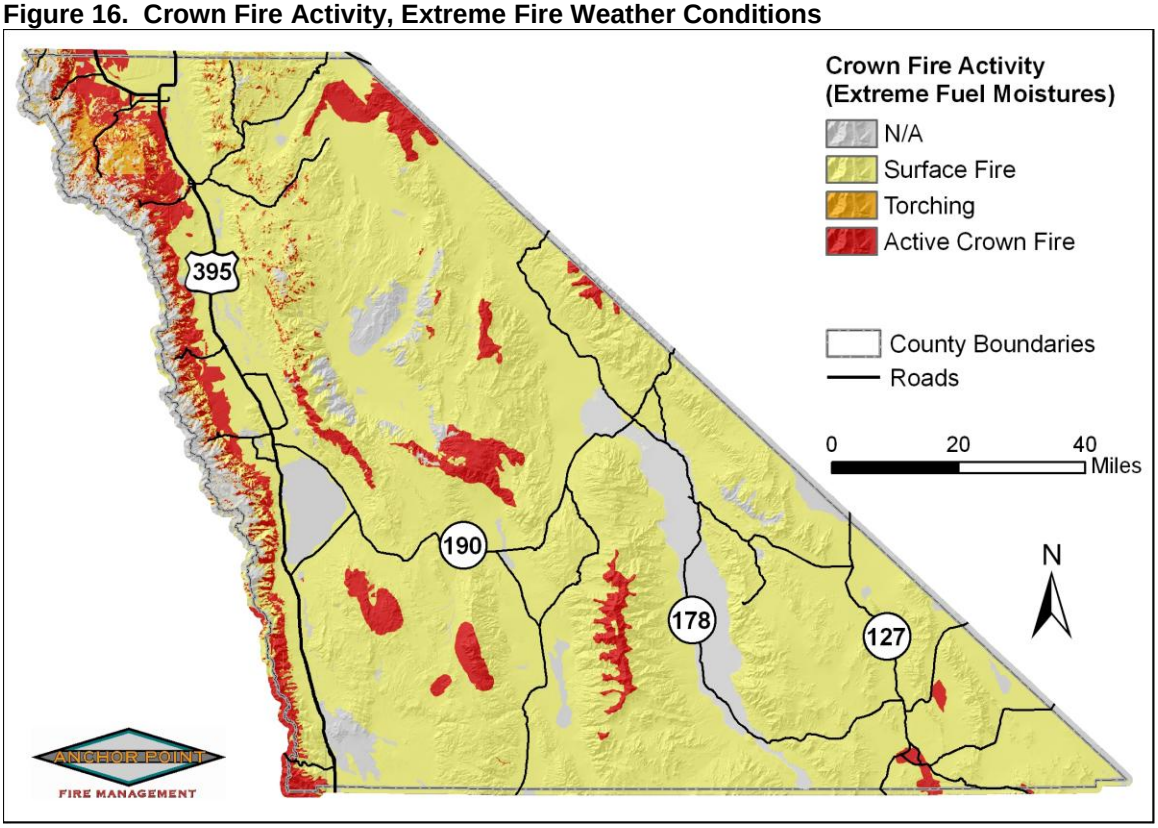


Figure 16. Crown Fire Activity, Extreme Fire Weather Conditions



Note that the likelihood of progression from the surface into the aerial fuels is displayed in four categories. ***N/A*** refers to areas where surface fires are unlikely to develop due to the lack of combustible fuels. These would include any area lacking a combustible fuel bed such as rock, ice, snow fields, water, sand or some urban landscapes. The ***Surface Fire*** category covers areas where fires are expected to be limited to the surface fuels and lack the energy to initiate and sustain vertical development into the aerial fuels. Areas where grass fuels without overstory plants are dominant fall into this category regardless of the energy produced by the fire due to the lack of an aerial fuel bed. Areas covered by the ***Torching*** category are expected to experience isolated combustion of the tree crowns in individual trees and groups of trees. That is to say, individual or relatively small clusters of trees will be completely involved, but these fires lack the energy to initiate sustained horizontal movements (referred to as “runs” by fire fighters) through the crowns. The **A*ctive Crown Fire*** category includes areas where sustained horizontal movements through tree crowns are expected.

This category can be further subdivided into ***dependent*** or ***independent*** crown fire. Dependent crown fires rely on the presence of surface fires to support aerial burning. Independent crown fires develop when aerial burning is sustained without the need for associated surface fire. Independent crown fires are rare and are associated with the most extreme fire behavior conditions. Current fire behavior models do not have the ability to predict independent crown fire development. All crown fires, regardless of whether they are dependent or independent, represent extreme fire behavior conditions and are notoriously resistant to all methods of suppression and control.

It is interesting to note that weather variables had little effect on the development of crown fire in the study area. In general, there is a possibility of torching and/or active crown fire development

in most of the WUI communities where timber fuels are present in the northeast portion of the study area and along the eastern slope of the Sierra. It is important to note most of the WUI communities with high to extreme WHR scores (a measure of the severity of damage expected to Values at Risk from an unsuppressed wildland fire) also fall into this area. The model predicts the possibility of active crown fire developing in the aerial fuels (primarily the crowns of sage stands) near the Tecopa community; however this community received a low WHR score due mostly to a lack of fuels near the Values at Risk. In most of the other populated areas, primarily the central Hwy 395 corridor, large scale crown fires are unlikely to develop. Please see **Appendix B** for a further discussion of the WHR methodology.

RECOMMENDATED SOLUTIONS

Mitigation solutions for the protection of Values at Risk are reflected in specific recommendations, such as developing effective public outreach programs, or designating geographic treatment areas that may have related fuel reduction projects. Specific activities, actions and objectives are recommended for each category of mitigation. Local land and fire management agencies, with the input of the citizen's advisory council or fire safe councils, must determine specific priority actions.

The following mitigation solutions have been identified for the study area. Recommendations are provided for each category.

- Addressing
- Access / Evacuation Routes
- Public Education
- Local Preparedness and Firefighting Capabilities
- Home Mitigation
- Fuels Modification Projects

These categories are NOT ordered by priority in this report, but priority levels have been provided for specific tactical mitigation actions, where appropriate, within each category.

ADDRESSING

In most of the WUI communities within Inyo County, missing or inadequate street signage and addressing is an issue. Where applicable, this problem is also noted in the community descriptions in **Appendix B**. Markers of all types, some homemade, are used throughout the study area with no particular order or system. In some parts of Inyo County, street signs are broken or worn out (see **Figure 17**). The most common address marker is at the mailbox. Address numbers on the box itself, or on the post, are frequently the only indication of the address. In most cases address marker poles and mailbox poles are wooden (see **Figure 18**). There are some community driveways in the study area where multiple homes are accessed from a single driveway off the public road. Some of these unmarked and some have flagged addressing. Flagged addressing is a term describing the placement of multiple addresses on a single sign, servicing multiple structures located on a common access. Where flagged addressing exists, the marker placements are inconsistent and in some cases confusing (see **Figure 18**). There are numerous properties with no address marker of any type scattered throughout the county (see **Figure 19**) including some gated driveways with no marker (see **Figure 20**).

While some residents may consider reflective address signage to be unattractive, it is essential for quick and effective response. The time saved, especially at night and in difficult conditions, cannot be overestimated. Knowing at a glance the difference between a road and a driveway (and which houses are on the driveway) cuts down on errors and time wasted interpreting maps. This is especially true when resources from outside the area are brought in for project

fires that do not have experience with local access issues. General recommendations for address markers can be found in **Appendix D**. Specific recommendations are listed below.

Figure 17. Weathered Wood Street Sign

Figure 18. No Address Marker

Figure 19. Mailbox Address Markers for Common Driveway (boxes mounted on wood poles)

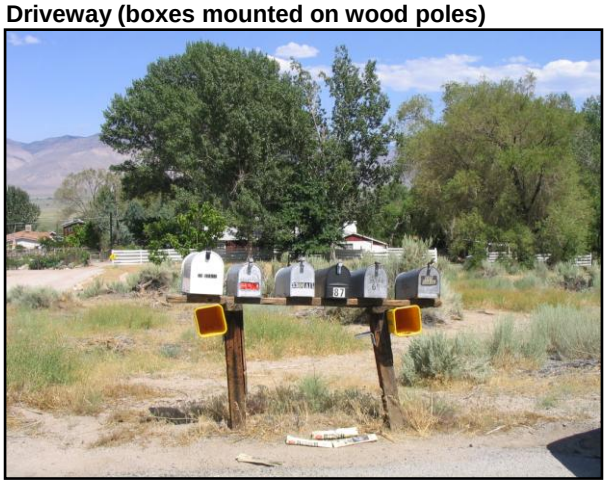


Figure 20. Gated and Unmarked Driveway

RECOMMENDATIONS

- A program of locating and replacing worn or difficult to read street signs should be undertaken. Every intersection and street name change should have large, reflective signage. Enlist the help of Cal Fire and public land managers to enforce home address marker requirements in state responsibility areas.
- Flagged addressing on community driveways should be replaced with reflective markers that indicate the proper road fork, where applicable, for each address. This system should be repeated at every place where the driveway divides and an individual driveway leaves the community driveway.
- For each home, reflective markers should be placed where the driveway leaves an access road and on the house itself. These may be in addition to, or in place of, existing decorative address markers. Consistency in height and placement should be stressed.
- Disseminate the address marker specifications in **Appendix D** to HOAs and local fire departments with the recommendation they be adopted as a part of the local fire code and HOA covenants.
- For all new construction, lot markers should be replaced with address markers as soon as the home has a certificate of occupancy.
- Where dead-end and private road markers occur, the addresses of homes beyond the marker should be clearly posted. This can be done with a group address marker, for example “14391-14393 Highway 120.”
- Develop a public education campaign to advise property owners of the importance of proper street addressing and how to properly address their property.
- Conduct an inventory of all locked gates fire response agencies do not have access to. Property owners should be contacted regarding providing emergency access such as a Knox Box or combination lock codes to local responders.

ACCESS / EVACUATION ROUTES

High Priority: Surveys of fire department officials and other stakeholders identified Buttermilk Road as a potential alternate evacuation route to the primary access roads. This evacuation route makes use of dirt roads linking Buttermilk Road with the now defunct USFS green dump near the Aspendell community. This route could be useful for citizen evacuation and as an access route for firefighters in the event the main access to Aspendell, Highway 168, becomes compromised by heat and smoke. This route may need road surface improvements in order to be viable as an escape route. Road improvements, where necessary, should be continued along Buttermilk road to its junction with Highway 168. If the road improvements necessary to make this a viable escape route are determined to be feasible, thinning of vegetation along both sides of the roadway is also recommended (see *Fuels Modification Projects,* **Project 10, p. 55**). This project could provide a secondary access for Starlite and South Lake depending on the location of fire.

If the fire location is between the Aspendell and the South Lake communities on South Lake Road, South Lake would not have egress. The abandon road that leads behind the South Lake community leads to Coyote Flats, then to Bishop Creek and out to Hwy168. This potential alternative route would also require road surface improvements to be a viable alternative. Since there is currently only one way in and out of Aspendell and South Lake, this project is rated as high priority.

Should a fire enter the entrance to the South Fork Bishop Creek Canyon, a wide open space just north of the Tyee Lakes trail and bridge could be a safe haven and is large enough for Camp Grounds and the South Fork Bishop Creek Community within the Canyon.

High Priority: Until the alternative evacuation route roads are complete, the communities of Aspendell and South Lake need to have agreements with all fire department officials and other stakeholders as to the location of a staging area or shelter in place area when no road egress evacuation is possible.

Investigate the open space just north of the Tyee Lakes trail and bridge to develop an area large enough for camp ground visitors and the South Fork Bishop Creek Community to shelter within the canyon.

PUBLIC EDUCATION

Organization and Ordinances

The purpose of this organization and ordinances section is to provide recommendations on how to best achieve certain administrative activities within Inyo County related to this CWPP. The underlying goal is to work with communities and citizens to educate, inform and involve them in all aspects of the wildfire issues facing Inyo County.

ORGANIZATIONAL RECOMMENDATIONS

Very High Priority: Develop a countywide wildfire coordinator position to help develop annual operating plans, coordinate with community groups, provide public information and education, increase volunteer fire department membership and increase operating funds and grants. Define responsibilities of position within a county wildfire ordinance.

Very High Priority: Develop an annual operating plan to coordinate wildfire management. An annual operating plan would be prepared cooperatively with local, state, and federal government agencies to address the following:

- fire prevention
- public education
- encourage defensible space
- public information during incidents
- evacuation planning and coordination
- fuels treatments

Very High Priority: Emphasize the use of the Incident Command System (ICS). ICS will help organize multi-agency incidents and smooth out communications problems. Ensure that all county agencies are National Incident Management System (NIMS) compliant; refer to the FEMA web site for more information and clarification.[14]

Very High Priority: Currently homeowners have no jurisdiction to create defensible space onto adjacent government lands. Often this is needed to maintain adequate clearance of at least 100ft around homes. Community leaders should work with the local Federal land managers to craft a solution to this issue. The USFS Good Neighbor Policy may provide a foundation for discussion.

High Priority: Inyo County will coordinate with community groups to promote fire prevention, fuels treatments and defensible space in the wildland urban interface.

High Priority: Develop a lead Public Information Officer (PIO) position. Other individuals should be developed to support the lead PIO. This would be a collateral duty for those individuals.

Moderate Priority: Conduct a review of all levels of county wildfire agreements to ensure that no conflicts exist between them.

[14] http://www.fema.gov/emergency/nims/

ORDINANCES RECOMMENDATIONS

High Priority: Consider adoption of the Wildland Urban Interface codes to reduce structure ignitability, recognize issues such as construction standards and creation of defensible space and fuels treatment to reduce risk. The codes also recognize importance of access and water availability. The State of California has adopted the code statewide.

High Priority: Create an ordinance to manage open burning. The goal would be to create an ordinance to streamline the process and improve coordination between the landowner and the county.

High Priority: Consider using the current Inyo Hazard Ordnance to cause adjacent home or vacant lot owners, mitigate to the distance required by State Code.

Should there be a conflict between this document and either the California Recourse Code 4291 or Inyo County Ordinances, the State Code or County Ordinances shall apply.

PUBLIC EDUCATION AND AWARENESS RECOMENDATIONS

Within Inyo County there is likely to be a varied understanding among property owners of the hazards associated with the threat of a wildfire. An approach to wildfire education that emphasizes safety and hazard mitigation on an individual property level should be undertaken, in addition to the counties agencies efforts at risk reduction. Attempts should be made to provide educational materials through personal contact. Property owner education and the wildfire hazard mitigation message should be an ongoing effort.

Very High Priority: provide information to citizens during emergencies such as wildfire. Use the PIO position to coordinate public information. Use local radio (English and Spanish), reverse 911, internet and local phone trees to provide the public with information. However, early notification to residents and visitors to the area will provide the greatest benefit.

Very High Priority: Educate homeowners about forest health and fire prevention. Programs should provide the public with information about mechanical and prescribed fire fuels treatments. Workshops should include information on how to create defensible space and promote the safe use of chainsaws (professional instruction and PPE).

Very High Priority: Emphasize homeowners need to take responsibility to help fire departments better protect their homes.

Very High Priority: Encourage public involvement and feedback.

Very High Priority: Public Land Management Agencies will create an updated procedure for notifying local fire departments of their prescribed fires and other types of fuel treatment plans and operations.

High Priority: Promote the recommendations for each community with regards to defensible space and hazard reduction. See **Appendix B** for specific community recommendations.

High Priority: Coordinate with high risk community groups to encourage evacuation planning and preparedness.

High Priority: Obtain additional "Smokey Bear" signs for use along major highways to inform the public of the current fire danger and to promote fire prevention. Where current signs are placed, check to be sure they are visible.

High Priority: Conduct fire prevention campaigns during times when fire danger is high such as during the spring when fires can start in dry fuels and spread rapidly in windy conditions. Create fire prevention messages in the local newspaper and on the radio to raise public awareness of the danger of wildfires.

High Priority: Provide FireSafe fire prevention materials to encourage all homeowners/landowners to take responsibility and voluntarily implement defensible space practices that will reduce the chance of their homes catching fire during a wildfire. Consider having firefighters distribute FireSafe materials door to door to provide fire prevention and home protection advice in person.

High Priority: Ensure that any and all Address Map books are updated to reflect information stemming from this CWPP. Consider the development of a Wildfire Pre-Attack Plan. Every piece of emergency equipment in the county should have a copy (county and municipal fire departments, the county road department, CalFire, USFS, BLM) Command/Supervisor vehicles will need multiple copies or the ability to generate multiple copies. This will allow for the distribution of specific maps to incoming mutual aid resources that may not have the maps.

Visit these web sites for a list of public education materials. These are suitable for firefighters and homeowners alike:

- http://www.nwcg.gov/pms/pubs/pubs.htm
- http://www.firewise.org
- http://www.firesafecouncil.org/homeowner/index.cfm
- http://www.firesafecouncil.org/find/view_council.cfm?c=7
  - Aspendell FireSafe Council Minutes
- http://www.firesafecouncil.org/find/view_council.cfm?c=70
  - South Bishop Creek FireSafe Council Minutes

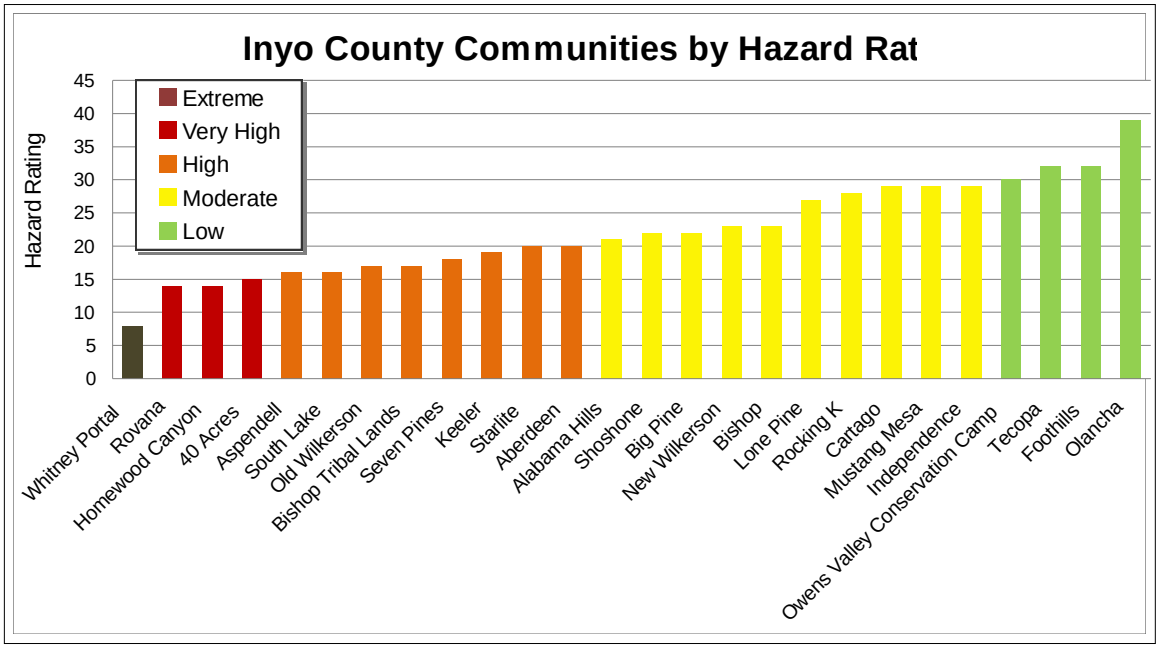
HOME MITIGATION

Community responsibility for self-protection from wildfire is essential. Educating homeowners is the first step in promoting a shared responsibility. Part of the educational process is defining the hazard and risks both at the community-level and parcel level.

The community-level assessment has identified four of the 10 communities in the study area to be at extreme or very high risk. Construction type, condition, age, the fuel loading of the structure/contents and position are contributing factors in making homes more susceptible to ignition under even moderate burning conditions. There is also a likelihood of rapid fire growth and spread in these areas due to steep topography, fast burning or flashy fuel components and other topographic features that contribute to channeling winds and promotion of extreme fire behavior.

Figure 21 illustrates the relative hazard rankings for communities in the study area.

Figure 21. Inyo County Community Hazard Ratings

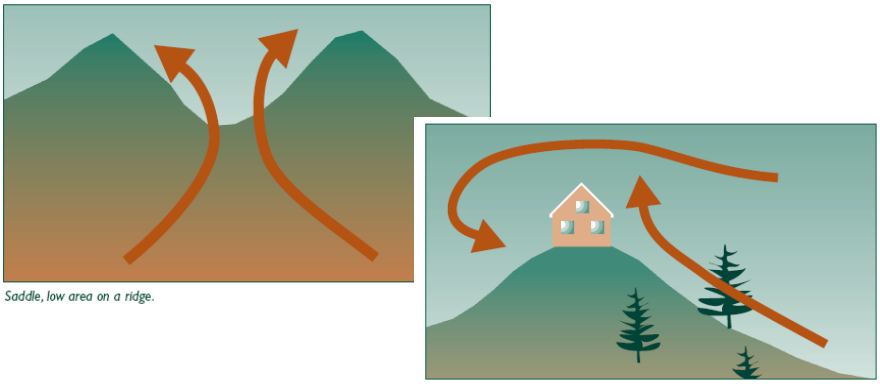


- A rating of nine or less indicates an area of extreme hazard.
- A rating of 10 to 15 indicates a very high hazard.
- A rating of 16 to 20 indicates high hazard.
- A rating of 21 to 30 indicates moderate hazard.
- A rating of 30 or greater indicates a low hazard.

DEFENSIBLE SPACE

The most important element for the improvement of life safety and property preservation is for every home in the study area to have compliant, effective defensible space. This is especially important for homes with wood roofs and homes located on steep slopes, in chimneys, saddles, or near any other topographic feature that contributes to fire intensity.

Figure 22. Saddle & Ridge Top Development[15]



Saddle, low area on a ridge.

Ridge with wind exposure.

Outside of the established communities many ranches and individual home sites exist. The following recommendations apply to all structures which could be threatened by wildfire.

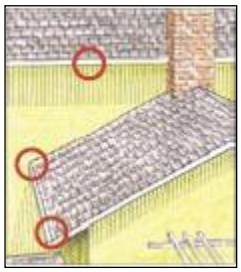
Due to the nature of the vegetation and topography combined with the majority of homes situated on medium sized parcels, an aggressive program of evaluating and implementing defensible space for all homes will do more to limit fire-related property damage than perhaps any other single recommendation in this report.

To improve life safety and preserve property, every home in the study area must have compliant, effective defensible space. This is especially important for homes with wood roofs and homes located on steep slopes, in chimneys, saddles, or near any other topographic feature that contributes to fire intensity. These recommendations are intended to give homeowners enough information to immediately begin making their home fire-safe or improve existing home mitigation efforts. Defensible space must be maintained throughout the year.

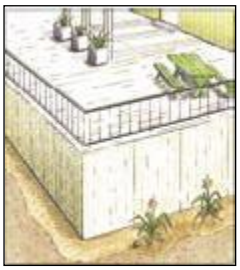
- ✓ Trees and shrubs are properly thinned and pruned within the defensible space. Slash from the thinning has been disposed of properly.
- ✓ Roof and gutters are clear of debris. Branches overhanging the roof and chimney are removed.
- ✓ Chimney screens are in place and in good condition.
- ✓ An outdoor water supply is available, complete with a hose and nozzle that can reach all parts of the house. Fire extinguishers are checked and in working condition. Hand tools such as shovels and rakes are easily accessible.

15 *FireWise Construction*, Peter Slack, Boulder Colorado

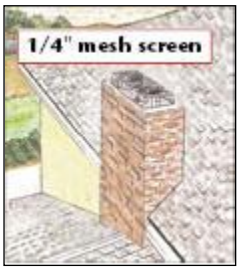
- ✓ The driveway is wide enough. The clearance of trees and branches is adequate for fire and emergency equipment. (Check with your local fire department.)
- ✓ Road signs and your house number are posted and easily visible.
- ✓ Attic, roof, eaves, and foundation vents are screened and in good condition. Stilt foundations and decks are enclosed, screened or walled up.
- ✓ Firewood is staked on a side contour, at least 50 feet away from structures.
- ✓ Propane tanks should be located at least 30' from all structures. The area around the tank must be free of combustible material such as yard debris, weeds, etc.
- ✓ Power poles have vegetation cleared away in a 5 foot radius.
- ✓ Maintain your defensible space constantly:
    - Mow non-irrigated grass to a low height. Mow early in the morning, avoiding times of wind, and avoid rocks because a grass fire could ignite from a spark.
    - Remove any branches overhanging the roof or chimney.
    - Remove all debris and cuttings from the defensible space.



Clean Gutters and Roof



Enclose Decks



Maintain Chimneys

Figure 23. Defensible Space Zones (Timber and Brush Lands)[16]

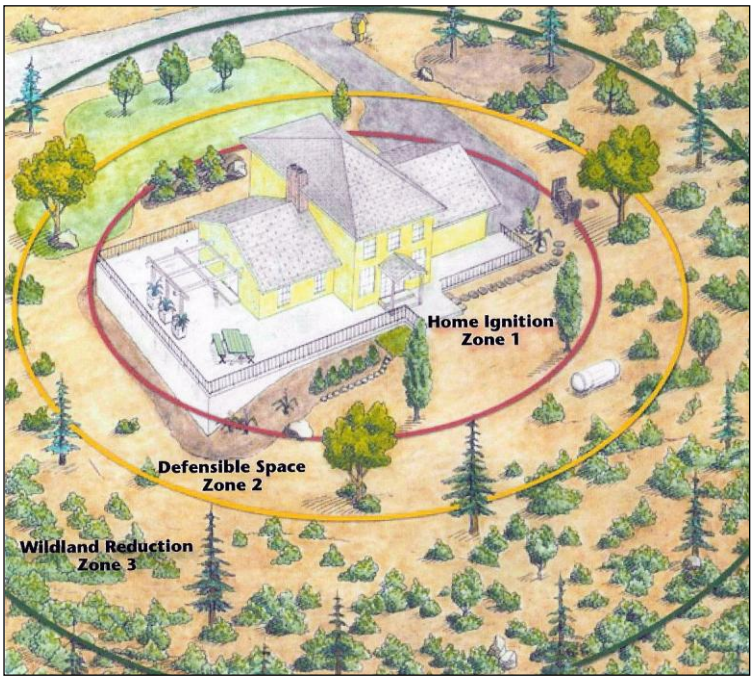
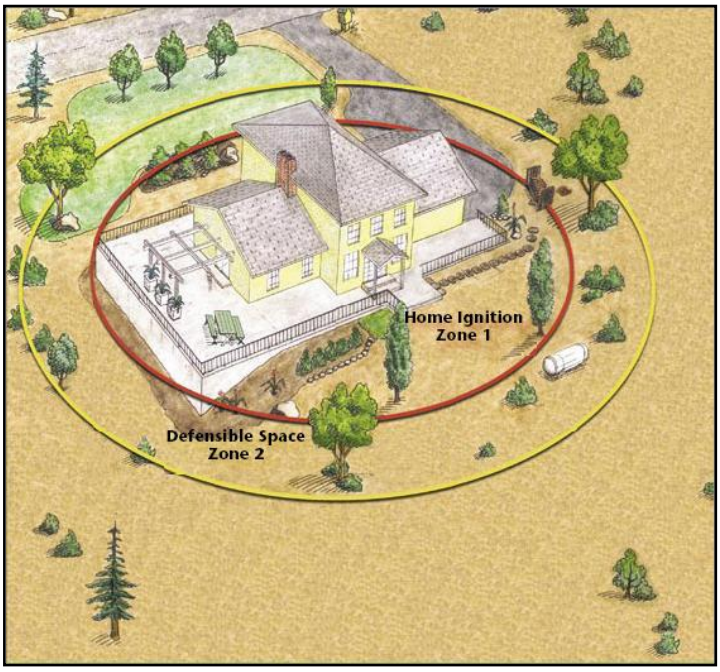


Figure 24. Defensible Space Zones (Grass Lands)



ZONE 1 (within 15 feet of the home), shown as Home Ignition Zone, suggests eliminating all flammable materials (fire-prone vegetation, wood stacks, wood decking, patio furniture, umbrellas, etc.). Irrigated grass, rock gardens, non-flammable decking, or stone patios are desirable substitutions.

[16] A Homeowner's Guide to Fire Safe Landscaping (2005), www.firesafecouncil.org, referenced 9/10/07

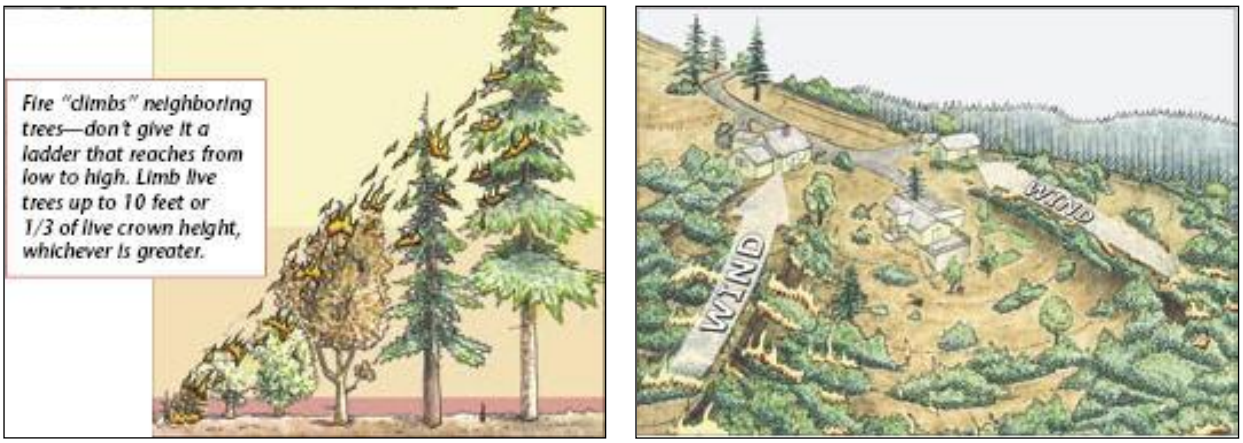
ZONE 2 Defensible Space (15 to 100 feet from the home – on steep slopes or areas of high winds the Defensible Space will need to be expanded to 150 feet) suggests thinning trees and large shrubs so there is at least 10 feet between tree tops (crowns). Crown separation is measured from the furthest branch of one tree to the nearest branch on the next tree. On steep slopes or areas subject to high winds, allow at least 1.5 times more space between tree crowns. Remove all ladder fuels from under these remaining trees. Prune all trees to a height of at least 10 feet, or 1/3 of the live crown height. Small clumps of 2 to 3 trees may be occasionally left but leave more space between the crowns of these clumps and surrounding trees. Isolated shrubs may remain, provided they are not under tree crowns. Remove dead stems from trees and shrubs annually. Where shrubs are the primary vegetation in Zone 2, refer to the "Brush and Shrubs" section below.[17]

ZONE 3 Wildland Reduction, aka Extended Defensible Space (beyond 100 feet), suggests a much more limited thinning and pruning to the standards in zone 2. The goal in this zone is to improve the health of the wildlands, which will also help to slow the approaching wildfire.

BRUSH AND SHRUBS

Brush and shrubs are smaller than trees, often formed by a number of vertical or semi-upright branches arising close to the ground. On nearly level ground (increase 1.5 times for slope and windy areas), minimum spacing recommendations between clumps of brush or shrubs is 2 1/2 times the height of the vegetation. Maximum diameter of clumps should be 2 times the height of the vegetation. All measurements are made from the edges of vegetation crowns.

For example: For shrubs 6 feet high, spacing between shrub clumps should be 15 feet or more apart (measured from the edges of the crowns of vegetation clumps). The diameter of shrub clumps should not exceed 12 feet (measured from the edges of the crowns). Branches should be pruned to a height of 3 feet.



Increase Defensible Space in Windy and Steep Areas

[17] http://www.ext.colostate.edu/PUBS/natres/06302.html, referenced 9/10/07

RECOMMENDATIONS

Very High Priority: Develop defensible space around individual homes and structures.

High Priority: Any community with a rating of extreme, very high, or high hazard should undergo a parcel-level analysis (individual home assessment) as soon as possible. Please see **Appendix B** for detailed information on each community. The data in **Appendix B** will facilitate the following important fire management practices:

- Establish a baseline hazard assessment for homes in these communities
- Educate the community through the presentation of the parcel-level Hazard and Risk Analysis at neighborhood public meetings
- Identify defensible space needs and other effective mitigation techniques
- Identify and facilitate "cross-boundary" projects such as fuels modification projects adjacent to the community
- Develop a Pre-Attack/Operational Plan. A pre-attack plan assists fire agencies in developing strategies and tactics that will mitigate incidents when they occur.

High Priority: Use the structure triage methodology provided in **Appendix C** to identify homes not likely to be defendable.

LOCAL PREPAREDNESS AND FIREFIGHTING CAPABILITIES

Fire suppression in Inyo County is provided by Special Fire Districts and a mixture of rural fire departments, town/city fire departments, CalFire, and Federal Land Management Agencies. Coordination between agencies with regards to firefighter training and communications will greatly enhance the safety and effectiveness during fire suppression.

Inyo County should take the lead and strive to coordinate and support the following recommendations. Land management agencies within the county have the ability to call upon agency experts from outside the county and should be viewed as a valuable resource before, during, and after wildfire incidents.

TRAINING

High Priority: Work with state and federal agencies to conduct basic wildfire suppression and multi-agency ICS training.

- I-100 (basic ICS) for all firefighters and I-200 (Intermediate ICS) for all fire officers. NIMS courses could satisfy these recommendations.
- A Inyo County tailored Basic Wildland Firefighting and Fire Behavior (NWCG S-130/190) for all City and County fire department members.
- At a minimum, have the safety and structure triage units from S-215 Fire Operations in the Urban Interface presented to all City and County fire department members.
- Provide a NWCG S-234 Firing Operations course to City and County fire department members.
- Organize and facilitate table-top or sand table wildfire exercises with all county agencies attending.
- Organize and facilitate an annual wildfire interface training exercise within the communities outlined in this CWPP and encourage multi-agency participation.
- Encourage personnel to participate in out of county training opportunities.
- Encourage personnel to participate in federal and State prescribed fire opportunities. These burns should also be scheduled on weekends so as to attract volunteer firefighter who otherwise would not be able to attend.

High Priority: Consider adopting “appropriate response” or indirect fire suppression tactics in remote areas, given the threat from heavy fuel loading and the lack of fire fighting resources.

High Priority: Work with state and federal agencies to conduct the pack test, or other similar fitness evaluation and annual refresher courses that can be worked into local fire department schedules such as evenings and weekends.

High Priority: Train local fire departments on how to create defensible space around homes.

FIREFIGHTER SAFETY

High Priority: Provide minimum wildland Personal Protective Equipment (PPE) for all career and volunteer firefighters (see NFPA Standard 1977 for requirements).

High Priority: Establish a personnel rehabilitation system. At a minimum, each department should have drinking water and MREs (meals ready to eat) to support their personnel for 24-48 hours.

High Priority: Bridge Load Limits: Post load limits on all bridges.

COMMUNICATIONS

Communication problems are very commonly linked to tragic results with regard to firefighter safety.

High Priority: Publish a list of frequencies for each fire department and list the associated channels.

High Priority: Consider organizing all fire department frequencies in similar configurations. Develop an inventory of radio equipment and create a list of needs for replacement and new acquisitions.

High Priority: Develop and publish a general communications plan for incidents that require multi-fire department response.

High Priority: Participate in the California Statewide Interoperability Communications Program to increase competitiveness for communication grants.

EQUIPMENT

High Priority: Develop and publish a list of fire equipment by location. Develop an equipment needs and replacement list.

High Priority: Work with Inyo County Road Department and California Department of Transportation to train employees, provide employees with personal protective equipment such as fire shirts and fire shelters, and mobilize equipment to fight fires that threaten life and property.

WATER SUPPLY

In Inyo County, like many of the mountainous and rural areas of California, water is a critical fire suppression issue. Only a few communities have a reliable source of water via hydrants. Most of the communities are reliant on seasonal ponds and creeks. Immediately accessible water sources must always be considered to fully support fire operations, therefore the following recommendations are suggested.

Very High Priority: Need to work with community water associations to assure new hydrant systems are adequate for fire suppression when water supply is available.

Very High Priority: Need to map existing water sources and make them known.

High Priority: Where secondary pressurized water sources exist (golf course, development landscaping, other types of sprinkler systems) develop a procedure for quickly activating these systems.

High Priority: Develop a plan, and install dry hydrant and cistern water supply systems around the County. Specifically the older subdivisions where homes have individual water supplies or water systems that have no hydrants or inadequate volume, pressure or flow rates.

High Priority: Ensure that hydrants are operational. Test hydrants annually and guarantee that they are obstruction-free and visible.

FUELS MODIFICATION PROJECTS

Introduction

One of the most effective forms of landscape scale fuels modification is the fuelbreak (sometimes referred to as “shaded fuelbreak”). A fuelbreak is an easily accessible strip of land of varying width, depending on fuel and terrain, in which fuel density is reduced, thus improving fire control opportunities. Vegetation is thinned, removing diseased, fire-weakened, and most standing dead trees. Thinning should select for the more fire-resistant species. Ladder fuels – such as low limbs and heavy regeneration – are removed from the remaining stand. Brush, dead and down materials, logging slash, and other heavy ground fuels are removed and disposed of to create an open park-like appearance. The use of fuelbreaks under normal burning conditions can limit the uncontrolled spread of fires and aid firefighters in slowing the spread rate. Under extreme burning conditions, where spotting occurs for miles ahead of the main fire, and probability of ignition is high, even the best fuelbreaks have limited effectiveness. Factors that were considered when determining the need for fuelbreaks in Inyo County communities include:

- The presence and density of hazardous fuels (see *Fire Behavior Outputs* in **Appendix A**)
- Slope (see *Fire Behavior Outputs* in **Appendix A**)
- Other hazardous topographic features
- Crowning potential (see *Fire Behavior Outputs* in **Appendix A**)
- Ignition sources

Chimneys, saddles, and deep ravines are all known to accelerate fire spread and influence intensity. Communities with homes located on or above such features, as well as developments located on summits and ridge tops, were given significant consideration for fuel breaks. Crown fire activity values for Inyo County were generated by the FlamMap model and classified into four standard ranges. In areas where independent and dependent crown fire activity is likely to exist, fuelbreaks were considered. When there were known likely ignition sources (such as recreation areas that allow campfires) present in areas where there is a threat of fire being channeled into communities, fuelbreaks were considered.

Fuelbreaks should always be connected to a good anchor point, like a rock outcropping, river, lake, or road. The classic location for fuelbreaks is along the tops of ridges, in order to stop fires from backing down the other side or spotting into the next drainage. This is not always practical from a WUI standpoint, because the structures firefighters are trying to protect are usually located at the tops of ridges or mid-slope. Mid-slope positioning is considered the least desirable for fuelbreaks, but it may be easiest to achieve as an extension of defensible space work or off existing roads and escape routes. One tactic would be to create fuelbreaks on slopes below homes located mid-slope and on ridge tops, so that the area of continuous fuels between the defensible space of homes and the fuelbreak is less than ten acres. Another commonly employed tactic is to position fuelbreaks along the bottom of slopes. It would make sense to locate fuelbreaks mid-slope below homes to break the continuity of fuels into the smaller units mentioned above, even though this position is considered the least desirable from a fire suppression point of view.

Fuelbreaks are often easiest to locate along existing roadbeds. The minimum recommended fuelbreak width is usually 200 feet. As spread rate and intensity increases with slope angle, the size of the fuelbreak should also be increased, with an emphasis on the downhill side of the roadbed or centerline employed. The formulas for slope angles of 30% and greater are as follows: below road distance = 100' + (1.5 x slope %), above road distance = 100' – slope %. Fuelbreaks that pass through hazardous topographic features should have these distances increased by 50%.[18] Since fuelbreaks can have an undesirable effect on the aesthetics of the area, crown separation should be emphasized over stand density levels. In other words, isolating groupings rather than cutting for precise stem spacing will help to mitigate the visual impact of the fuelbreak.

It is important to consider that fuelbreaks must be maintained to be effective. Thinning usually accelerates the process of regenerative growth. The effectiveness of the fuelbreak may be lost in as little as three to four years if ladder fuels and regeneration are not controlled.
One of the most difficult issues in establishing and maintaining fuelbreaks is securing the cooperation and participation of landowners. Ownership maps of the area indicate that implementation of fuels reduction projects recommended here would require the approval of public land management agencies as well as private landowners.

NOTE: It is very important to recognize that the **Inyo County Recommended Fuels Modification Projects** represented on the follow pages are treatment areas, recommended through the above stated criteria but are not to be viewed as specific forestry prescriptions. The graphics represent the general area in which the fuels reduction is recommended but not the specific length, width or even location. It is imperative that the local Federal land agency be contacted to collaborate on specific fuel reduction design criteria and to ensure a coordinated approach to private/public fuels reduction.

18 Frank C. Dennis, "Fuelbreak Guidelines for Forested Subdivisions" (Colorado State Forest Service, Colorado State University, 1983), p. 11.

INYO COUNTY EXISTING FUELS MODIFICATION PROJECTS

The following table shows USFS existing fuels treatment projects.

Table 3. USFS Existing Fuels Treatment Projects.

Project Name	Agency	Year	Acres	General Location
Fish Slough Prescribed Burn	BLM	2008	200	Fish Slough
Wilkerson	BLM	2005	36	Wilkerson
Oak Creek	BLM	2005	15	Oak Creek/Fort Independence
Forty Acres	BLM	2004	10	Round Valley
Horse Creek	Inyo NF	2006	450	Bishop Creek Drainage
Seven Pines	Inyo NF	2004	1,250	Seven Pines
George Creek	Inyo NF	2004	400	George Creek Drainage
Lone Pine Creek	Inyo NF	2004	150	Lone Pine Creek Drainage
Lone Pine Creek 3	Inyo NF	2004	240	Lone Pine Creek Drainage
Mt. Whitney Fuel Breaks	Inyo NF	2004	242	Mt. Whitney Ranger Dist.

The following table shows future/proposed BLM fuels reduction projects in Inyo County.

Table 4. BLM Future Fuels Modification Projects

Project Name	Agency	General Location
Highway 6 Communities	BLM	Laws/Chalfant/Hammil
Rovana	BLM	Round Valley
Mustang Mesa	BLM	Round Valley
Horton Creek	BLM	Round Valley
Rocking K	BLM	Bishop
Birch Creek	BLM	Fish Springs/Tinemaha
Goodale Creek/Aberdeen	BLM	Aberdeen
Manzanar Interagency	BLM	Manzanar
Lone Pine	BLM	Lone Pine
Olivas Ranch/Grandview	BLM	Lone Pine
Alabama Hills	BLM	Lone Pine
Olancha/Cartago	BLM	Olancha/Cartago

The following table shows the fuels modification projects recommended in this report. The projects are listed by priority level. Detailed descriptions and maps of each project begin on the next page.

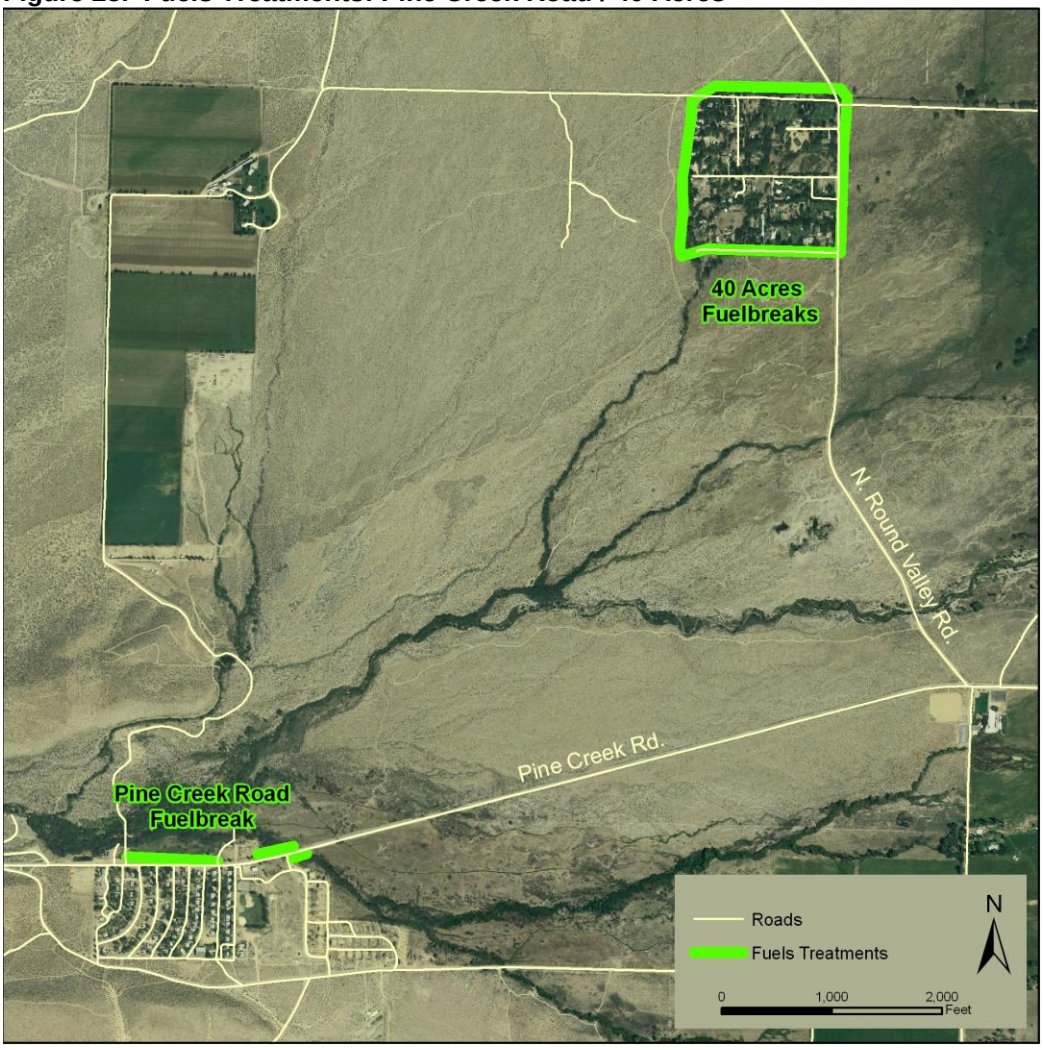
Table 5. CWPP Recommended Fuels Modification Projects by Priority

Fuelbreak Name	Size	Priority Level
Lone Pine Paiute Shoshone Reservation Fuelbreak	Approximately 19 Acres	**Priority level - High**
LPPSR	Approximately 30 Acres	**Priority level - High**
Whitney Portal Access Road Fuels Treatment	Approximately 34 Acres	**Priority level - High**
40 Acres Fuelbreaks	Approximately 13 Acres	**Priority level - High**
Homewood Canyon Road Fuels Treatment	Approximately 84 Acres	**Priority level - High**
Aspendell Fuelbreak	Approximately 14.5 Acres	**Priority level - High**
South Lake Fuelbreak	Approximately 7.5 Acres	**Priority level - High**
Baker Creek Fuelbreak	Approximately 24 Acres	**Priority level - High**
Rolling Green Fuelbreak	Approximately 46 Acres	**Priority level - High**
West Lone Pine Fuelbreak	Approximately 3 Acres	**Priority level - Moderate**
East Lone Pine Fuelbreak	Approximately 8.5 Acres	**Priority level - Moderate**
Bishop Linked Defensible Spaces	Approximately 80 Acres	**Priority level - Moderate**
Pine Creek Road Fuelbreak	Approximately 6 Acres	**Priority level - Moderate**
Alabama Hills Riparian Fuels Evaluation	2.4 miles	**Priority level - Moderate**
Amargosa River Riparian Fuels Evaluation and Dry Hydrant Installation	2.5 miles	**Priority level - Moderate**
Highway 168 Road Treatment	Approximately 120 Acres	**Priority level - Moderate**
Buttermilk Road Treatment	Approximately 360 Acres	**Priority level - Moderate**
Starlite Fuelbreak	Approximately 3 Acres	**Priority level - Moderate**
Seven Pines Fuelbreaks	Approximately 2 Acres	**Priority level - Moderate**
Big Pine Riparian Fuels Evaluation	1.4 miles	**Priority level - Moderate**
New Wilkerson Linked Defensible Spaces	Approximately 1.5 Acres	**Priority level - Moderate**
Old Wilderson Linked Defensible Spaces	Approximately 1.5 Acres	**Priority level - Moderate**
Sierra Ladera Fuelbreak	Approximately 40.5 Acres	**Priority level - Moderate**
Oak Creek Fuelbreak	Approximately 40.5 Acres	**Priority level - Low**

1. **Pine Creek Road Fuelbreak (Approximately 6 Acres). Priority level - Moderate. (see Figure 25):** Limbing and thinning and dead and down fuel removal should be conducted to shaded fuelbreak standards for 200 feet from the centerline of Pine Creek Road to the north to reduce the possibility of embers from fires in the heavy fuel bed adjacent to the road igniting flammable ornamental vegetation located near homes in Rovana Village. Fuels should also be thinned to the same standard along the south side of Pine Creek Road where heavy riparian vegetation is adjacent to the road. This project will be most effective when combined with conforming defensible space for all homes in Rovana Village.

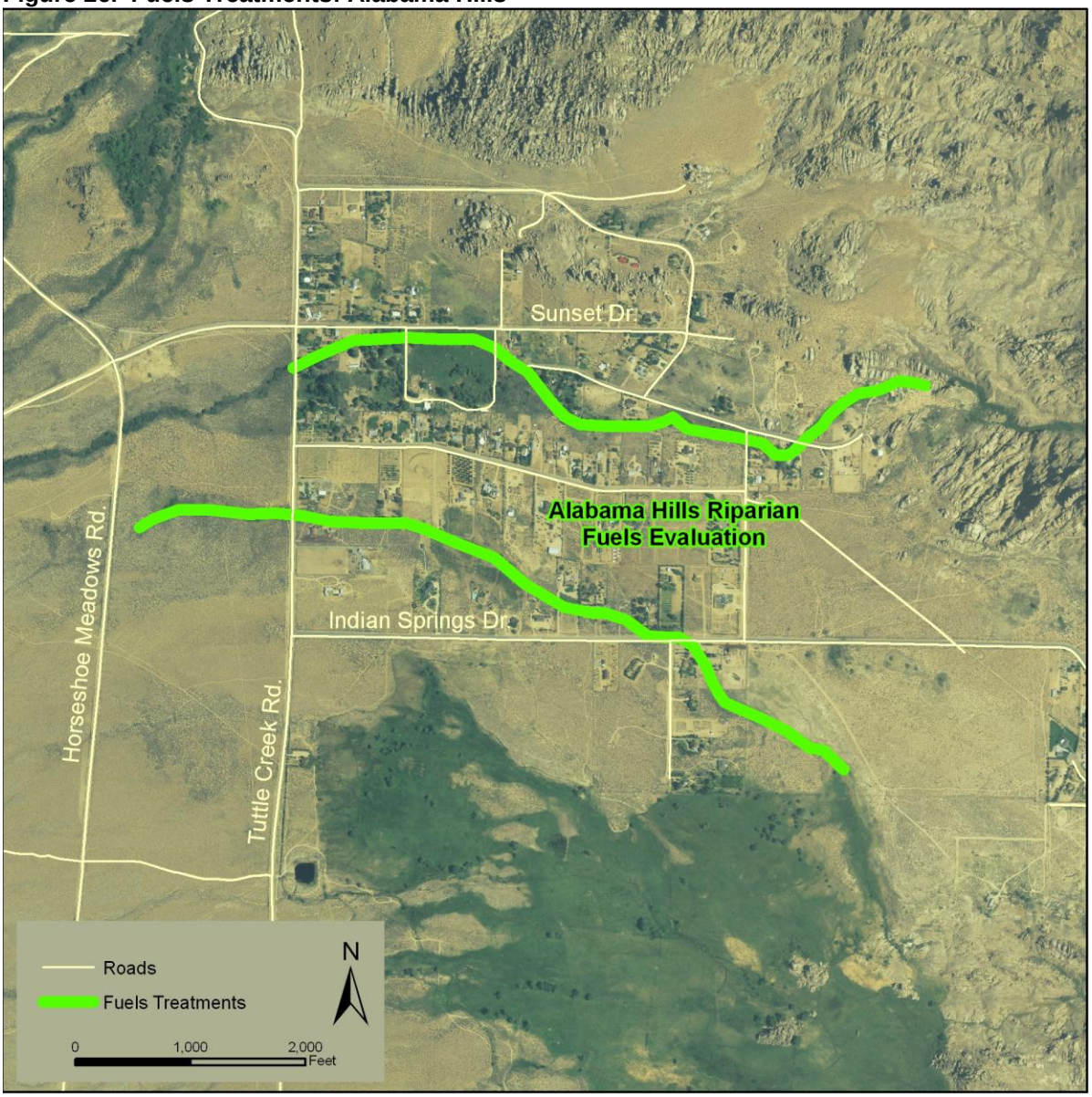
2. 40 Acres Fuelbreaks: (Approximately 13 Acres). Priority level - High. (see Figure 25): Limbing and thinning should be conducted to shaded fuelbreak standards for 100 feet to the north of Birchim Lane to the east of North Round Valley Road, to the south of Hardy Road and to the west of the unnamed dirt road connecting Birchim Lane and Hardy Road. Hydroaxing is highly recommended in the rocky, primarily shrub fuels close to the roads. Hydroaxing will also reduce the possibility of arcing when working under power lines. This project will reduce the possibility of embers from fires in the fuels adjacent to the road igniting flammable ornamental vegetation located near homes in the 40 acres community. This project will be most effective when combined with conforming defensible space for all homes in 40 acres.

Figure 25. Fuels Treatments: Pine Creek Road / 40 Acres



3. Alabama Hills Riparian Fuels Evaluation. Priority level - Moderate. (see Figure 26): There is some risk of wildfire being brought into the Alabama Hills community from fire spreading out of brush and grass fuel beds into riparian vegetation corridors extending through this community, especially under extreme burning conditions. The two major riparian corridors running through Alabama Hills are recommended for an assessment of Proper Functioning Condition (PFC). This analysis should include recommendations for restoration and maintenance of these corridors. Ensuring the health of these areas reduces the likelihood of them becoming conduits for wildland fire.[19]

Figure 26. Fuels Treatments: Alabama Hills



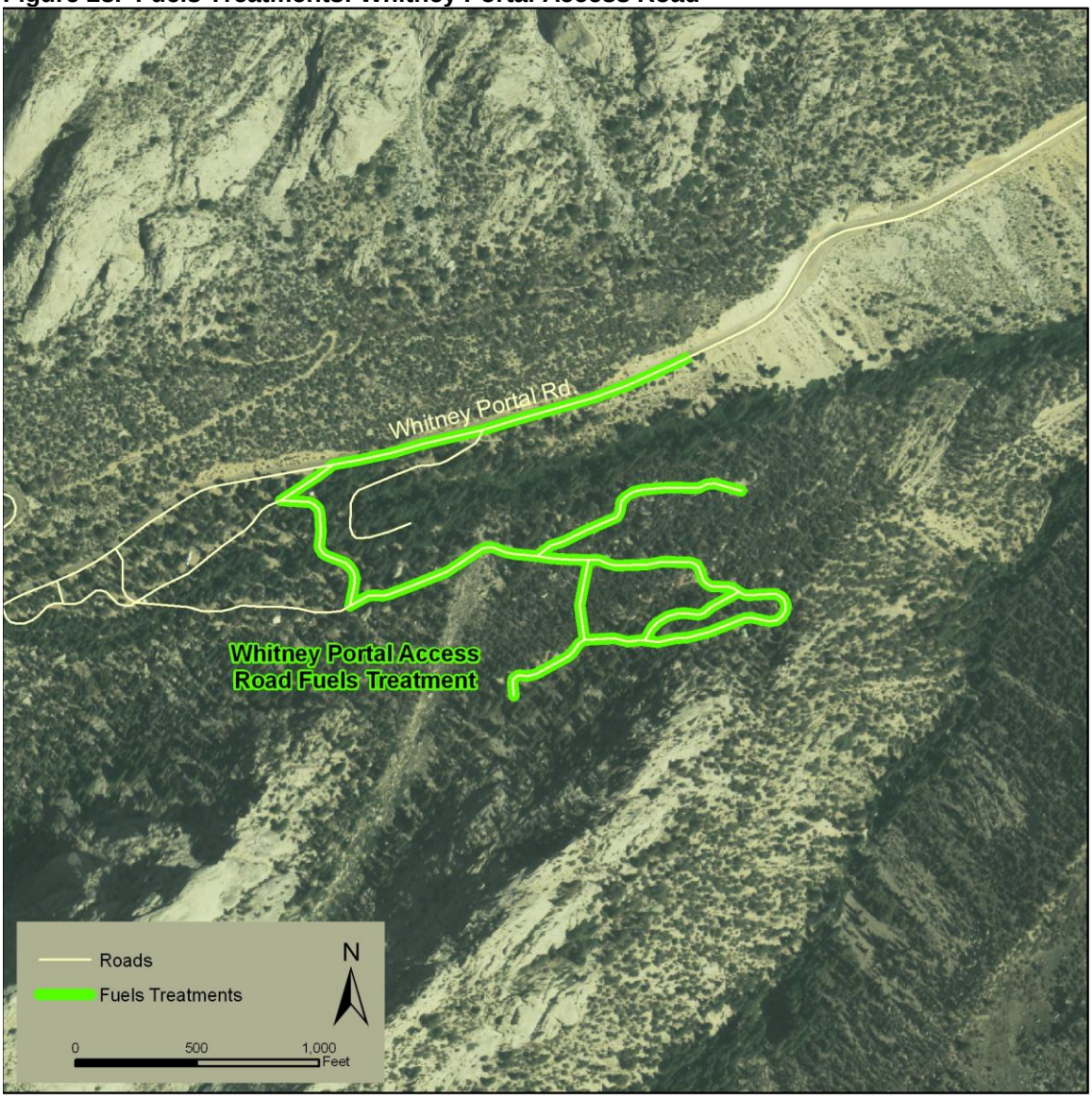
[19] For an explanation of riparian ecosystem assessment please see Riparian Area Management: Process for Assessing Proper Functioning Condition - by D.J. Prichard, H. Barret, J. Cagney, R. Clark, J. Fogg, K. Gebhardt, P. Hansen, B. Mitchell and D. Tippy. 1998. TR 1737-9. Bureau of Land Management.

4. Amargosa River Riparian Fuels Evaluation and Dry Hydrant Installation. Priority level - Moderate. (see Figure 27): There is heavy riparian vegetation growing along the Amargosa River through the Shoshone community. Under extreme burning conditions it is possible that fires occurring in this fuel bed could spread to homes before responders could arrive. Fires in this vegetative type may also be resistant to control. The riparian corridor is recommended for an evaluation of PFC. The evaluation should include recommendations for restoration and maintenance. Ensuring the health of this corridor reduces the likelihood of it becoming a conduit for wildland fire. As a part of this project, an area should be selected and cleared for construction of a dry hydrant in the town of Shoshone. The river is the only water source for fire suppression, other than a pre-positioned water tender. Currently heavy vegetation along the river makes access for drafting impossible.

Figure 27. Fuels Treatments: Amargosa River

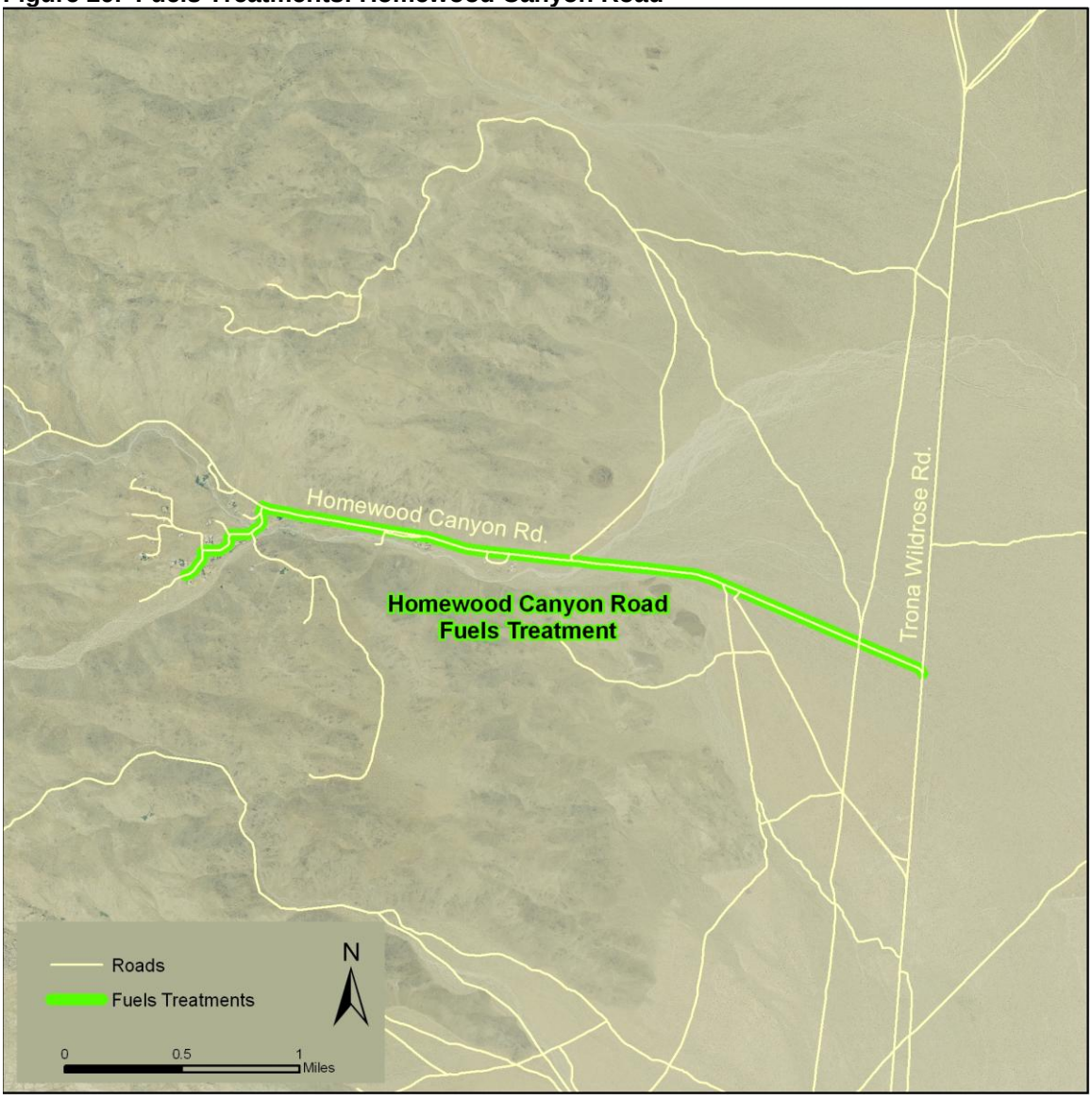
5. Whitney Portal Access Road Fuels Treatment (Approximately 34 Acres). Priority level - High. (see Figure 28): The selected treatment area concentrates on limbing, thinning, and dead and down fuel removal to shaded fuelbreak standards for 100 feet from the centerline of Whitney Portal Road and Campground Road. Thinning should be continued from the end of Campground Road along the residential loop to provide a safe egress from the USFS lease cabins during a wildfire event. The route should be marked as a fire escape route. This project improves safety for residents, firefighters and campground visitors and is rated as high priority due to heavy use during the fire season in this single access community.

Figure 28. Fuels Treatments: Whitney Portal Access Road



6. Homewood Canyon Road Fuels Treatment: (Approximately 84 Acres). Priority level - High. (see Figure 29): In areas where sage and other desert shrubs encroach Homewood Canyon Road, fuels should be thinned for 100 feet on both sides of the roadway. This project is designed to decrease the possibility of heat and smoke blocking the only access to this hazardous and isolated community.

Figure 29. Fuels Treatments: Homewood Canyon Road



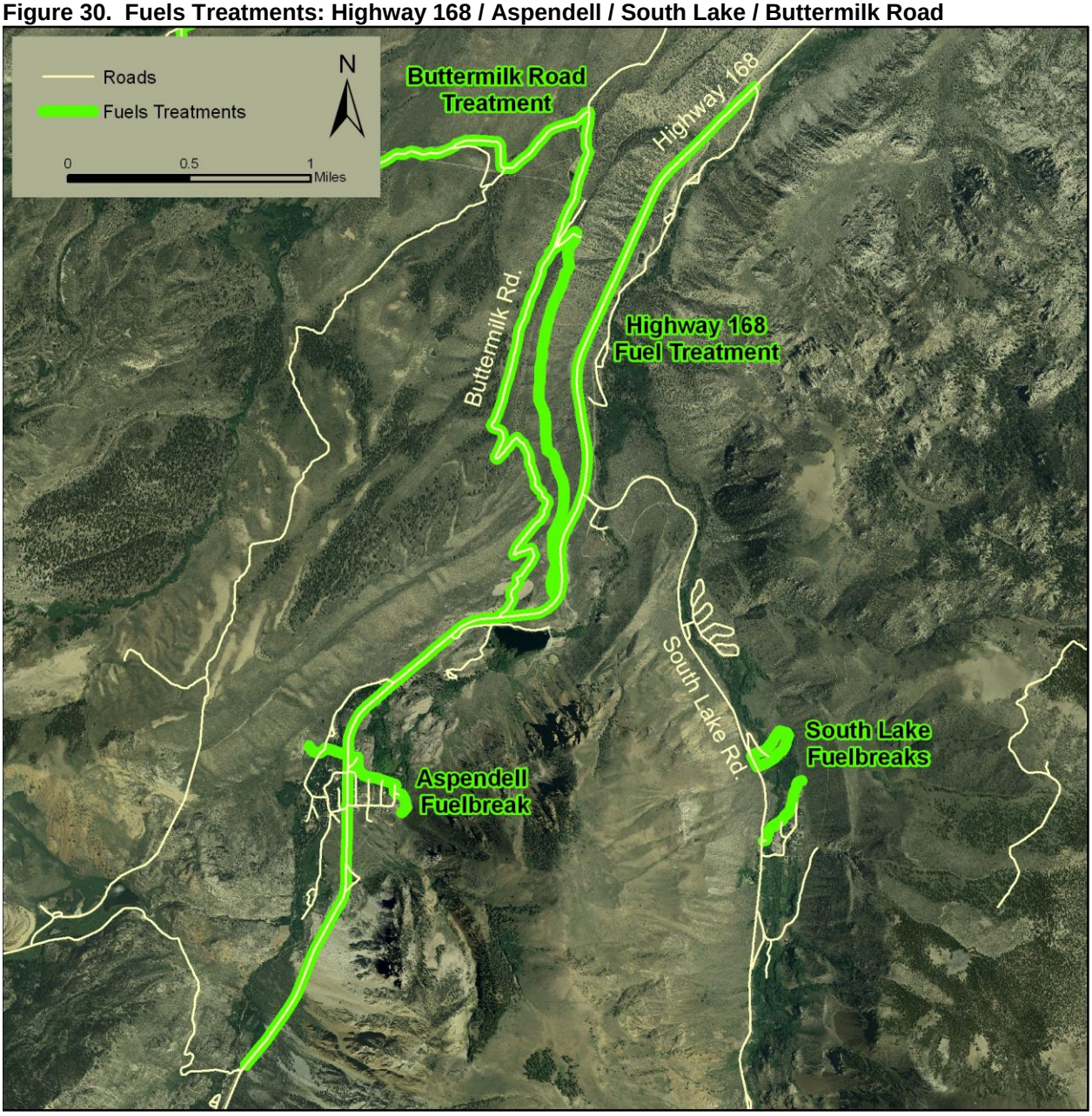
7. Highway 168 Road Treatment: (Approximately 120 Acres). Priority level - Moderate. (see Figure 30, following page): There are some areas along Highway 168 north of Aspendell where shrub fuels encroach the highway. Thinning should be conducted to 100 feet from the highway centerline in areas where shrub fuel beds could compromise travel. Thinning should be focused between Aspendell and Dutch John Meadow (approximately five miles north of Aspendell) where topography, and therefore the threat to the access from heat and smoke, is the greatest. This project helps protect not only the primary access to Aspendell and South Lake communities but also access to several campgrounds along Highway 168.

8. Aspendell Fuelbreak (Approximately 14.5 Acres). Priority level - High. (see Figure 30, following page): A 200-foot shaded fuelbreak should be constructed north of Aspendell from the bottom of the slope along Cataract Road to the clearing at the end of Nutcracker Road. This project will create a break in fuel continuity between the community of Aspendell and fires moving up canyon resulting in a reduction in fire intensity and rates of spread.

9. South Lake Fuelbreak (Approximately 7.5 Acres). Priority level - High. (see Figure 30, following page): A 200-foot shaded fuelbreak should be constructed north of the South Lake community from the intersection of South Lake Road East to the start of the uphill slope. This project will create a break in fuel continuity between the community of Aspendell and fires moving up canyon, resulting in a reduction in fire intensity and rate of spread.

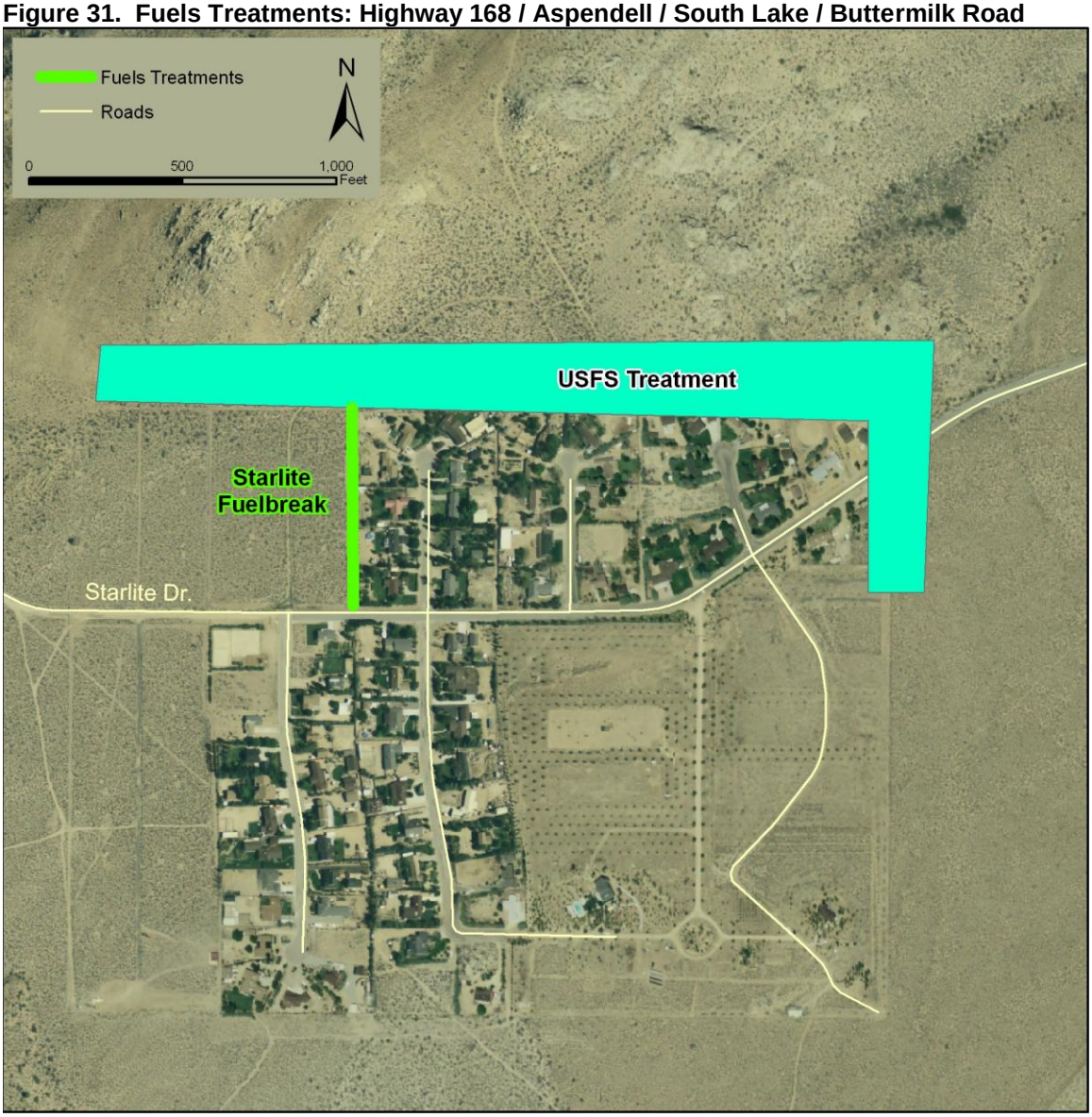
10. Buttermilk Road Treatment (Approximately 360 Acres). Priority level - Moderate. (see Figure 30, following page): Thinning, where necessary, should be conducted along the dirt roads connecting the now defunct USFS green dump with Buttermilk Road and continued along Buttermilk Road to its junction with Highway 168 for a distance of 100 feet from the centerline of the roadway. This route may also need road improvements to be useful as a viable escape route. When combined with road surface improvements, this project would provide a secondary access for Aspendell, Starlite and South Lake, all of which are rated as high hazard communities. Because the road surface improvements necessary to make this an adequate escape route have not yet been determined to be feasible, this project is rated as moderate priority.

Figure 30. Fuels Treatments: Highway 168 / Aspendell / South Lake / Buttermilk Road



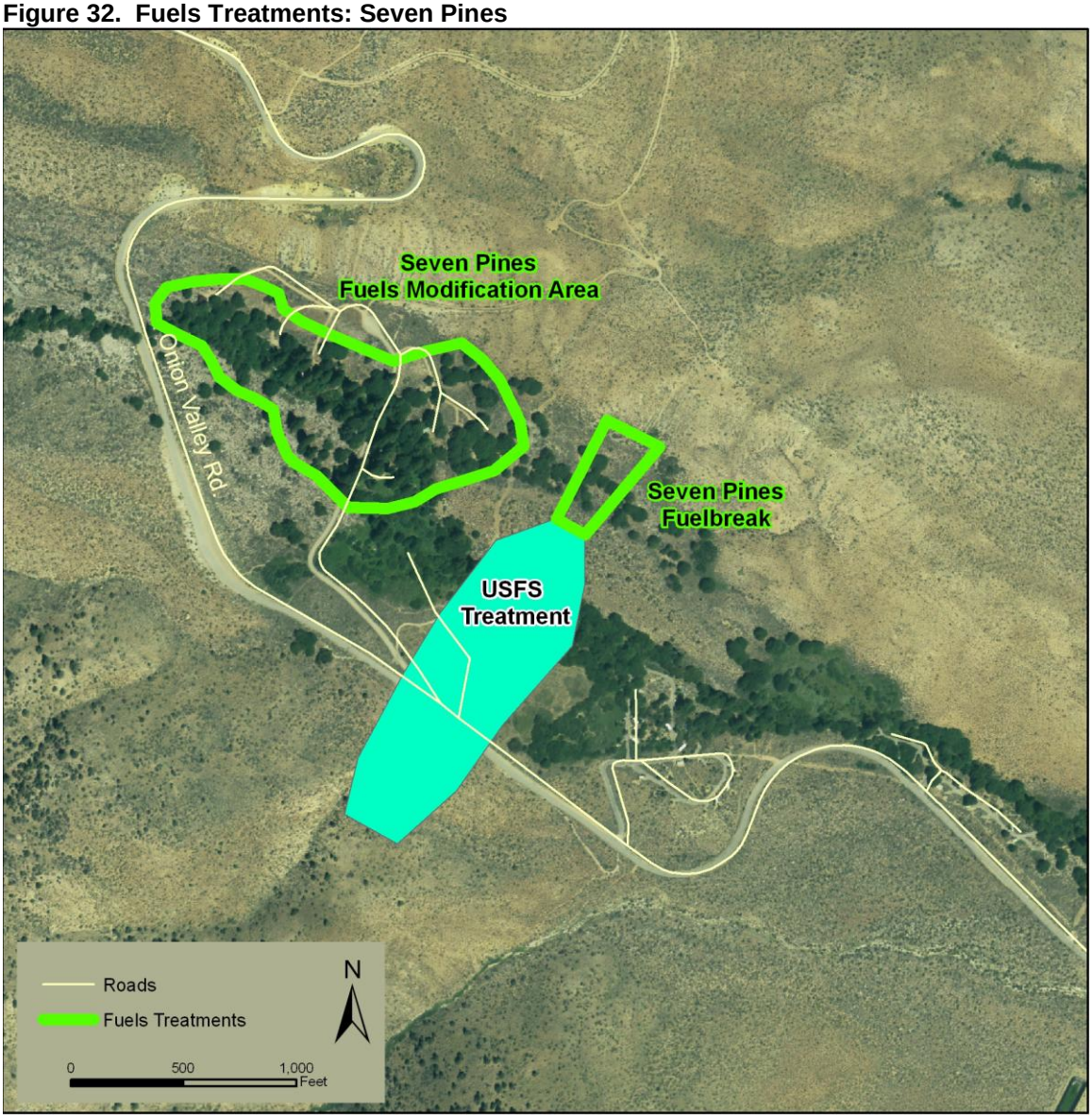
11. Starlite Fuelbreak (Approximately 3 Acres). Priority level - Moderate. (see Figure 31): The USFS has proposed a fuelbreak for the north and east sides of the Starlite community. Thinning of the primarily shrub fuel beds is recommended for 100 feet along the USFS proposed corridor. It is also recommended the USFS project be extended to anchor to Polaris Circle on the east and Starlite Drive on the west. Continuing the USFS project to the roads will enhance the project value by providing a potential control line for firefighters.

Figure 31. Fuels Treatments: Highway 168 / Aspendell / South Lake / Buttermilk Road



12. Seven Pines Fuelbreaks (Approximately 2 Acres). Priority level - Moderate. (see Figure 32): The USFS created two fuelbreaks, the Upper Grays Fuelbreak and the Lower Grays Fuelbreak, to the southeast of the Seven Pines community in 1997 and 1998. These fuelbreaks were cut primarily to protect the Grays Meadow campground. It is recommended the Upper Grays Fuelbreak be continued to the northeast and anchored in the rocky slopes east of the Seven Pines community. The extension should include thinning of shrub fuels and limbing of conifers and should be the width of the existing fuelbreak or 100 feet, whichever is wider. Both existing fuelbreaks should be inspected and maintained on an annual basis. This project is designed to provide greater protection for the Seven Pines community against ignitions occurring down slope.

Figure 32. Fuels Treatments: Seven Pines

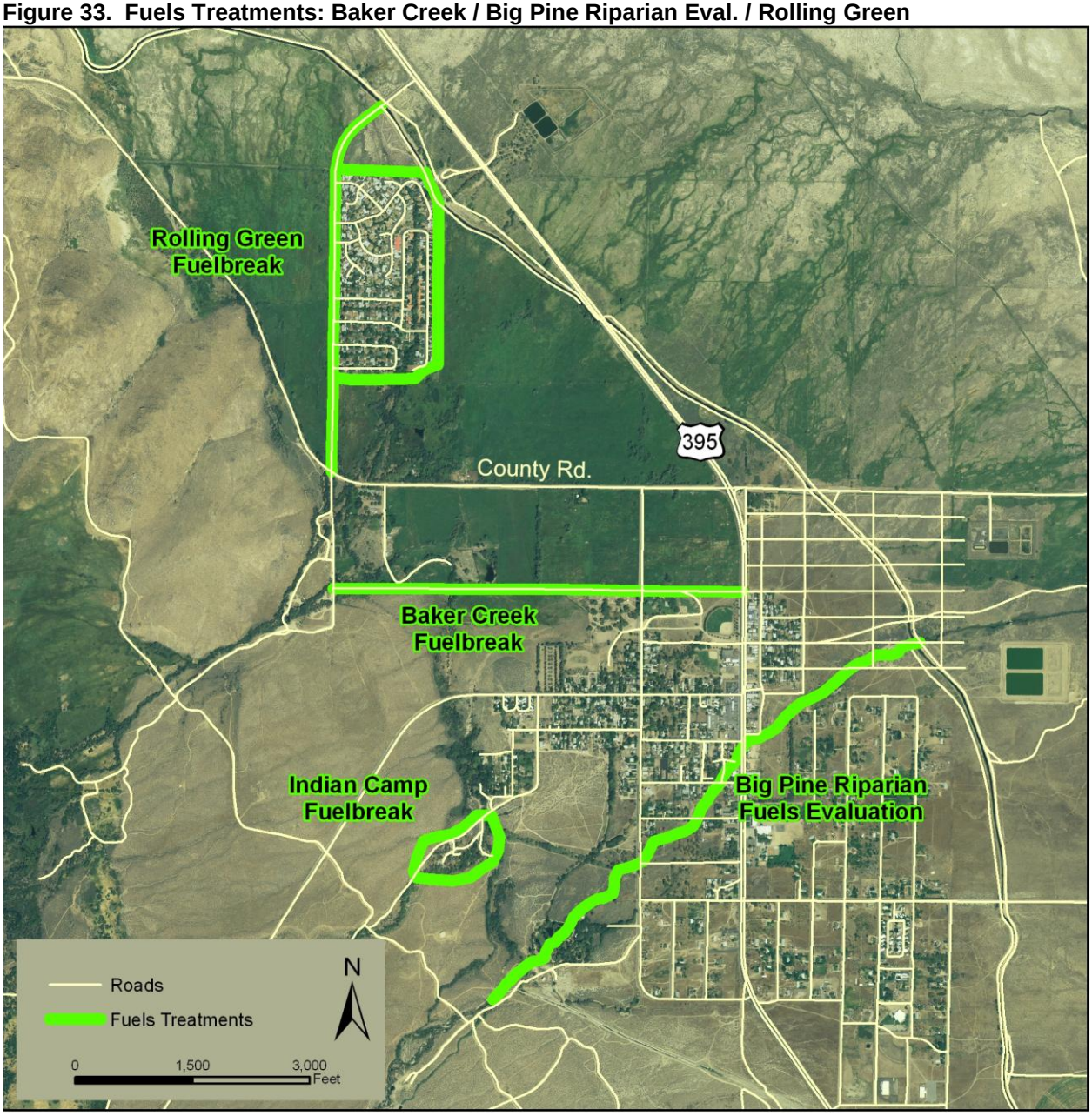


13. Baker Creek Fuelbreak (Approximately 24 Acres). Priority level - High. (see Figure 33, following page): A significant fuel bed exists in the northwest portion of the Big Pine community between the town of Big Pine and the Big Pine Indian Reservation. A 200-foot shaded fuelbreak should be constructed along Baker Creek Road to the north from its intersection with Highway 395 to the intersection with Reynolds Road. This will create a buffer between homes in the northern portion of Big Pine and the wildland fuel bed.

14. Big Pine Riparian Fuels Evaluation. Priority level - Moderate. (see Figure 33, following page): There is some risk of wildfire being brought into the Big Pine community from fire spreading out of brush and grass fuel beds into a riparian vegetation corridor which extends through this community, especially under extreme burning conditions. The major riparian corridor running through Big Pine is recommended for an assessment of Proper Functioning Condition (PFC). This analysis should include recommendations for restoration and maintenance. Ensuring the health of this area reduces the likelihood of it becoming a conduit for wildland fire.

15. Rolling Green Fuelbreak (Approximately 46 Acres). Priority level - High. (see Figure 33, following page): A significant fuel bed exists in the northwest portion of the Big Pine community between the town of Big Pine and the Big Pine Indian Reservation. A 200-foot shaded fuelbreak should be constructed along the perimeter of the Reservation. This fuelbreak should be extended for 100 feet in each direction of the centerline of Reynolds Road (where possible) between Highway 395 and the Baker Creek fuelbreak to protect the access to the Reservation.

Figure 33. Fuels Treatments: Baker Creek / Big Pine Riparian Eval. / Rolling Green

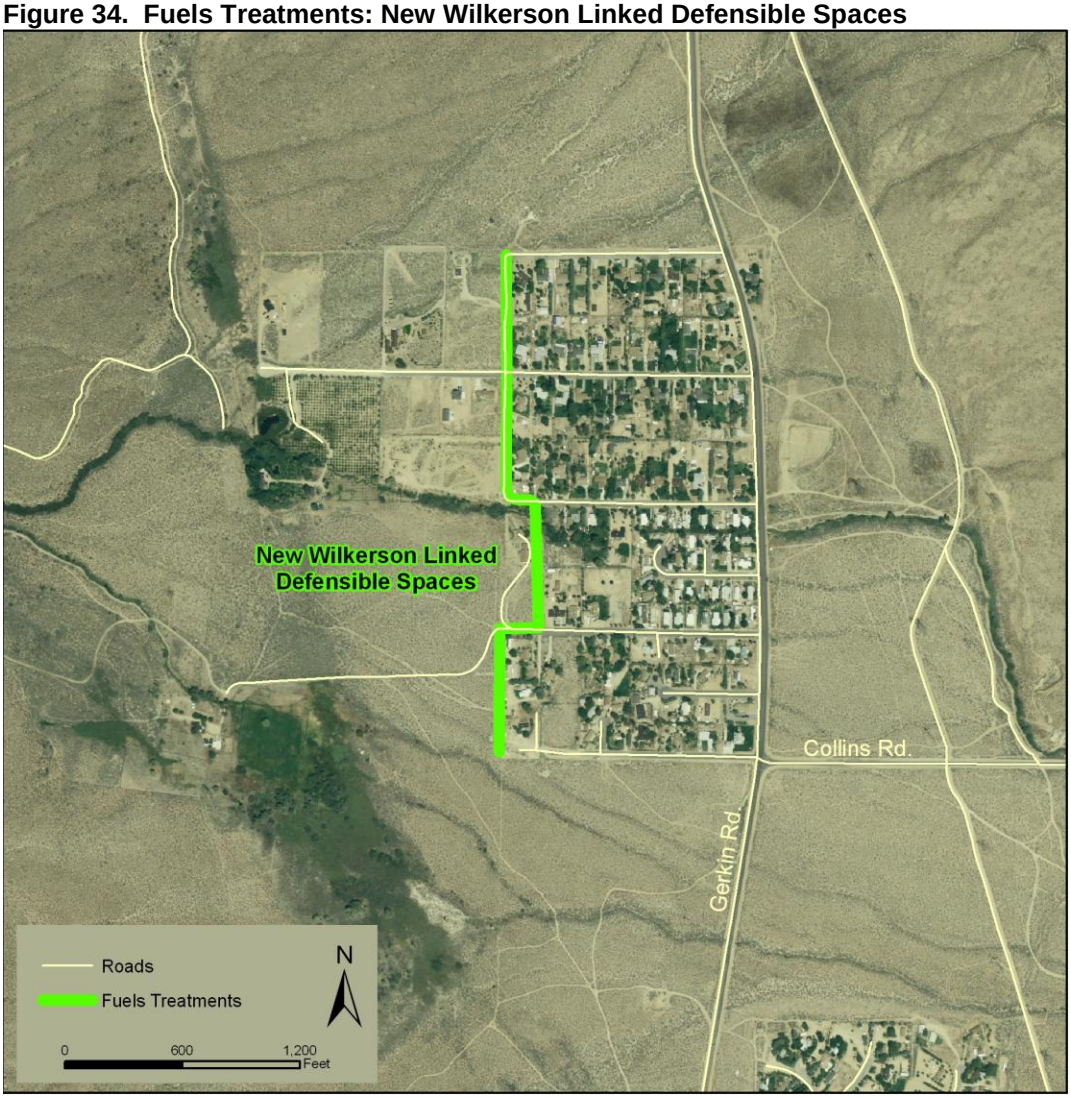


16. New Wilkerson Linked Defensible Spaces (Approximately 5 Acres). Priority level - Moderate. (see Figure 34): Evaluate and mark (as allowed by property owners) defensible space around homes located on the western edge of the New Wilkerson community for a distance of 100 feet. If there are any lots without existing structures, thinning and limbing should be conducted as described for **Zone 2** in the *Home Mitigation* section of this report. The goal of this project is create defensible spaces that will continue seamlessly from property to property in order to provide the maximum effectiveness for the fuelbreak.

Old Wilkerson Priority level - Moderate. Linked Defensible Spaces should also be performed as above. Consider a fuel brake at the Southern end due to the rise from US-395 and predominate winds from the south.

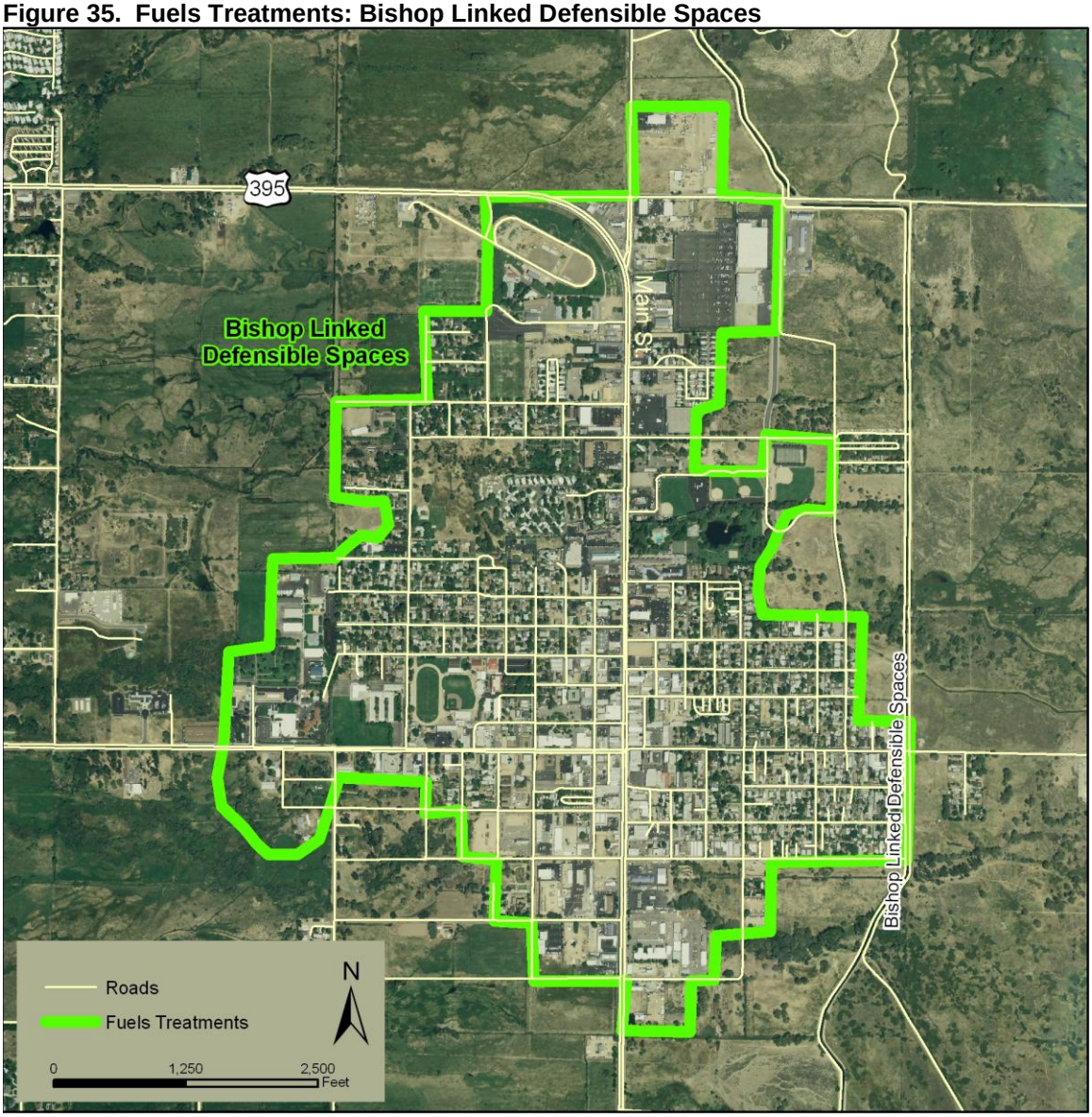
17. Sierra Ladera Fuelbreak (Approximately 1.5 Acres). Priority level - Moderate. (see Figure 34): Thinning of the primarily shrub fuel beds is recommended for 100 feet along Sierra Ladera Street in the New Wilkerson community. When combined with the New Wilkerson Linked Defensible Spaces Project this project will provide a buffer between the homes on the western edge of New Wilkerson and shrub fuel beds.

Figure 34. Fuels Treatments: New Wilkerson Linked Defensible Spaces



18. Bishop Linked Defensible Spaces (Approximately 80 Acres). Priority level - Moderate. (see Figure 35): Evaluate and mark (as allowed by property owners) defensible space around homes located on the perimeter of the urban core of the Bishop and Bishop Tribal Lands communities which are adjacent to native vegetation (as opposed to irrigated agricultural fields) for a distance of 100' from structures. If there are any lots without existing structures, thinning and limbing should be conducted as described for Zone 2 in the *Home Mitigation* section of this report. The goal of this project is create defensible spaces that will continue seamlessly from property to property in order to provide the maximum effectiveness for the fuelbreak.

Figure 35. Fuels Treatments: Bishop Linked Defensible Spaces



19. Lone Pine Paiute Shoshone Reservation Fuelbreak (Approximately 19 Acres). Priority level - High. (see Figure 36, following page): A significant fuel bed exists along the fence line between the Reservation property and LADWP property bordering E. Inyo Street between Zucco Road and Esha Street. Limbing, thinning and cleanup of dead and down fuels are recommended for 100 feet from the center line of E. Inyo Street between Zucco Road and Esha Street. This is a cross-boundary project and will require the cooperation of Tribal and LADWP officials. The area between Quing-Ah Road and Highway 395 separating tribal land from private property to the south also contains a high fuel loading. Limbing, thinning and cleanup of dead and down fuels are recommended for 100 feet from the center line of Quing-Ah Road to Highway 395. Thinning is recommended to continue along Highway 395 for approximately ½ mile to the northern edge of the Reservation property. This is a cross-boundary project and will require the cooperation of Tribal officials, Cal Trans and the private property owner to the east of Quing-Ah Road.

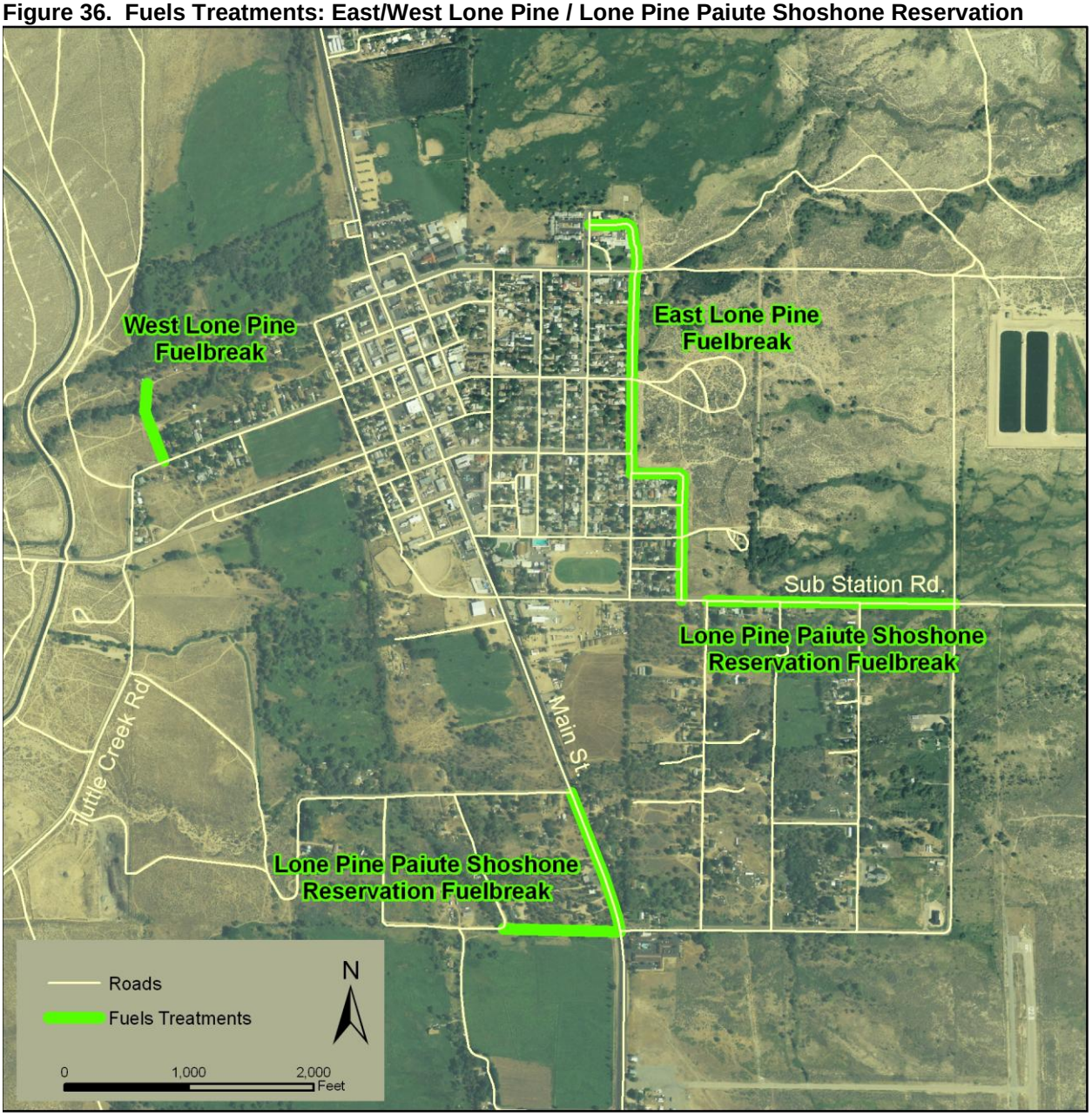
Additional fuels reduction projects recommended by the LPPSR include:

- A fuel break on the Eastern boundaries of LPPSR along the fence line of E-Sha Road on LADWP property.
- A fuel break on the southern border of LPPSR (East of Highway 395, from the Best Western Hotel property line) extending along the border fence line on LADWP property along Teya Road until it meets with E-Sha Road
- A fuel break on the northern boundaries of LPPSR (West of Highway 395) along the fence line of LADWP & LPPSR adjacent to Burkhardt Road
    - Combined, these fuels breaks would entail approximately an additional 27-30 acres of fuel break activities.

20. East Lone Pine Fuelbreak (Approximately 8.5 Acres). Priority level - Moderate. (see Figure 36, following page): Significant openings exist between the road and natural fuels along N. Valley View Street between the northern edge of Lone Pine and E. Inyo Street. It is recommended that these openings be maintained for a distance of 100 feet east of the centerline of N. Valley View Street. Where necessary tree and shrub fuels should be limbed and thinned and dead and down materials removed to make this a continuous fuelbreak.

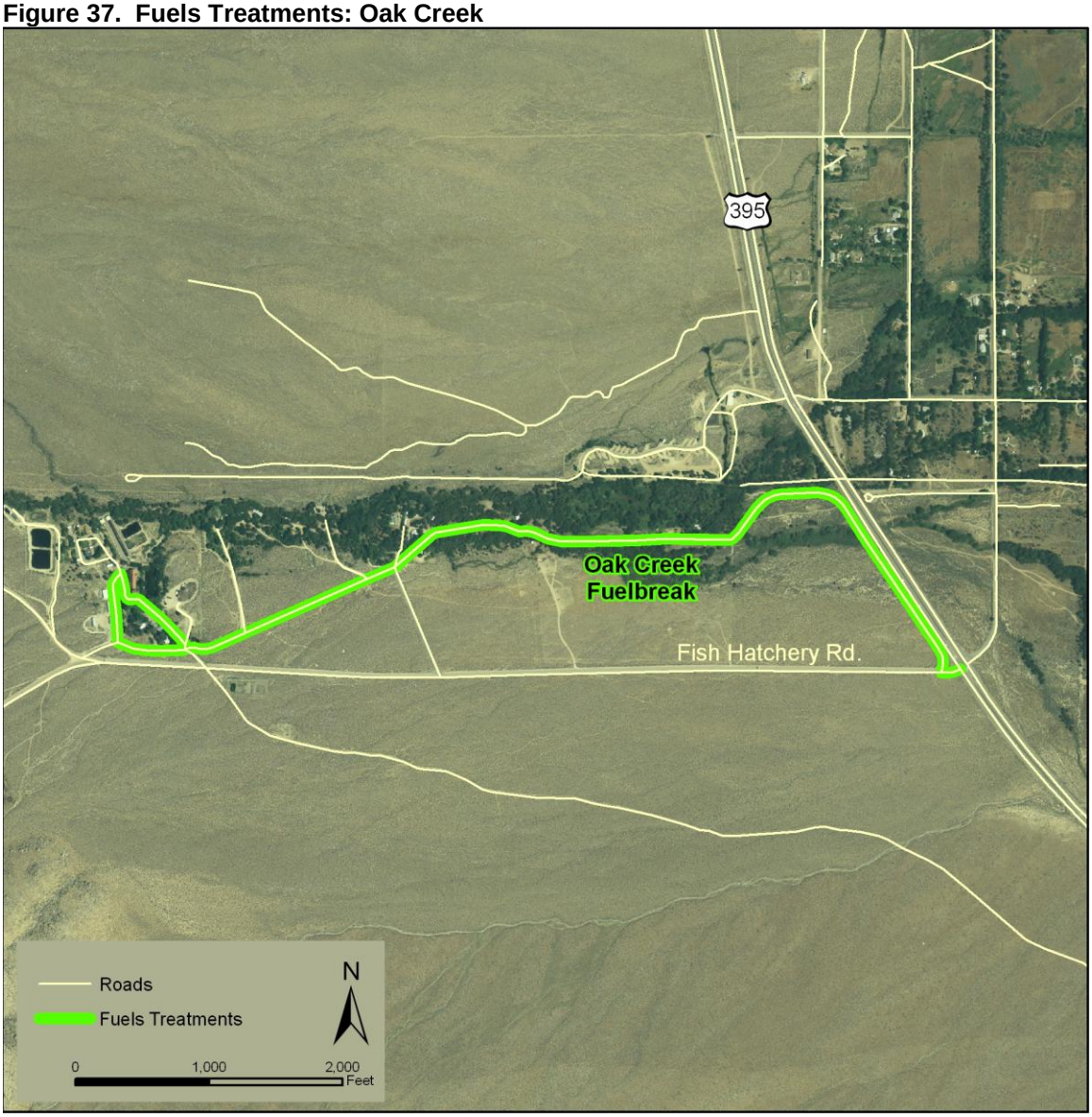
21. West Lone Pine Fuelbreak (Approximately 3 Acres). Priority level - Moderate. (see Figure 36, following page): A fuelbreak of at least 100 feet in width should be constructed along the western edge of Lone Pine between Statham Way and W. Bush Street to break the continuity of tree and shrub fuels between Lone Pine Creek and homes on the west side of Lone Pine.

Figure 36. Fuels Treatments: East/West Lone Pine / Lone Pine Paiute Shoshone Reservation



22. Oak Creek Fuelbreak (Approximately 40.5 Acres). Priority level - Low. (see Figure 37): Limbing, thinning and dead and down fuel removal should be conducted to shaded fuelbreak standards for 100' along the centerline of Oak Creek Road between Highway 395 and the historic Mt Whitney Fish Hatchery. This project should be continued along the streets surrounding the fish hatchery buildings. This was originally a high priority project since it protected the fish hatchery, which is a cultural site, as well as homes located in heavy fuels along Oak Creek Road. The project has been downgraded due to a fire in the summer of 2007 which may have consumed most of the fuels in this area.

Figure 37. Fuels Treatments: Oak Creek



GLOSSARY

The following definitions apply to terms used in the Inyo County Community Wildfire Protection Plan.

1 hour Timelag fuels: Grasses, litter and duff; <1/4 inch in diameter

10 hour Timelag fuels: Twigs and small stems; ¼ inch to 1 inch in diameter

100 hour Timelag fuels: Branches; 1 to 3 inches in diameter

1000 hour Timelag fuels: Large stems and branches; >3 inches in diameter

Active Crown Fire: This is a crown fire in which the entire fuel complex – all fuel strata – become involved, but the crowning phase remains dependent on heat released from the surface fuel strata for continued spread (also called a Running Crown Fire or Continuous Crown Fire).

ArcGIS 9.x: This is Geographic Information System (GIS) software that is designed to handle mapping data in a way that can be analyzed, queried, and displayed. ArcGIS is in its ninth major revision and is published by the Environmental Systems Research Institute (ESRI).

Crown Fire (Crowning): The movement of fire through the crowns of trees or shrubs; may or may not be independent of the surface fire.

Defensible Space: An area around a structure where fuels and vegetation are modified cleared or reduced to slow the spread of wildfire toward or from the structure. The design and distance of the defensible space is based on fuels, topography, and the design/materials used in the construction of the structure.

Energy Release Component: An index of how hot a fire could burn. ERC is directly related to the 24-hour, potential worst case, total available energy within the flaming front at the head of a fire.

Extended Defensible Space (also known as Zone 3): This is a defensible space area where treatment is continued beyond the minimum boundary. This zone focuses on forest management with fuels reduction being a secondary consideration.

Fine Fuels: Fuels that are less than ¼-inch in diameter, such as grass, leaves, draped pine needles, fern, tree moss, and some kinds of slash which, when dry, ignite readily and are consumed rapidly.

Fire Behavior Potential: The expected severity of a wildland fire expressed as the rate of spread, the level of crown fire activity, and flame length. This is derived from fire behavior modeling programs using the following inputs: fuels, canopy cover, historical weather averages, elevation, slope, and aspect.

Fire Danger: In this document we do not use this as a technical term, due to various and nebulous meanings that have been historically applied.

Fire Hazard: Given an ignition, the likelihood and severity of Fire Outcomes (Fire Effects) that result in damage to people, property, and/or the environment. The hazard rating is derived from the Community Assessment and the Fire Behavior Potential.

Fire Mitigation: Any action designed to decrease the likelihood of an ignition, reduce Fire Behavior Potential, or to protect property from the impact of undesirable Fire Outcomes.

Fire Outcomes, AKA Fire Effects: This is a description of the expected effects of a wildfire on people, property and/or the environment, based on the Fire Behavior Potential and physical presence of Values at Risk. Outcomes can be desirable as well as undesirable.

Fire Risk: The probability that an ignition will occur in an area with potential for damaging effects to people, property, and/or the environment. Risk is based primarily on historical ignitions data.

Flagged Addressing: A term describing the placement of multiple addresses on a single sign, servicing multiple structures located on a common access.

FlamMap: A software package created by the Joint Fire Sciences Program, Rocky Mountain Research Station. The software uses mapped environmental data such as Elevation, Aspect, Slope, and Fuel Model, along with fuel moisture and wind information, to generate predicted fire behavior characteristics such as Flame Length, Crown Fire Activity, and Spread Rate.

Flame Length: The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface)—an indicator of fire intensity.

Fuelbreak: A natural or constructed discontinuity in a fuel profile that is used to isolate, stop, or reduce the spread of fire. Fuelbreaks may also make retardant lines more effective and serve as control lines for fire suppression actions. Fuelbreaks in the WUI are designed to limit the spread and intensity of crown fire activity.

ICP (Incident Command Post): The base camp and command center from which fire suppression operations are directed.

ISO (Insurance Standards Office): A leading source of risk (as defined by the insurance industry) information to insurance companies. ISO provides fire risk information in the form of ratings used by insurance companies to price fire insurance products to property owners.

Jackpot Fuels: A large concentration of fuels in a given area such as a slash pile.

Passive Crown Fire: A crown fire in which individual or small groups of trees torch out (candle), but solid flaming in the canopy fuels cannot be maintained except for short periods.

Shelter-in-Place Areas: A method of protecting the public from an advancing wildfire that involves instructing people to remain inside their homes or public buildings until the danger passes. This concept is new to wildfire in the United States, but not to 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, short-duration 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. For a more complete discussion of the application and limitations of shelter-in-place concepts, see the *Addressing, Evacuation, and Shelter-In-Place* section in the main report.

Slash: Debris left after logging, pruning, thinning, or brush cutting. This includes logs, chips, bark, branches, stumps, and broken understory trees or brush.

Spotting: Refers to the behavior of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire.

Structural Triage: The process of identifying, sorting, and committing resources to a specific structure.

Surface Fire: A fire that burns in the surface litter, debris, and small vegetation on the ground.

Timelag: Time needed under specified conditions for a fuel particle to lose about 63% of the difference between its initial moisture content and its equilibrium moisture content.

Values at Risk: People, property, ecological elements, and other human and intrinsic values within the project area. Values at Risk are identified by inhabitants as important to the way of life in the study area, and are particularly susceptible to damage from undesirable fire outcomes.

WHR (Community Wildfire Hazard Rating, AKA Community Assessment): A sixty-point scale analysis designed to identify factors that increase the potential for and/or severity of undesirable fire outcomes in WUI communities.

WUI (Wildland Urban Interface): The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. This is sometimes referred to as Urban Wildland Interface, or UWI.

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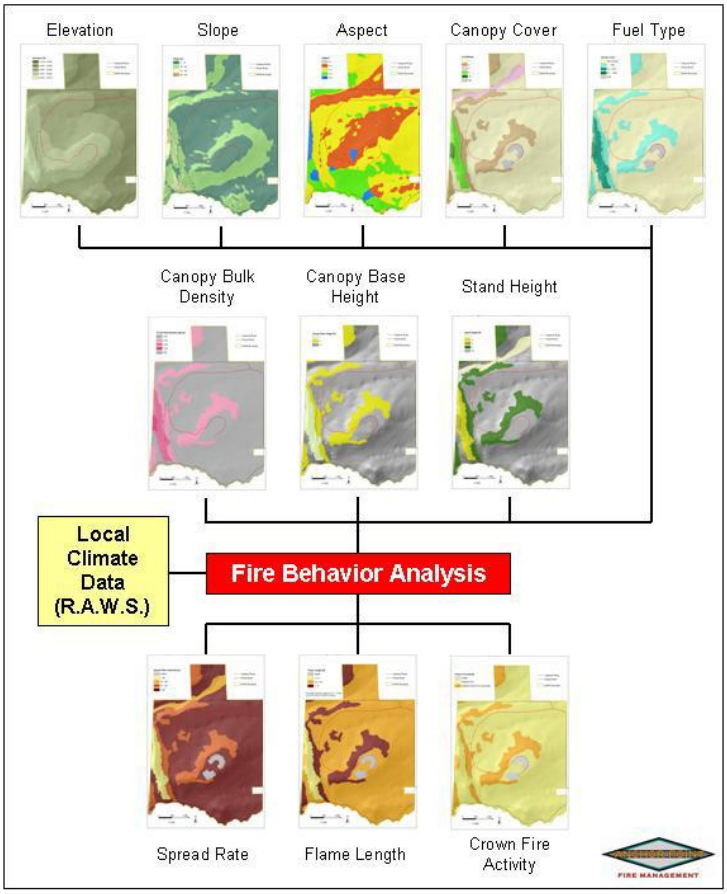
APPENDIX A
FIRE BEHAVIOR POTENTIAL ANALYSIS METHODOLOGY

PURPOSE

The purpose of this document is to describe the methodology used to evaluate the threat represented by physical hazards—such as fuels, weather and topography—to values at risk in the study area, by modeling their effects on fire behavior potential.

Figure 1. Flow Chart



The fire behavior potential analysis reports graphically the probable range of spread rate, flame length, and crown fire potential for the analysis area, based upon a set of inputs significant to fire behavior. The model inputs include aspect, slope, elevation, canopy cover, fuel type, canopy bulk density, canopy base height, stand height, and climate data. The model outputs are determined using FlamMap[1], which combines surface fire predictions with the potential for crown fire

[1] Mark Finney, Stuart Brittain and Rob Seli., The Joint Fire Sciences Program of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana), the Bureau of Land Management and Systems for Environmental Management (Missoula, Montana).

development. Calculations for surface fire predictions (rate of spread and flame length) are based on the USDA Forest Service's BEHAVE[2] model.

BEHAVE

The BEHAVE fire behavior prediction and fuel modeling system was employed to determine surface fire behavior estimates for this study. BEHAVE is a nationally recognized set of calculations used to estimate a surface fire's intensity and rate of spread given certain conditions of topography, fuels, and weather. The BEHAVE modeling system has been used for a variety of applications, including prediction of an ongoing fire, prescribed fire planning, fuel hazard assessment, initial attack dispatch, and fire prevention planning and training. Predictions of wildland fire behavior are made for a single point in time and space, given simple user-defined fuels, weather, and topography. Requested values depend on the modeling choices made by the user.

Assumptions of BEHAVE:

- Fire is predicted at the flaming front
- Fire is free burning
- Behavior is heavily weighted towards the fine fuels
- Continuous and uniform fuels
- Surface fires

FlamMap

Anchor Point uses FlamMap to evaluate the potential fire conditions in the fire behavior study area. Inyo County encompasses 6,542,102 acres (10,222 square miles). The study area for the fire behavior analysis covers approximately 6,872,430 acres (10,738 square miles). This area includes the entire county plus a one-mile buffer in all directions. The use of this buffer provides the county with an analysis of potential fire behavior on adjacent lands. The study area is broken down into grid cells of 10-meters per side (10M). Using existing vector and raster spatial data and field data, ArcGIS spatial analysis capabilities are used to calculate model inputs for each 10M cell. These values are input into FlamMap, along with reference weather and fuel moisture (long-term weather observations statistically calculated from the Rifle Remote Automated Weather Station information). The outputs of FlamMap include the estimated Rate of Spread (ROS) (from BEHAVE), Flame Length (FL) (from BEHAVE) and Crown Fire Activity for a fire in that 10M cell. The model computes these values for each cell in the study area independently, so the data in each cell is unaffected by adjacent cells.

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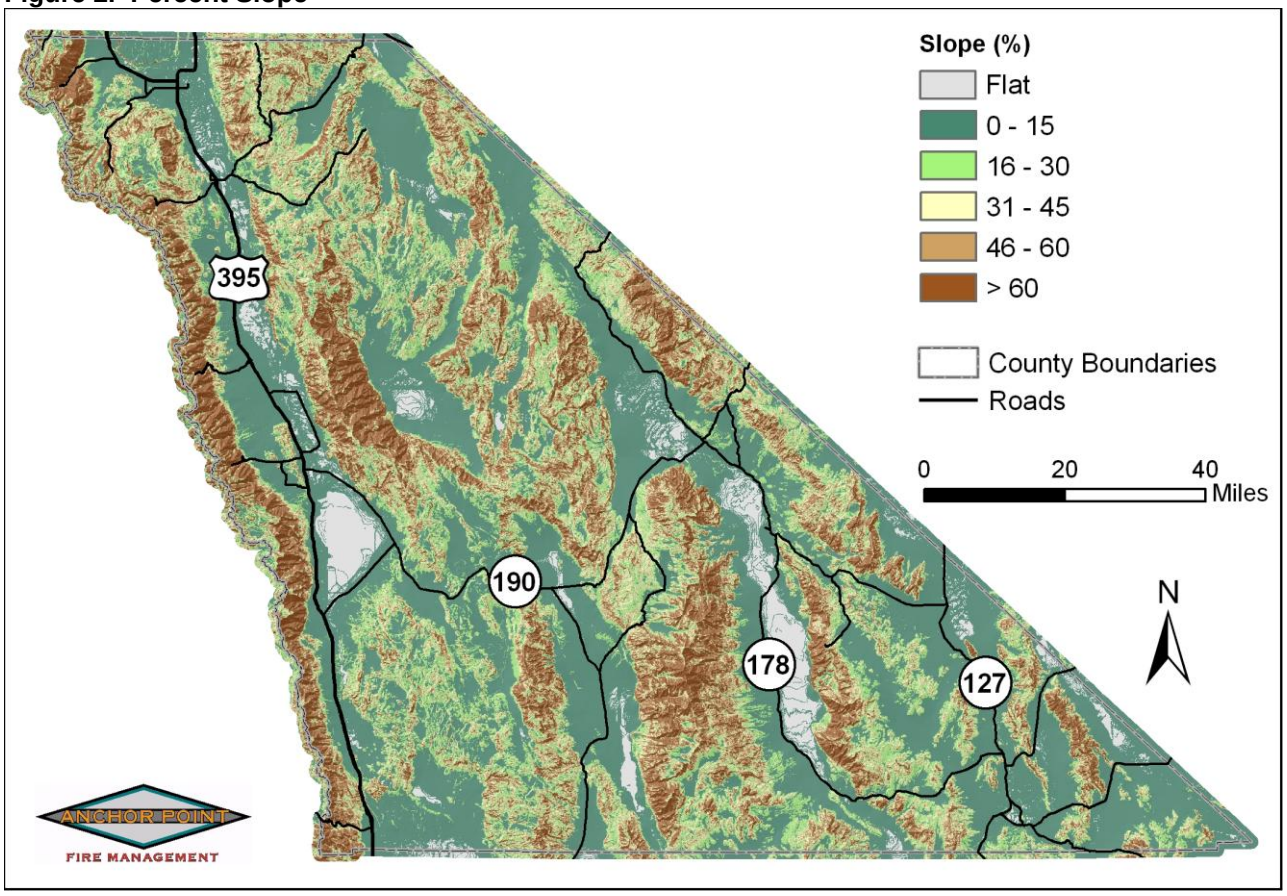
[2] Patricia L. Andrews, producer and designer, Collin D. Bevins, programmer and designer, The Joint Fire Sciences Program of the Rocky Mountain Research Station (USDA Forest Service, Missoula, Montana) and Systems for Environmental Management (Missoula, Montana).

FIRE BEHAVIOR INPUTS

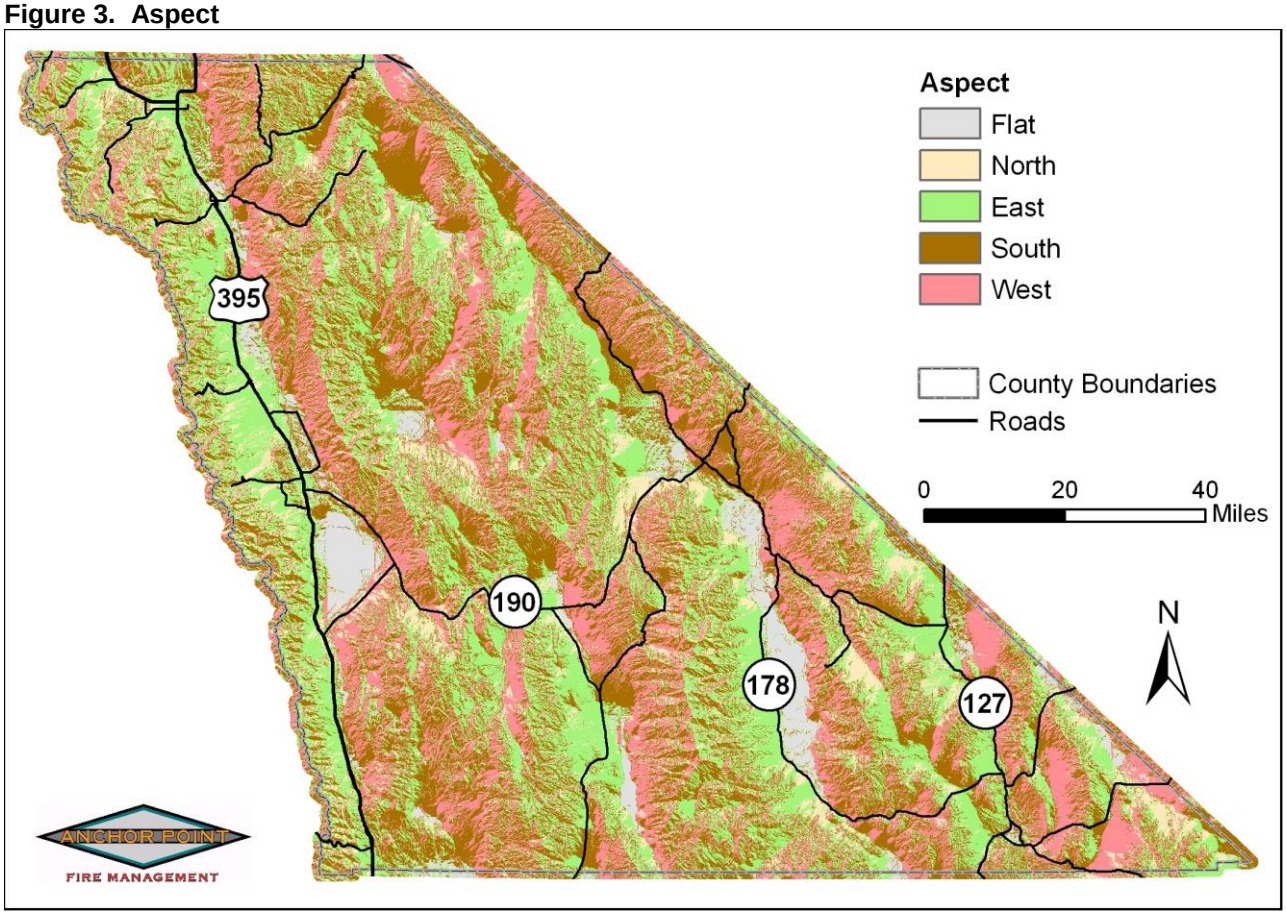
The major factors influencing fire behavior are fuels (type and coverage), weather, and topography (aspect, slope and elevation). The following pages contain a brief explanation of each.

Figure 2. Percent Slope



Slopes are shown here as percent (rise/run x100). Steeper slopes intensify fire behavior and thus will contribute to a higher wildfire hazard rating. Rates of spread for a slope of 30% are typically double those of flat terrain, when all other influences are equal.

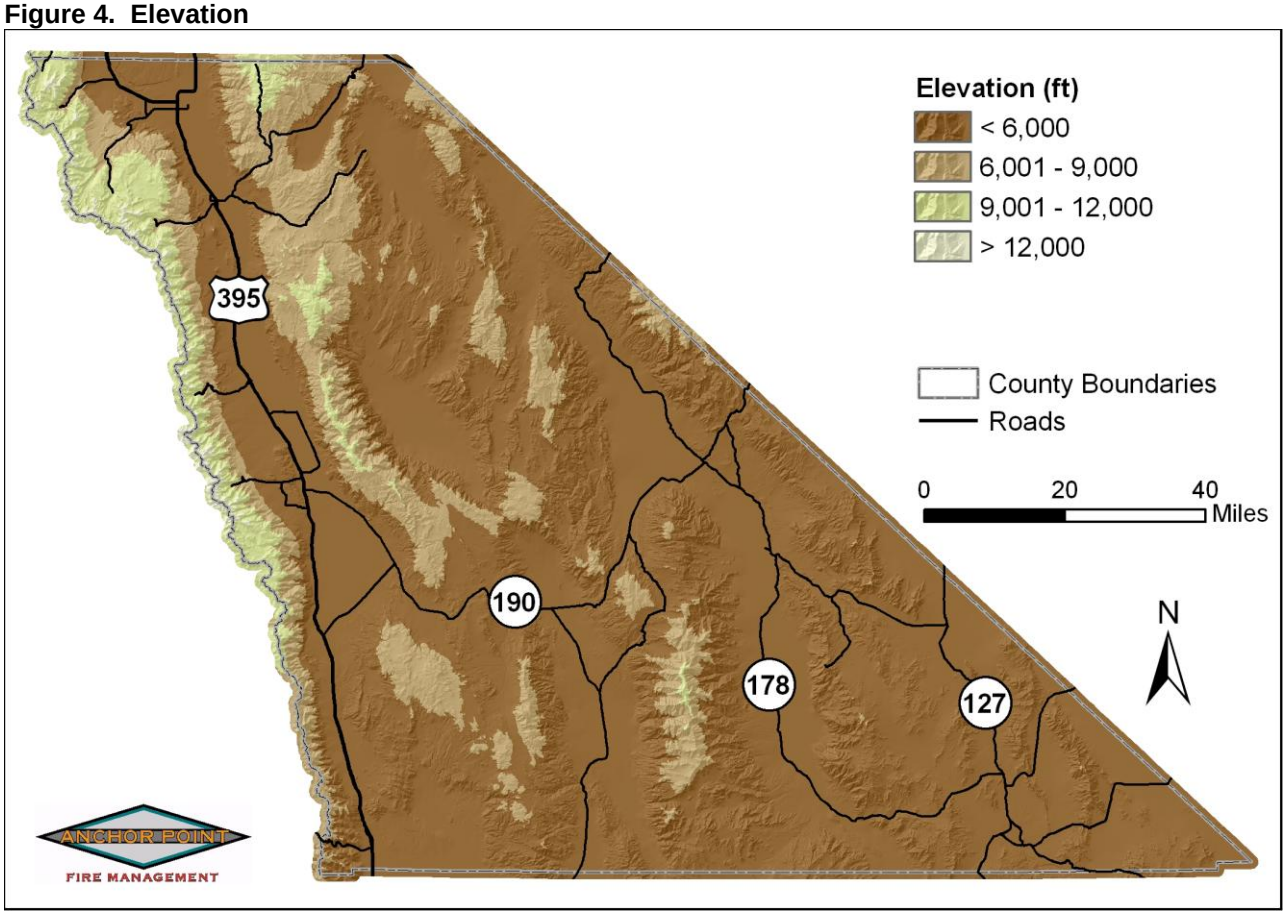
Figure 3. Aspect



Aspects are shown as degrees from north ranging from 0 to 360 according to their orientation. Aspects are influential in the type and quantity of vegetative fuels. Fuels on south facing slopes tend to be drier and more lightly loaded than fuels on north facing slopes, when all other influences are equal. Aspect also has an influence on plant species dominance.

Classification	North	East	South	West
Range	315-45	45-135	135-225	225-315

Figure 4. Elevation



Elevations within the study area range from -285′ to over 14,000′. As elevation increases, environmental conditions, fuel species, and characteristics change.

FUEL MODELS AND FIRE BEHAVIOR

Fire behavior fuel models are a set of numbers that describe fuels in terms that a fire behavior model, in this case FlamMap, can use. There are seven characteristics used to categorize fuel models.

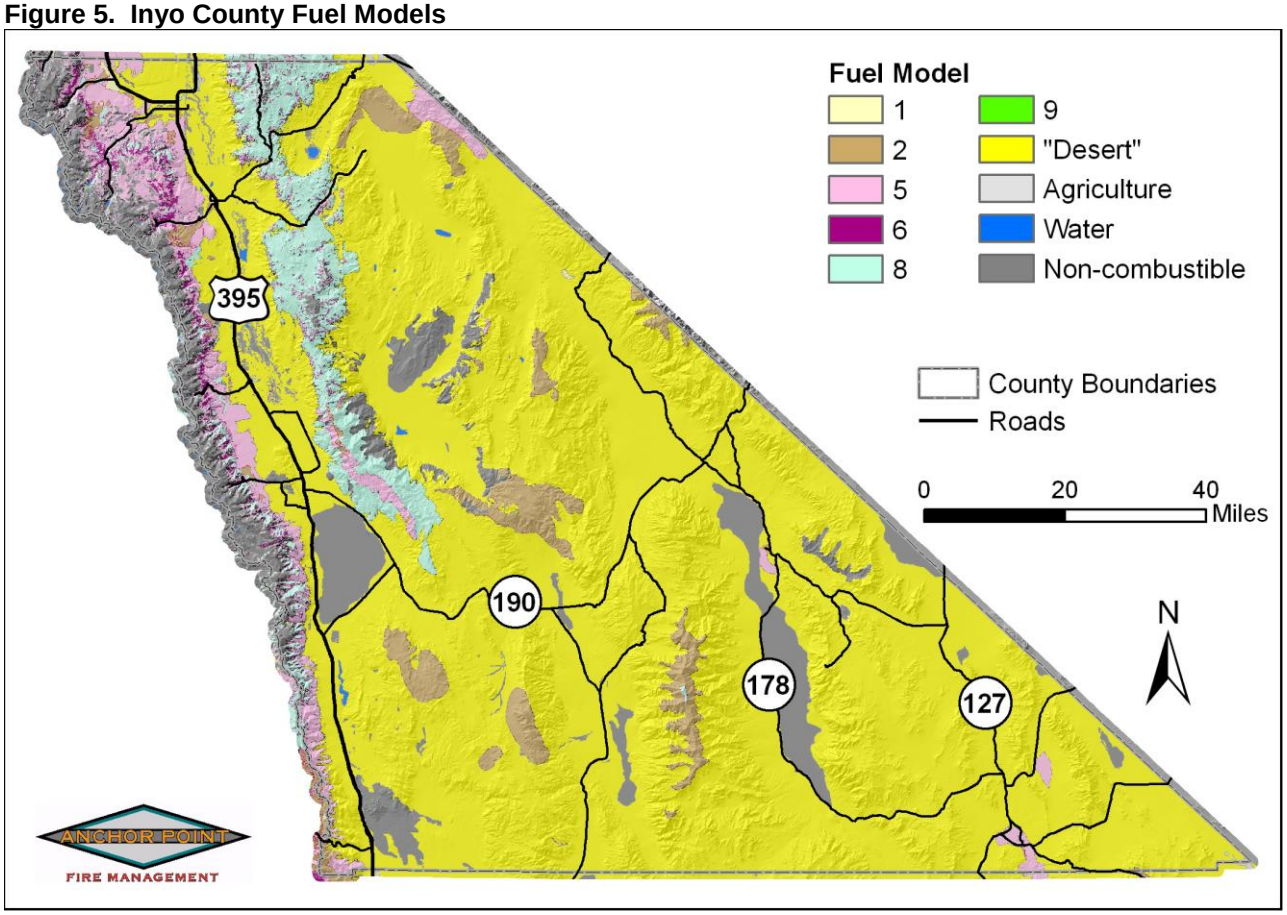
- Fuel Loading
- Size and Shape
- Compactness
- Horizontal Continuity
- Vertical Arrangement
- Moisture Content
- Chemical Content

Each of the major fuel types present in the study area are described below in terms of the characteristics that coincide with that fuel model. Fuel model descriptions are taken from Anderson's *Aids to Determining Fuel Models for Estimating Fire Behavior*[3], a national standard guide to fuel modeling, unless otherwise noted. **Vegetation for the project area may or may not be specifically listed in the description**. Plant species are only an aid to help visualize the characteristics of the model. The photos are taken from the project area and show where the local vegetation fits in. A table showing a range of surface fire behavior based on the **BEHAVE** system is also included.

The study area is represented primarily by seven fuel models (FM): FM 1, 2, 5, 6, 8, 9 and 15 (custom for Desert). Other fuel models may exist, but not in quantities sufficient to significantly influence fire behavior in the Wildland Urban Interface. **Figure 5** displays the fuel types graphically for the study area.

[3] Anderson, Hal E., *Aids to Determining Fuel Models for Estimating Fire Behavior*, National Wildfire Coordinating Group, NFES 1574, April 1982.

Figure 5. Inyo County Fuel Models



Fuel models 97, 98, and 99 in the map legend indicate areas of insignificant combustibility such as water, rock, sand, etc.

FUEL MODEL 1

Figure 6. Short Grass

Characteristics

Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations.

Common Types/Species

Annual and perennial grasses are included in this fuel model.

Fire Behavior

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires in this fuel model are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present—generally less than one third of the area.

FUEL MODEL 1

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	28.8	92.9	203.6	362.4	570.1	665.6
4.0	22.0	71.1	155.7	277.0	345.1	345.1
6.0	19.4	62.4	136.8	243.4	270.1	270.1
8.0	16.7	53.9	118.1	198.7	198.7	198.7
10.0	11.0	35.6	64.8	64.8	64.8	64.8

10-hr fuel = 5%, 100-hr fuel = 6%, herbaceous fuel moisture = 100%, slope = 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	3.0	5.1	7.3	9.6	11.8	12.7
4.0	2.4	4.1	5.9	7.8	8.6	8.6
6.0	2.2	3.8	5.5	7.1	7.5	7.5
8.0	2.0	3.4	4.9	6.3	6.3	6.3
10.0	1.4	2.4	3.2	3.2	3.2	3.2

FUEL MODEL 2

Figure 7. Timber (grass and understory)

Characteristics

Fire spread is primarily through the fine herbaceous fuels, either curing or dead.

Common Types/Species

Open shrub lands and pine stands or scrub oak stands that cover one third to two thirds of the area may generally fit this model. Such stands may include clumps of fuels that generate higher intensities and that may produce firebrands. Some piñon-juniper may be in this model.

Fire Behavior

These are surface fires where the herbaceous material—in addition to litter and dead-down stemwood from the open shrub or timber overstory—contributes to the fire intensity.

FUEL MODEL 2

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	12.4	34.2	67.5	111.6	166.0	230.2
4.0	10.2	28.0	55.3	91.4	135.9	188.5
6.0	9.0	24.9	49.1	81.2	120.8	167.6
8.0	8.3	22.9	45.3	74.9	111.3	154.4
10.0	7.4	20.5	40.5	67.0	99.7	138.5
12.0	5.9	16.3	32.3	53.3	79.3	110.0

10-hr fuel 5%, 100= 6%, herbaceous fuel moisture = 100%, slope 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	4.3	6.9	9.4	11.8	14.2	16.5
4.0	3.7	5.8	8.0	10.1	12.1	14.0
6.0	3.4	5.4	7.3	9.2	11.1	12.9
8.0	3.2	5.1	6.9	8.7	10.5	12.2
10.0	2.9	4.7	6.4	8.1	9.7	11.2
12.0	2.4	3.9	5.3	6.7	8.0	9.3

FUEL MODEL 5

Figure 8. Brush (2 feet)

Characteristics

This model consists of continuous stands of low brush. Generally, heights do not exceed six feet. The stands will have a grass or scattered grass understory. Usually shrubs are short and almost totally cover the area.

Common Types/Species

Young, green stands with no dead wood would qualify: laurel, vine maple, alder, or even chaparral, manzanita, or chamise. Mountain grasses are also associated with this type.

Fire Behavior

The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. Cured leaves retained on shrubs can cause greater intensities.

FUEL MODEL 5

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	9.7	22.5	38.2	56.2	76.0	97.5
4.0	8.7	20.1	34.2	50.3	68.1	87.3
6.0	7.5	17.5	29.8	43.8	59.2	76.0
8.0	5.5	12.7	21.6	31.8	43.1	55.2
10.0	2.7	6.4	10.8	15.9	21.5	21.8
12.0	2.6	6.1	10.4	15.3	20.1	20.1

10-hr fuel 5%, 100 = 6%, herbaceous fuel moisture = 100%, slope 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	4.3	6.4	8.1	9.7	11.2	12.5
4.0	3.9	5.8	7.4	8.8	10.1	11.4
6.0	3.5	5.1	6.5	7.8	8.9	10.0
8.0	2.6	3.8	4.9	5.8	6.7	7.5
10.0	1.4	2.0	2.6	3.1	3.5	3.6
12.0	1.3	2.0	2.5	3.0	3.4	3.4

FUEL MODEL 6

Figure 9. Dormant Brush

Characteristics

Shrubs in Fuel Model 6 are older than, but not as tall as, the shrub types of Fuel Model 4. They also do not contain as much fuel as FM 4.

Common Types/Species

A broad range of shrub conditions is covered by this model. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. Even hardwood slash that has cured can be considered. Piñon-juniper shrub lands may be represented but may over-predict rate of spread except at high winds, such as 20 mi/h (32 km/h) at the 20-foot level.

Fire Behavior

Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mi/h (13 km/h), at mid-flame height. Fire will drop to the ground at low wind speeds or at openings in the stand.

FUEL MODEL 6

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	17.2	38.5	63.9	92.4	123.5	156.8
4.0	13.9	31.1	51.7	74.8	99.9	126.9
6.0	11.7	26.2	43.5	62.9	84.1	106.8
8.0	10.2	22.9	38.1	55.0	73.6	93.4
10.0	9.2	20.7	34.4	49.7	66.5	84.4
12.0	8.5	19.1	31.7	45.9	61.4	77.9

10-hr fuel = 5%, 100-hr fuel = 6%, herbaceous fuel moisture = 100%, slope = 10%,

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	5.0	7.3	9.2	10.9	12.4	13.9
4.0	4.3	6.2	7.8	9.3	10.6	11.8
6.0	3.8	5.5	6.9	8.2	9.3	10.4
8.0	3.4	5.0	6.3	7.4	8.5	9.5
10.0	3.2	4.7	5.9	7.0	8.0	8.9
12.0	3.1	4.4	5.6	6.7	7.6	8.5

FUEL MODEL 8

Figure 10. Closed Timber Litter

Characteristics

Hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and occasionally twigs because little undergrowth is present in the stand. Amounts of needle and woody litter are also low.

Common Types/Species

Closed canopy stands of short-needle conifers or hardwoods. Representative conifer types are white pine, lodgepole pine, spruce, fir and larch.

Fire Behavior

Fires in this fuel model are slow burning and low intensity, burning in surface fuels. Fuels are mainly needles and woody litter. Heavier fuel loadings from old dead and down trees or branches can cause flare-ups. Heavier fuel loads have the potential to develop crown fires in extreme burning conditions.

FUEL MODEL 8

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	1.1	2.3	3.9	5.7	7.8	10.1
4.0	0.9	1.9	3.2	4.7	6.4	6.9
6.0	0.7	1.6	2.6	3.9	4.9	4.9
8.0	0.6	1.4	2.3	3.4	3.8	3.8
10.0	0.6	1.2	2.0	3.0	3.1	3.1
12.0	0.5	1.1	1.8	2.7	2.7	2.7

10-hr fuel = 5%, 100-hr fuel = 6%, herbaceous fuel moisture = 100%, slope = 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	0.9	1.3	1.7	2.0	2.3	2.6
4.0	0.8	1.1	1.4	1.7	2.0	2.0
6.0	0.7	1.0	1.2	1.5	1.7	1.7
8.0	0.6	0.9	1.1	1.3	1.4	1.4
10.0	0.6	0.8	1.0	1.2	1.3	1.3
12.0	0.6	0.8	1.0	1.2	1.3	1.3

FUEL MODEL 9

Figure 11. Timber (litter and understory)

Characteristics

Both long-needle conifer stands and hardwood stands, especially the oak-hickory types, are typical. Concentrations of dead/down woody material will contribute to possible torching out of trees, spotting, and crowning.

Common Types/Species

Closed stands of long-needled pine like Ponderosa, Jeffrey, and Red pines, or southern pine plantations are grouped in this fuel model.

Fire Behavior

Fires in this fuel model run through the surface litter faster than in Fuel Model 8 and have longer flame height. Fall fires in hardwoods are predictable, but high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling and blowing leaves.

FUEL MODEL 9

Rate of spread in chains/hour (1 chain=66 ft)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	4	9.8	18.1	28.7	41.5	56.2
4.0	3.2	7.7	14.3	22.7	32.7	44.4
6.0	2.6	6.4	11.8	18.8	27.1	36.7
8.0	2.3	5.5	10.2	16.3	23.5	31.8
10.0	2	5	9.2	14.7	21.2	28.7
12.0	1.9	4.6	8.5	13.5	19.5	26.5

10 hr fuel=5, 100 hr fuel=6%, herbaceous fuel moisture=100%, slope=10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	2.3	3.5	4.7	5.8	6.8	7.9
4.0	1.9	2.9	3.9	4.8	5.7	6.6
6.0	1.7	2.5	3.4	4.2	5	5.7
8.0	1.5	2.3	3.1	3.8	4.5	5.2
10.0	1.4	2.2	2.9	3.5	4.2	4.8
12.0	1.4	2.1	2.7	3.4	4	4.6

FUEL MODEL 10

Figure 12. Timber (litter and understory)

Characteristics

This model is represented by dense stands of over-mature ponderosa pine, Lodgepole pine, mixed-conifer, and continuous stands of Douglas-fir. In all stand types, heavy down material is present. There is also a large amount of dead, down woody fuels. Reproduction may be present, acting as ladder fuels. This model includes stands of budworm-killed Douglas-fir, closed stands of ponderosa pine with large amounts of ladder and surface fuels, and stands of Lodgepole pine with heavy loadings of downed trees. This model can occur from the foothills through the sub-alpine zone.

Common Types/Species

All types of vegetation can occur in this model, but primary species are Douglas-fir, ponderosa pine and lodgepole pine.

Fire Behavior

Fire intensities can be moderate to extreme. Fire moves through dead, down woody material. Torching and spotting are more frequent. Crown fires are quite possible.

FUEL MODEL 10

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	3.8	8.2	13.7	20.1	27.3	35.1
4.0	3.3	7.2	12.1	17.8	24.1	31.0
6.0	3.0	6.6	11.0	16.1	21.8	28.0
8.0	2.8	6.1	10.2	14.9	20.2	26.0
10.0	2.6	5.7	9.6	14.1	19.1	24.5
12.0	2.5	5.5	9.2	13.4	18.2	23.4

10-hr fuel 5%, 100 = 6%, woody fuel moisture = 100%, slope 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	3.8	5.5	7.0	8.3	9.5	10.7
4.0	3.5	5.0	6.3	7.5	8.6	9.7
6.0	3.2	4.6	5.8	6.9	7.9	8.9
8.0	3.0	4.3	5.5	6.5	7.5	8.4
10.0	2.9	4.1	5.2	6.2	7.2	8.0
12.0	2.8	4.0	5.1	6.0	6.9	7.8

FUEL MODEL 15-DESERT

Figure 13. Desert shrubs and grasses (custom fuel model from FRAP)

FM 15 is a desert grass custom model. It most closely resembles the Scott and Burgan FM 121 (GS1).[4] The following descriptions are from "Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model" by Joe H. Scott and Robert E. Burgan.[5]

Characteristics

The primary carrier of fire in GS1 is grass and shrubs combined. Shrubs are about one foot high, grass load is low.

Common Types/Species

Dry-climate grasses and shrubs.

Fire Behavior

Spread rate is moderate: flame length is low. Moisture of extinction is low.

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[4] The source for this is an email from David Sapsis, Wildland Fire Scientist, CDF Fire and Resource Assessment Program (FRAP), August 17, 2006.

[5] Scott, Joe and Burgan, Robert., *Standard Fire Behavior Fuel Models:A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*, USDA Forest Service Rocky Mountain Research Station, General Technical Report RMRS-GTR-153, June 2005, page 36.

FUEL MODEL 15

Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	9.3	22.5	39.2	58.7	80.6	104.7
4.0	8.1	19.6	34.2	51.3	70.4	91.5
6.0	7.5	18.1	31.5	47.2	64.8	84.1
8.0	7.1	17.1	29.8	44.7	61.4	79.7
10.0	6.2	15	26.1	39.1	53.7	69.7
12.0	2.2	5.3	5.9	5.9	5.9	5.9

10-hr fuel 5%, 100 = 6%, woody fuel moisture = 50%, slope 10%

Flame Length in Feet

Fine Dead Fuel moisture %	Mid-flame Wind Speed					
	2.0	4.0	6.0	8.0	10.0	12.0
2.0	3	4.5	5.8	6.9	8	9
4.0	2.6	4	5.1	6.2	7.1	8.1
6.0	2.5	3.7	4.8	5.8	6.7	7.5
8.0	2.4	3.6	4.6	5.5	6.4	7.2
10.0	2.1	3.2	4.1	4.9	5.7	6.4
12.0	0.8	1.2	1.3	1.3	1.3	1.3

REFERENCE WEATHER USED IN THE FIRE BEHAVIOR POTENTIAL EVALUATION

Inyo and Mono Counties cover an area of over 8,000,000 acres. The study area includes the highest (Mt. Whitney 14,495') and the lowest (Badwater Flats 282' below sea level) points in the continental United States. Mammoth Lakes averages 385 inches (32 feet) of snowfall per year[6] and Death Valley (2.5 inches of precipitation annually, July average temperature of 115°F)[7] is one of the hottest and driest places in the western hemisphere. No single set of weather inputs can capture the range of variability that exists in the study area and no single weather station is adequate to provide the weather inputs for the fire behavior analysis. Seasonal percentile weather reports were generated for all of the available Remote Automated Weather Stations (RAWS) and reviewed by our staff Fire Behavior Analyst (FBAN). Sites with poor data or significant errors were eliminated. Data from 10 RAWS were used to create fire weather zones for use in the fire behavior potential analysis. Site information for these stations is displayed in **Table 1**.

After evaluating the RAWS data, three fire weather zones were created for use in the fire behavior potential analysis. Percentile weather observations were calculated from each station using the Fire Family Plus software package to generate a moderate fire weather conditions class and an extreme fire weather conditions class. The moderate conditions class (16^{th} to 89^{th} percentile) was calculated for each variable (1 hour, 10 hour, and 100 hour fuel moisture, woody fuel moisture, herbaceous fuel moisture, and wind speed). This weather condition class most closely represents an average fire season day. Conditions class data from the stations within each zone were then averaged together to create an aggregate value for calculating the weather inputs for **FlamMap** for each fire weather zone.

The extreme conditions class was calculated using 97^{th} percentile weather data. In other words, the weather conditions existing on the three to five most severe fire weather days (sorted by Spread Component) in each season were averaged together. It is reasonable to assume that similar conditions may exist for at least five days of the fire season during an average year. During extreme years, such conditions may exist for significantly longer periods. These calculations may be conservative compared to observed fire behavior. Each weather zone is described below. Elevation ranges and vegetation descriptions are approximate.

Alpine Weather Zone (Fire Weather Zone 1) - Elevation 7,000' to 14,495', RAWS sites used: Crestview CA, Gaylor Meadow (Tuolumne) CA. The mountain fire weather zone contains the high elevations of the Sierra Nevada, Inyo, White, and Sweetwater mountain ranges. Although high elevations exist in other portions of the study area, most notably in the Panamint and Amargosa mountain ranges in Death Valley National Monument, the areas included in the mountain weather zone are typically substantially wetter and cooler than the high elevations of the desert areas. The presence of heavy to moderate coverage of timber makes surface fuels in the mountain zone the most shaded of the three weather zones. The values used in **FlamMap** for the mountain weather zone are shown in **Table 2**.

High Valleys Weather Zone (Fire Weather Zone 2) – Elevation 3,000' to 7,000', RAWS sites used: Walker CA, Bridgeport CA, Benton CA, Rock Creek CA, Owens Valley CA and Oak Creek CA. This fire weather zone contains the high valleys of the US 395 and US 6 corridors including Antelope Valley, Mono Valley, Chalfant Valley and the Owens Valley. The majority of WUI

[6] http://www.sfgate.com/cgi-bin/document.cgi?file=/sports/skiing/pages/resorts/mammoth.DTL

[7] http://www.nps.gov/archive/deva/weather.htm

communities in the study area occur in this weather zone. Vegetative cover includes irrigated agricultural, piñon /juniper stands, sage and annual grasses. The values used in **FlamMap** for the high valleys weather zone are shown in **Table 3**.

Desert Weather Zone (Fire Weather Zone 3) – Elevation -282' to 11,000', RAWS sites used: Panamint CA, Oriental Wash NV. This fire weather zone includes Death Valley National Monument, China Lake and portions of the Amargosa desert. Although elevations vary widely in this weather zone, the weather inputs used reflect the conditions below 7,000 feet. The high peaks have greater vegetation, usually piñon and other pine species, and more moisture but the vast majority of this zone is hot, dry and sparse in vegetation. That being said, however, wildland fires do occur in Death Valley (the Calico fire occurred just shortly before the data collection was done for this report) and WUI communities exist in this weather zone. The values used in **FlamMap** for the desert weather zone are shown in **Table 4**.

Table1: RAWS Site Information (listed north to south)

Walker, CA (Station ID # 043707)

Latitude (dd mm ss)	38° 33' 55" N
Longitude (dd mm ss)	119° 27' 33" W
Elevation (ft.)	5,440

Bridgeport, CA (Station ID # 043702)

Latitude (dd mm ss)	38° 16' 19" N
Longitude (dd mm ss)	119° 17' 21" W
Elevation (ft.)	6,650

Gaylor Meadow, CA (Station ID # 043611)

Latitude (dd mm ss)	37° 52' 06" N
Longitude (dd mm ss)	119° 19' 06" W
Elevation (ft.)	9,270

Benton, CA (Station ID # 043708)

Latitude (dd mm ss)	37° 50' 35" N
Longitude (dd mm ss)	118° 28' 40" W
Elevation (ft.)	5,450

Crestview, CA (Station ID # 043709)

Latitude (dd mm ss)	37° 44' 42" N
Longitude (dd mm ss)	118° 59' 00" W
Elevation (ft.)	7,600

Rock Creek, CA (Station ID # 043710)

Latitude (dd mm ss)	37° 33' 05" N
Longitude (dd mm ss)	118° 40' 02" W
Elevation (ft.)	7,040

Owens Valley, CA (Station ID # 044803)

Latitude (dd mm ss)	37° 23' 24" N
Longitude (dd mm ss)	118° 33' 02" W
Elevation (ft.)	4,640

Oriental Wash, NV (Station ID # 261502)

Latitude (dd mm ss)	37° 14' 07" N
Longitude (dd mm ss)	117° 29' 47" W
Elevation (ft.)	4,100

Oak Creek, CA (Station ID # 044804)

Latitude (dd mm ss)	36° 50' 33" N
Longitude (dd mm ss)	118° 15' 34" W
Elevation (ft.)	4,100

Panamint, CA (Station ID # 044806)

Latitude (dd mm ss)	36° 07' 13" N
Longitude (dd mm ss)	117° 05' 16" W
Elevation (ft.)	6,880

Table 2: FlamMap Weather Inputs, Alpine Weather Zone

Moderate Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	15 mph
Herbaceous fuel moisture	67%
Woody fuel moisture	98%
100-hr fuel moisture	12%
10-hr fuel moisture	7%
1-hr fuel moisture	5%

Extreme Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	23 mph
Herbaceous fuel moisture	30%
Woody fuel moisture	71%
100-hr fuel moisture	8%
10-hr fuel moisture	4%
1-hr fuel moisture	3%

Table 3: FlamMap Weather Inputs, High Valleys Weather Zone

Moderate Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	18 mph
Herbaceous fuel moisture	31%
Woody fuel moisture	61%
100-hr fuel moisture	6%
10-hr fuel moisture	4%
1-hr fuel moisture	3%

Extreme Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	36 mph
Herbaceous fuel moisture	31%
Woody fuel moisture	59%
100-hr fuel moisture	6%
10-hr fuel moisture	3%
1-hr fuel moisture	3%

Table 4: FlamMap Weather Inputs, Desert Weather Zone

Moderate Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	19 mph
Herbaceous fuel moisture	34%
Woody fuel moisture	60%
100-hr fuel moisture	5%
10-hr fuel moisture	4%
1-hr fuel moisture	3%

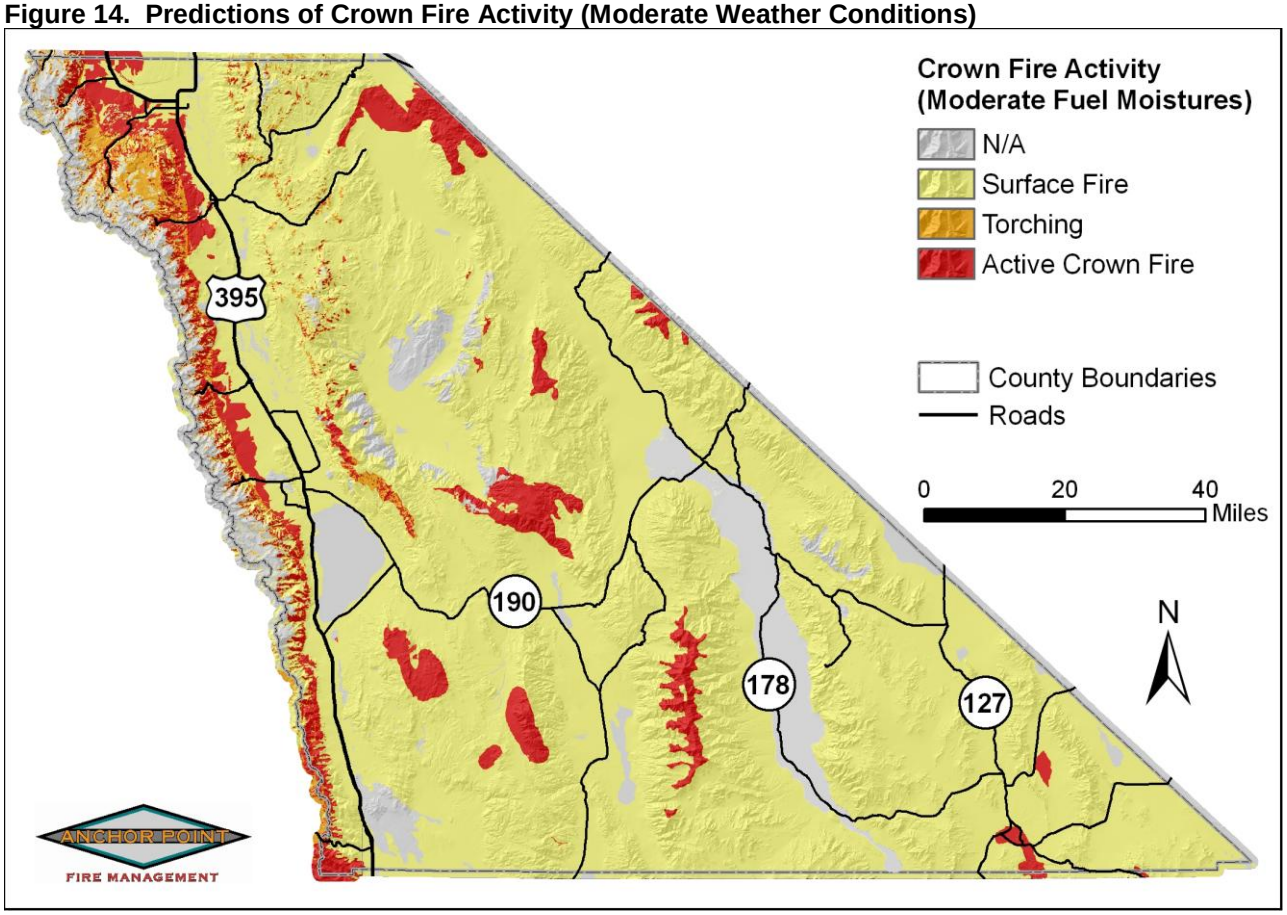
Extreme Weather Conditions	
Variable	**Value**
20 ft Wind speed up slope	30 mph
Herbaceous fuel moisture	34%
Woody fuel moisture	57%
100-hr fuel moisture	4%
10-hr fuel moisture	3%
1-hr fuel moisture	2%

Note:
Winds at 20 ft will be significantly less noticeable at ground level. Therefore, a "gentle breeze" may actually constitute an 11 MPH 20-foot wind, adding one of the components necessary for extreme weather conditions.

FIRE BEHAVIOR ANALYSIS OUTPUTS

Crown fire activity, rate of spread, and flame length are derived from the fire behavior predictions. The following maps graphically display the outputs of **FlamMap** for both average and extreme weather conditions.

Figure 14. Predictions of Crown Fire Activity (Moderate Weather Conditions)



Crown fire activity values are generated by the **FlamMap** model and classified into four categories based on standard ranges: Active, Passive, Surface, and Not Applicable. In the surface fire category, little or no tree torching will be expected. During passive crown fire activity, isolated torching of trees or groups of trees will be observed and canopy runs will be limited to short distances. During active crown fire activity, sustained runs through the canopy will be observed that may be independent of surface fire activity.

Figure 15. Predictions of Crown Fire Activity (Extreme Weather Conditions)

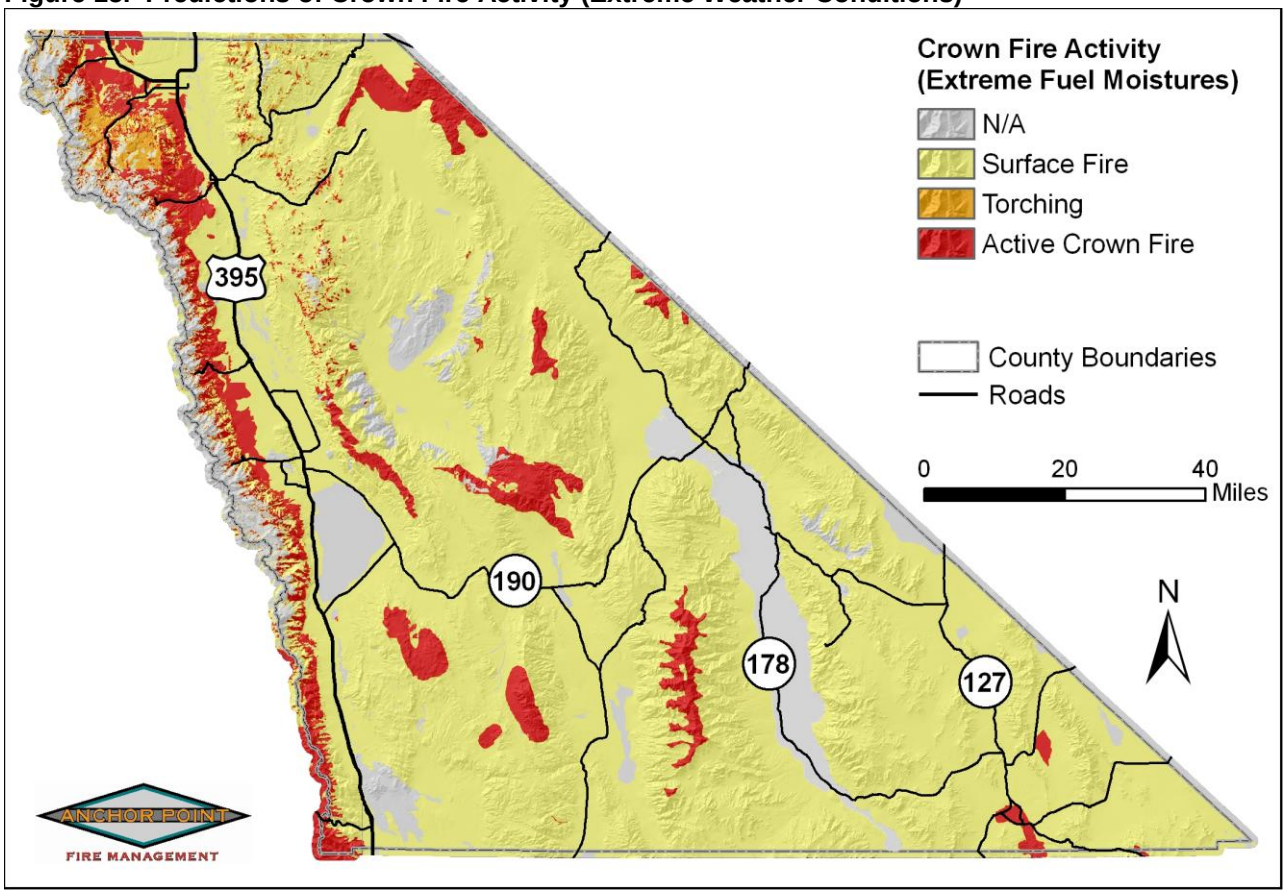
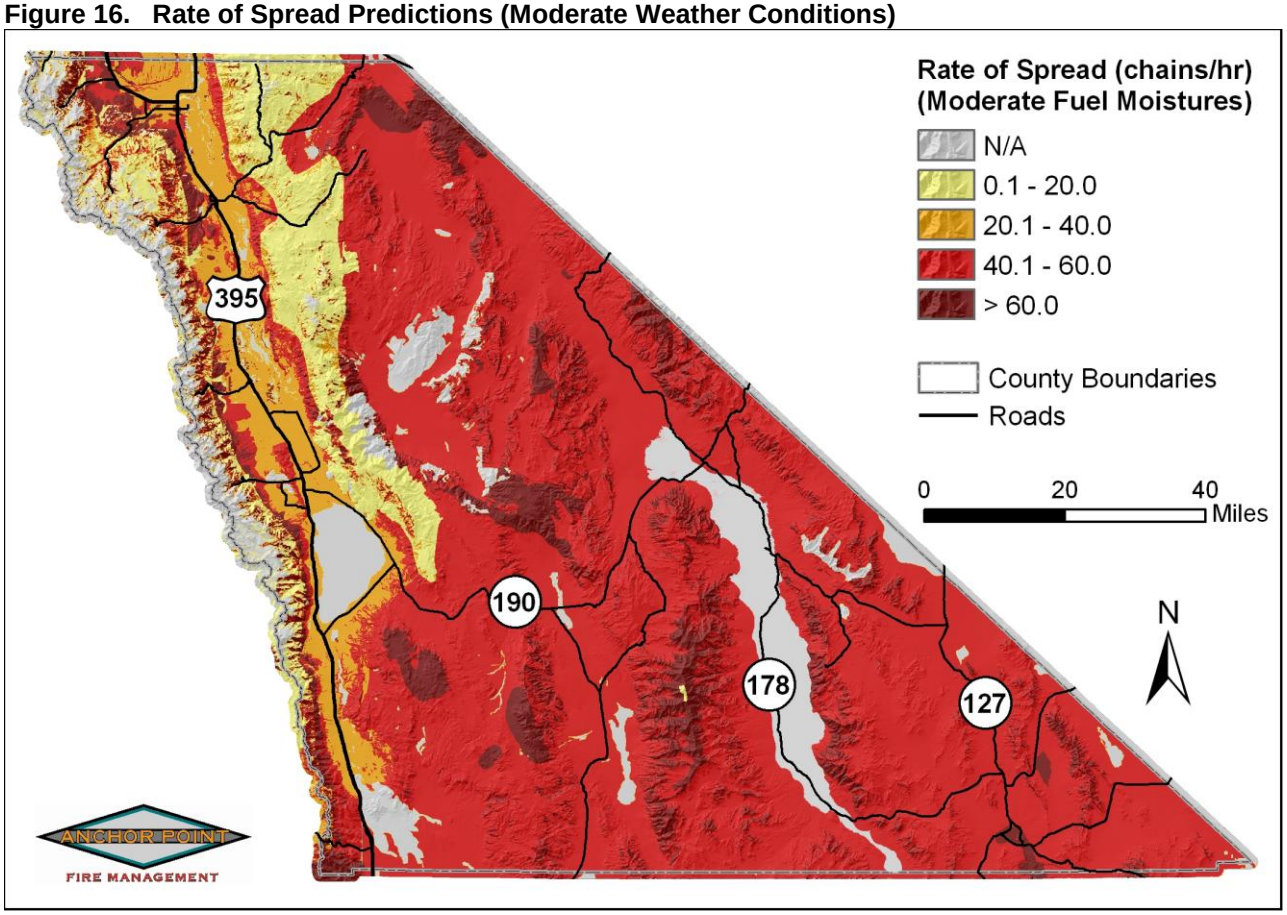


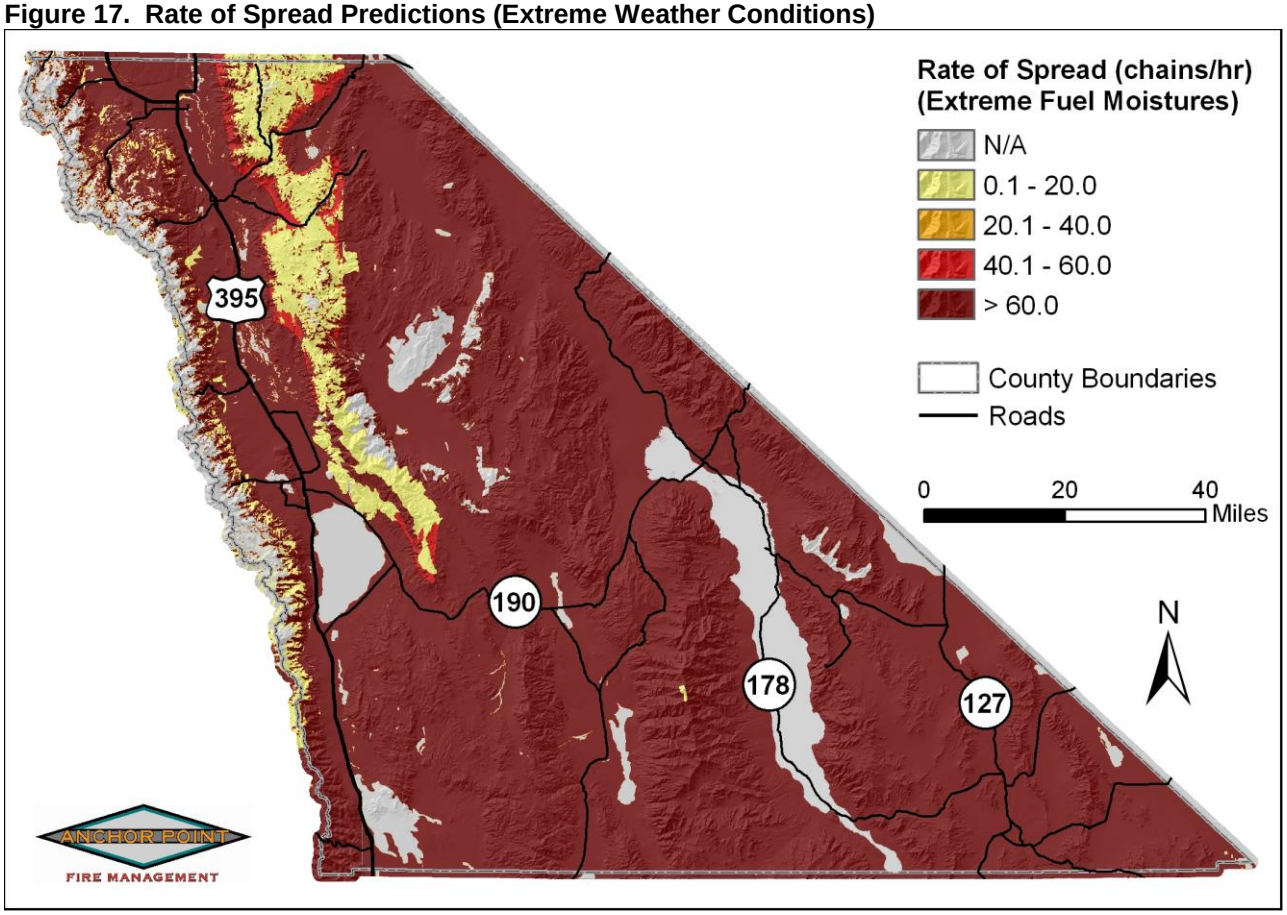
Figure 16. Rate of Spread Predictions (Moderate Weather Conditions)



Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

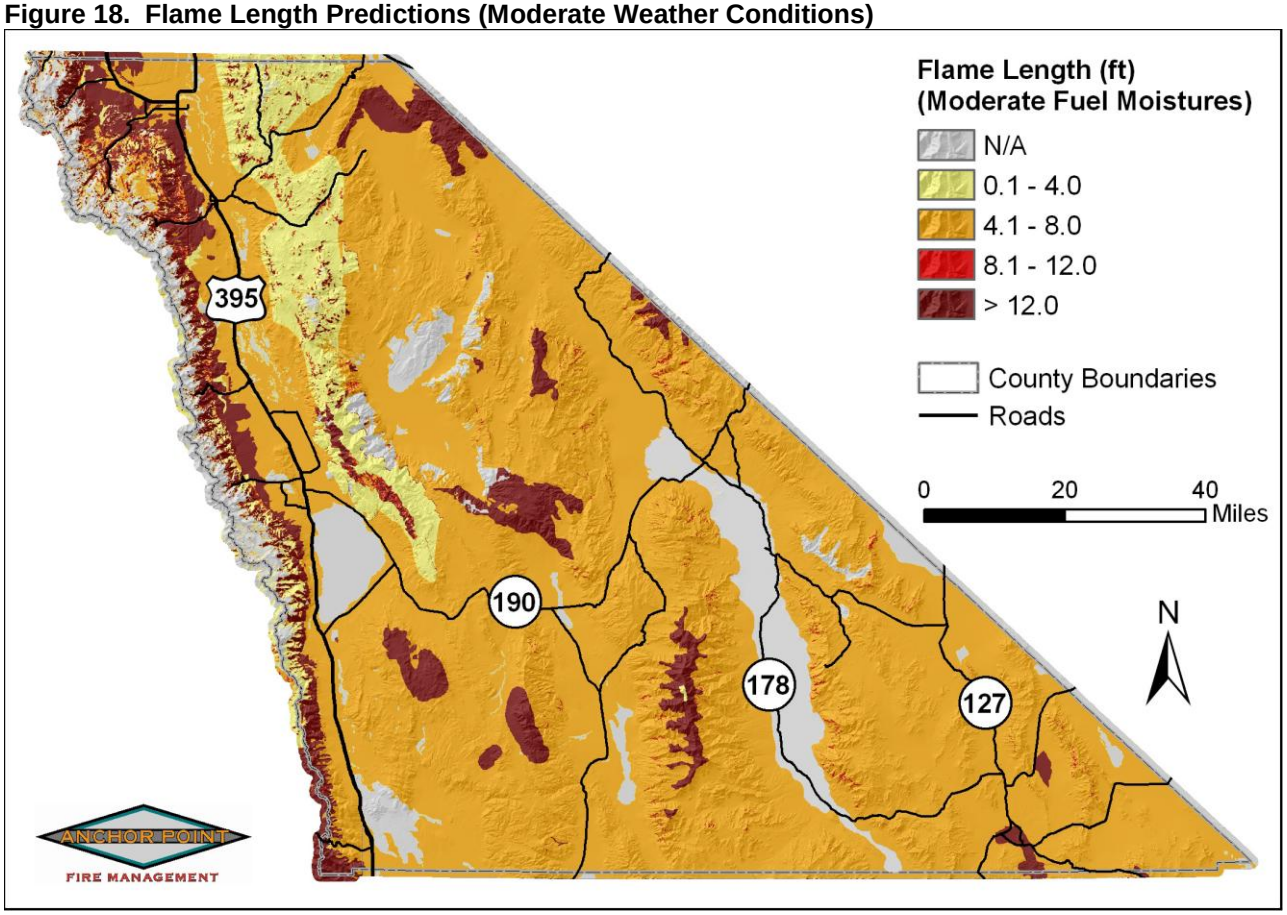
Spread rate values are generated by the **FlamMap** model and classified into four categories based on standard ranges: 0-20 ch/h (chains/hour), 20.1-40 ch/h, 40.1-60 ch/h, and greater than 60 ch/h. A chain is a logging measurement that is equal to 66 feet. One mile equals 80 chains. 1 ch/h equals approximately 1 foot/minute or 80 chains per hour equals 1 mile per hour.

Figure 17. Rate of Spread Predictions (Extreme Weather Conditions)



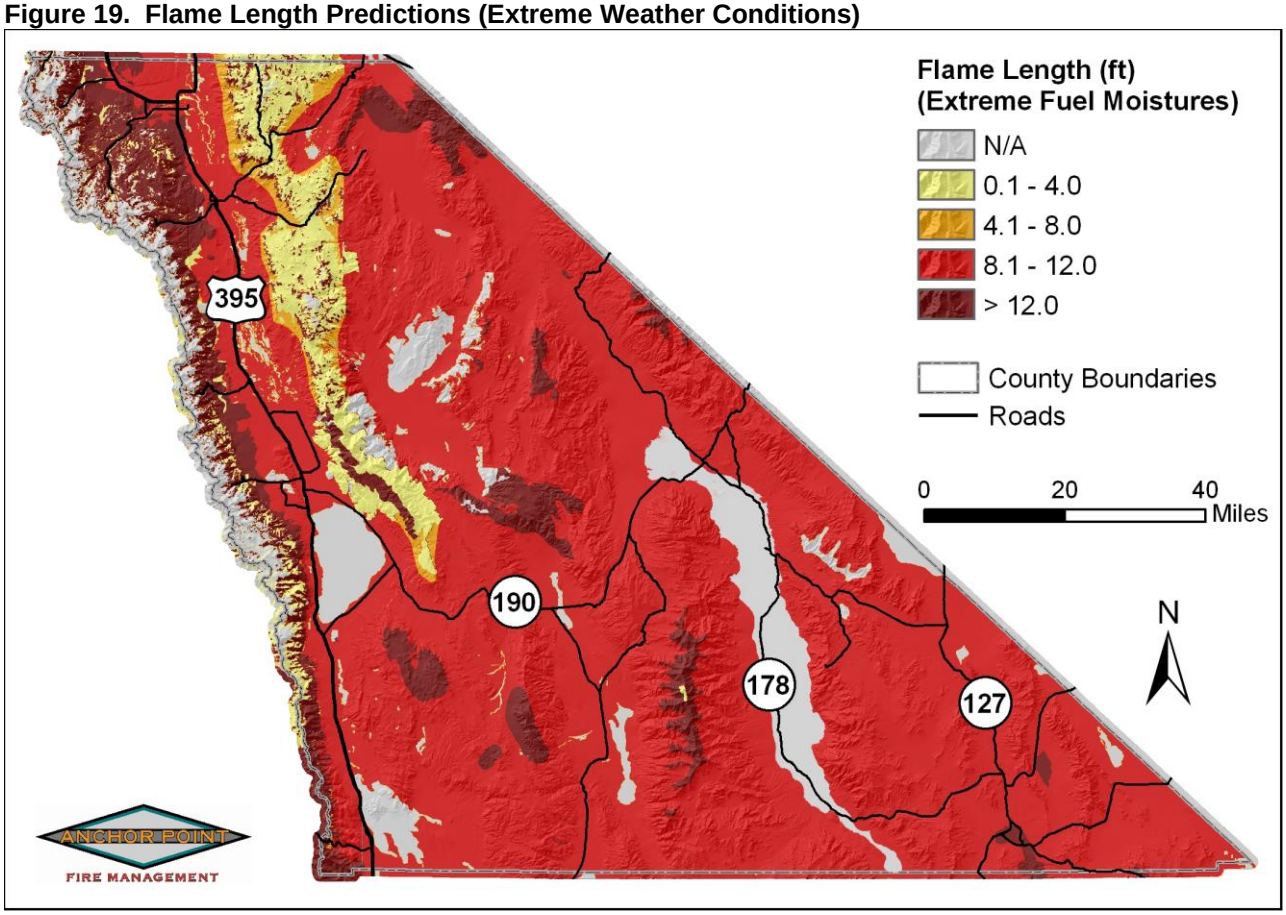
Rate of spread in chains/hour
(1 chain=66 ft) (80 chains/HR = 1 MPH)

Figure 18. Flame Length Predictions (Moderate Weather Conditions)



Flame length values are generated by the **FlamMap** model and classified in the four categories based on standard ranges: 0-4 feet, 4.1-8 feet, 8.1-12 feet and 12.1-60 feet. Flame lengths of 4 feet and less are acceptable for direct attack by hand crews. Flame lengths of 8 feet and less are suitable for direct attack by machinery. With flame lengths of greater than 8 feet, indirect attack and aerial attack are the preferred methods.

Figure 19. Flame Length Predictions (Extreme Weather Conditions)



Fire Behavior Interpretation and Limitations

This evaluation is a prediction of likely fire behavior, given a standardized set of conditions and a single point source ignition at every point. It does not consider cumulative impacts of increased fire intensity over time and space. The model does not calculate the probability that a wildfire will occur. It assumes an ignition occurrence for every cell (each 10 x 10 meter area).

Weather conditions are extremely variable and not all combinations are accounted for. These outputs are best used for pre-planning and not as a stand-alone product for tactical planning. Whenever possible, fire behavior calculations should be done with actual weather observations during the fire. The most current ERC values should also be calculated and distributed during the fire season to be used as a guideline for fire behavior potential.

FIRE BEHAVIOR MODELING LIMITATIONS AND INTERPRETATION

This evaluation is a prediction of likely fire behavior, given a standardized set of conditions and a single point-source ignition in every cell (each 10 x 10 meter area). It does not consider cumulative impacts of increased fire intensity over time and space. The model does not calculate the probability that a wildfire will occur. It assumes an ignition occurrence for every cell. These calculations may be conservative (under-predict) compared to observed fire behavior.

This model can be conceptually overlaid with the Community Wildfire Hazard Ratings (WHR) or other values at risk identification to generate current and future "areas of concern," which are useful for prioritizing mitigation actions. This is sometimes referred to as a "values layer." One possibility is to overlay the fire behavior potential maps with the community hazard map, in order to make general evaluations of the effects of the predicted fire behavior in areas of high hazard value (areas where there are concentrations of residences and other man-made values). However, one should remember that the minimum mapping unit used for fire behavior modeling is one acre; therefore, fine scale fire behavior and effects are not considered in the model. Additionally, weather conditions are extremely variable; all combinations cannot be accounted for. The fire behavior prediction maps are best used for pre-planning and not as a stand-alone product for tactical planning. If this information is used for tactical planning, fire behavior calculations should be done with actual weather observations during the fire event. For greatest accuracy, the most current Energy Release Component (ERC) values should be calculated and distributed during the fire season to be used as a guideline for fire behavior potential.

Rate of Spread

Figures 16 and **17** show the predicted rates of spread for the moderate fire weather and extreme fire weather scenarios, respectively. Rates of spread are expressed in chains/hour (CPH). A chain is a unit of measure commonly used by loggers and firefighters. It is equal to 66 feet. Therefore, one mile equals 80 chains. Rates of fire spread are influenced primarily by the wind, slope grade, fuel type/continuity, and fuel sheltering from the wind. Fire is the only force of nature which moves faster uphill than downhill. When all other factors are equal, fire moves twice as fast uphill on a slope of 30% than it does on flat terrain. In areas where high to extreme rates of spread are predicted (ROS of >40 CPH or ½ mile per hour), it is possible for fires to spread faster than humans can escape, creating extremely dangerous conditions for firefighters and evacuating residents. High rates of spread also make suppression efforts less effective and increase the tactical complexity of the incident.

In the moderate fire weather scenario, low to moderate rates of spread are predicted throughout the study area. However, there are pockets in all the interface communities where higher (up to 80 CHP) rates of spread are expected, due to the dominance of continuous grass fuels and the lack of sheltering from the wind. Even under moderate burning conditions, firefighters should expect that rates of spread could double in unsheltered areas where there is a continuous bed of fine fuels.

Under extreme burning conditions control efforts will be more difficult, and suppression tactics will need to be implemented further ahead of the fire. Firefighter safety will be an important consideration in planning suppression tactics, because crews and apparatus could be overrun or easily cut off by these fast-moving fires.

Flame Length

Figures 18 and **19** display the flame length predictions for the two weather scenarios. Flame length is a proxy for fire intensity. It is important to note that flame length is considered to be the entire distance from the base of the flame to the tip, irrespective of angle, and not simply the flame height above the ground. It is possible in high wind conditions to have very intense flames (high flame lengths) which are relatively close to the fuel bed. The legend boxes display flame length in ranges which are meaningful to firefighters. Flame lengths of four feet and less are deemed low enough intensity to be suitable for direct attack by hand crews, and therefore represent the best chances of direct extinguishment and control. Flame lengths of less than eight feet are suitable for direct attack by equipment such as bulldozers and tractor plows. Flame lengths of eight to 12 feet are usually attacked by indirect methods and aircraft. In conditions where flame lengths exceed 12

feet, the most effective tactics are fuel consumption ahead of the fire by burnouts, or mechanical methods. Indirect fire line and aerial attack are also used for fires with flame lengths of greater than 12 feet. However, as flame lengths increase, the effectiveness of these tactics decreases, and their use is generally designed to slow rates of spread and reduce fire intensity, especially in areas where values at risk are concentrated.

In the moderate fire weather scenario, the model predicts that fires in most of the populated portions of the WUI could be attacked directly by either hand crews or equipment. However, it is important to note there is no significant transition zone between low flame lengths and high to extreme flame lengths. In areas where shrub fuels could become the primary carrier of the fire, firefighters should expect sporadic but significant increases in flame lengths and fire line intensity as pockets of heavier fuels are consumed. Suppression resources working in shrub fuels and shrub fuels with a timber overstory should watch vigilantly for these increases, and remain prepared to disengage and employ alternative tactics to direct attack.

Under the extreme fire weather scenario, high to extreme flame lengths are predicted in most of the areas where the WUI communities are found. Throughout the interface communities, the predicted flame lengths indicate that fires are likely to be too intense for direct attack by hand crews. However, hand crews would be vital for structure preparation, triage and the construction of indirect fire line. Under extreme weather and fuel moisture conditions, the combination of high rates of spread and high fire intensity in many of the WUI communities will most likely make fire control difficult to establish and maintain.

Crown Fire Activity

The Crown Fire Activity maps (**Figures 14 and 15**) display the potential for fires to move from the surface into the canopy of trees and shrubs. The likelihood of progression from the surface into the aerial fuels is displayed in **four categories**.

1. **N/A** refers to areas where surface fires are unlikely to develop, due to the lack of combustible fuels. These would include any area lacking a combustible fuel bed such as rock, ice, snow fields, water, sand or some urban landscapes.
2. The **surface fire category** covers areas where fires are expected to be limited to the surface fuels and lack the energy to initiate and sustain vertical development into the aerial fuels. Areas where grass fuels without overstory plants are dominant fall into this category, regardless of the energy produced by the fire, due to the lack of an aerial fuel bed.
3. Areas covered by the **torching category** are expected to experience isolated combustion of the tree crowns in individual trees and groups of trees. In other words, individual or relatively small clusters of trees will be completely involved, but these fires lack the energy to initiate sustained horizontal movements (referred to as “runs” by fire fighters) through the crowns.
4. The **active crown fire** category includes areas where sustained horizontal movement through tree crowns is expected. This category can be further subdivided into “dependent” or “independent” crown fire.
    - **Dependent crown fires** rely on the presence of surface fires to support aerial burning. Independent crown fires develop when aerial burning is sustained without the need for associated surface fire.

- **Independent crown fires** are rare and are associated with the most extreme fire behavior conditions. Current fire behavior models do not have the ability to predict independent crown fire development.

All crown fires, regardless of whether they are dependent or independent, represent extreme fire behavior conditions and are notoriously resistant to all methods of suppression and control.

APPENDIX B: NEIGHBORHOOD IGNITABILITY ANALYSIS AND RECOMMENDATIONS

PURPOSE

The purpose of this appendix is to examine in greater detail the communities in the study area. Of the 26 WUI communities in Inyo County, one was found to represent an extreme hazard, three were rated as very high hazard, eight as high hazard, ten as moderate hazard, and four as low hazard (see **Figure1**). For easy reference, the map of communities presented in the main text has been reproduced here as **Figure 2**. **Figure 3** displays this grouping graphically. **Table 1** has been included for quick identification.

Figure 1. Community Groupings

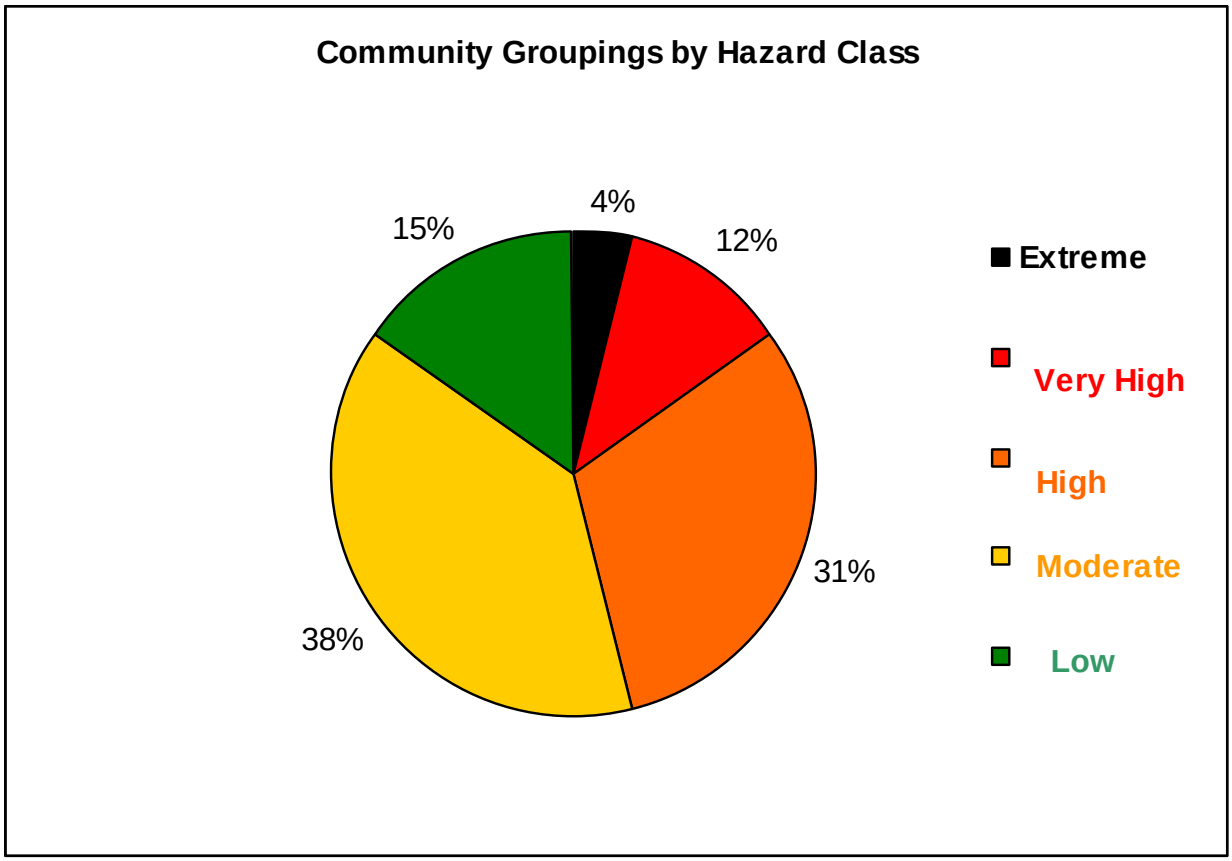


Figure 2. Community Hazard Ratings

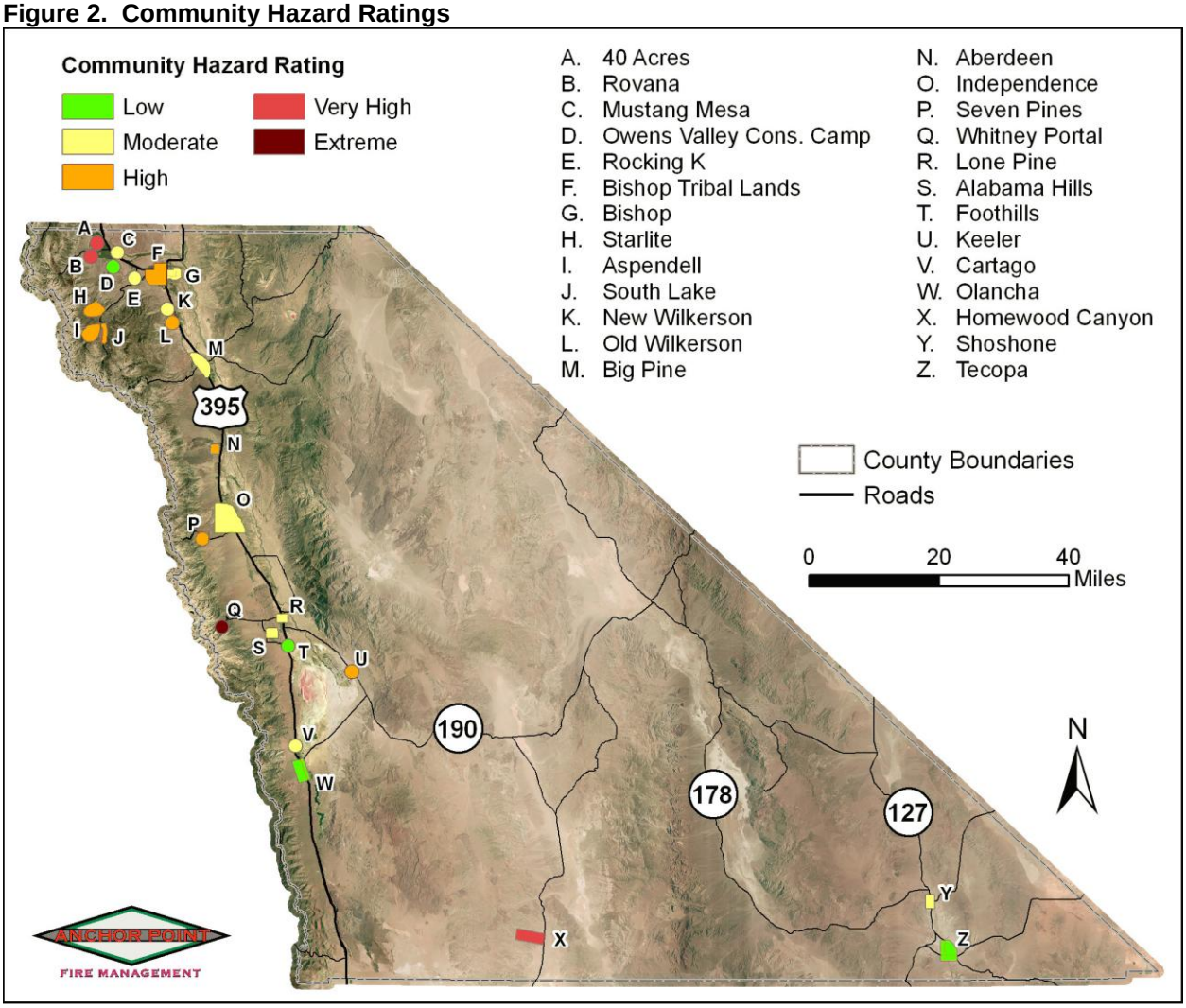


Figure 3. Hazard Ratings by Community

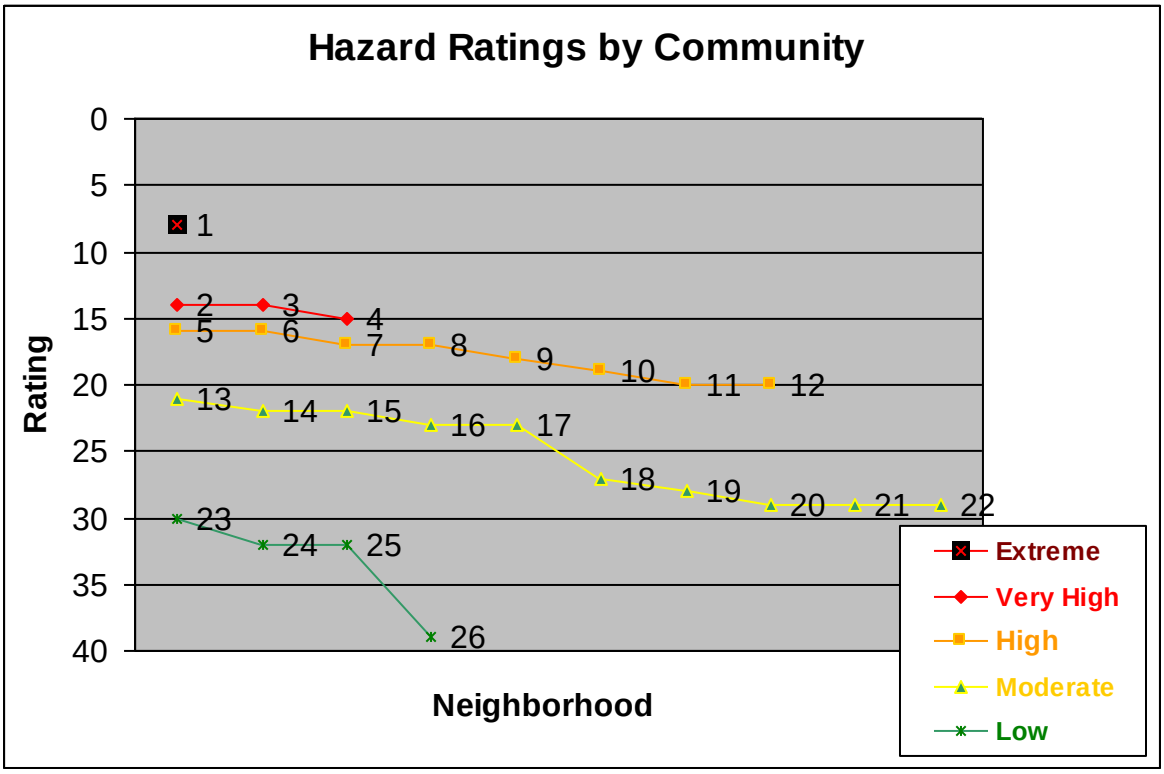


Table 1.

1. Whitney Portal	14. Shoshone
2. Rovana	15. Big Pine
3. Homewood Canyon	16. New Wilkerson
4. 40 Acres	17. Bishop
5. Aspendell	18. Lone Pine
6. South Lake	19. Rocking K
7. Old Wilkerson	20. Cartago
8. Bishop Tribal Lands	21. Mustang Mesa
9. Seven Pines	22. Independence
10. Keeler	23. Owens Valley Conservation Camp
11. Starlite	24. Tecopa
12. Aberdeen	25. Foothills
13. Alabama Hills	26. Olancha

GENERAL RECOMMENDATIONS

A combination of adequate access, ignition resistant construction, and fuels management will help create a safe environment for emergency service personnel and provide reasonable protection to structures from a wildfire. These techniques should also significantly reduce the chances of a structure fire becoming an ignition source to the surrounding wildlands.

In addition to the suggested mitigations listed for the individual communities, several general measures can be taken to improve fire safety. The following recommendations should be noted and practiced by anyone living in the Wildland-Urban Interface:

1. Stay aware of the current fire danger in the area.
2. Clean your roof and gutters at least two times a year, especially during cure-up in autumn.
3. Stack firewood uphill or on a side contour, at least 30 feet away from structures.
4. Don't store combustibles or firewood under decks.
5. Maintain and clean spark arresters on chimneys.
6. When possible, maintain an irrigated greenbelt around the home.
7. Connect, and have available, a minimum of 50 feet of garden hose.
8. Post reflective lot and/or house numbers so that they are clearly visible from the main road. Reflective numbers should also be visible on the structure itself.
9. Trees along driveways should be limbed and thinned as necessary to maintain a minimum 13'6" vertical clearance for emergency vehicle access.
10. Maintain your defensible space constantly.
    - Mow grass and weeds to a low height.
    - Remove any branches overhanging the roof or chimney.
    - Remove all trash, debris, and cuttings from the defensible space.

Note:
All communities rated as extreme to high hazard level were recommended for a parcel level analysis. In the moderate level communities a parcel-level analysis was recommended only if the evaluator found that a significant number of homes had no, or ineffective, defensible space or a significant number of hazards near homes was detected. In short, the recommendation was made if the evaluator felt information gathered by a parcel-level analysis could be used to generate a noticeable improvement in the community's defensibility.

TECHNICAL TERMS

The following definitions apply to terms used in the "Description" and "Comments and Mitigation" sections of this appendix.

Defensible Space: An area around a structure where fuels and vegetation are modified, cleared, or reduced to slow the spread of wildfire toward or from the structure. The design and extent of the defensible space is based on fuels, topography, and the design and materials of the structure.

Extended Defensible Space (also known as *Zone 3*): In this defensible space zone treatment is continued beyond the recommended minimum boundary for defensible space. This zone focuses on forest management with fuels reduction being a secondary function.

Shelter-in-Place Areas: There are several ways to protect the public from an advancing wildfire. One of these methods is evacuation, and involves relocation of the threatened population to a safer area. Another is to instruct people to remain inside their homes or public buildings until the danger passes. This concept is new to wildfire in the United States, but not to 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 pre-plan 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.

Citizen Safety Zone: An area that can be used for protection by residents in the event that the main evacuation route is compromised. The area should be maintained, cleared of fuels, and large enough for all residents of the area to survive an advancing wildfire without special equipment or training.

Fuelbreak: A natural or constructed discontinuity in a fuel profile used to segregate, stop, or reduce the spread of fire. As a practical matter, fuelbreaks in the WUI are most effective against crown fires.

COMMUNITY ASSESSMENT METHODOLOGY

The community level methodology for this assessment uses a Wildfire Hazard Rating (WHR) that was developed specifically to evaluate communities within the Wildland Urban Interface (WUI) for their relative wildfire hazard.[1] The WHR model combines physical infrastructure such as structure density and roads, and fire behavior components like fuels and topography, with the field experience and knowledge of wildland fire experts. It has been proven and refined by use in rating over 1,400 neighborhoods throughout the United States.

Many knowledgeable and experienced fire management professionals were queried about specific environmental and infrastructure factors, and wildfire behavior and hazards. Weightings within the model were established through these queries. The model was designed to be applicable throughout the western United States.

The model was developed from the perspective of performing structural triage on a threatened community in the path of an advancing wildfire with moderate fire behavior. The WHR survey and fuel model ground truthing are accomplished by field surveyors with WUI fire experience. The rating system assigns up to a maximum of 60 points based on seven categories: average lot size, slope, primary aspect, average fuel type, fuel continuity, dominant construction type and surface fuel loading. The higher the community scores, the lower its wildfire hazard. For example, a community with an average lot size of less than 1 acre and slopes of greater than 30% would receive 0 points for those factors, whereas a community with an average lot size of 5 acres and slopes of less than 15% would receive 16 points for the same factors. Additional hazards are then subtracted from the subtotal of points earned in the seven categories to give a final numeric value. The final value is then used to group communities into one of five hazard ratings: Extreme, Very High, High, Moderate, or Low.

It is important to note that not all groupings occur in every geographic region. There are some areas with no low hazard communities, just as there are some areas with no extreme communities. The rankings are also related to what is 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. It is designed to be used by experienced wildland firefighters who have a familiarity with structural triage operations and fire behavior in the interface.

[1] C. White, “Community Wildfire Hazard Rating Form” *Wildfire Hazard Mitigation and Response Plan*, Colorado State Forest Service, Ft. Collins, CO, 1986.

COMMUNITIES

1. Whitney Portal

Figure 4.

Hazard Rating	Extreme
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	8, 6, 5
Water supply:	1.5” stand pipe hydrants and a small pond
Hazards:	Steep slopes, ravines, natural chimneys, inadequate roads, no local fire protection, propane tanks, wood roofs

Description: This community consists of forest service lease cabins surrounded by heavy timber and located in steep, rocky terrain. Most of the structures are small on small lots. The dominant construction type is flammable or log siding with asphalt or metal roofs. However, there are a few tar paper and wood roofs in this community. There are many flammable decks and projections and there are no defensible spaces here. Access is dead-end, as well as steep and narrow. Road surfaces, even though mostly paved, are poor. Addressing here is present, but not reflective. This community is not within the Lone Pine Fire Protection District, but is within the Lone Pine FPD sphere of influence. Homes are a long way from the nearest fire station (located in Lone Pine), but some fire hose has been provided to residents in plastic boxes located near the 1.5” stand pipe hydrants. Hydrants are low flow, but it may also be possible to draft from a small pond located in this community. Fuels are heavy loads of mixed conifer consisting primarily of Jeffery Pine and juniper with timber litter and some sage in the understory. The USFS has done some prescribed burning around the Lone Pine Campground to reduce the fire danger in this community. The general topography is steep and complex.

WHITNEY PORTAL RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for most homes due to position, fuels and terrain.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs and tar paper roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along the access road and driveways. This is especially important for narrow driveways and road segments.
- Consider creating a shelter-in-place plan that includes a preplanned citizen safety zone. This area should be cleared of all fuels and maintained on an annual basis. This area should be large enough for citizens to be able to survive a fire event without special equipment or training. This area should be accessible even if the main access road is compromised by fire. This tactic is recommended only as last resort due to the dangerous fuels and topography in this community.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.
- Consider adding a dry hydrant installation to the pond in this community to augment the existing stand-pipe hydrants.

2. Rovana

Figure 5.

Hazard Rating	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 2, 8
Water supply:	Hydrants (but untested and usually low flow)
Hazards:	Ravines, inadequate roads, not in a FPD, inadequate water supply, propane tanks, power lines, wood roofs

Description: This community was originally built as a company town in the 1930s by a mining company and then expanded during WWII. The homes are small on small lots. Dominant construction is wood siding or stucco with a mix of asphalt and wood shake roofs. Very few homes have any defensible space. Many yards have flammable clutter and fuels growing right up to the structure. Access is poor with narrow roads and few turnarounds for apparatus. Most homes have some type of address marker, but most are low visibility and not reflective. This area is not in a fire protection district, but is within the Bishop FPD sphere of influence. Fire response would be from Cal Fire (formerly CDF), Paradise VFD and Bishop FD. Hydrants are present, but are low flow and not regularly tested. There are overhead power lines and propane tanks (many overgrown with vegetation) which may be a hazard to firefighters. Fuels are moderate loads of sage, bitterbrush and hardwoods, some with grass understory. The topography in this community is generally moderate, but complicated by ravines and drainages.

ROVANA RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above fuels.
- Clean leaf litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along the access road and driveways. This is especially important for narrow driveways and roads.
- Consider contracting for annual hydrant tests and investigate the possibility of upgrading the existing hydrant system. If that is not possible, investigate the possibility of adding a large (10,000 to 30,000 gallon) cistern to supplement the existing water supply.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider partnering with 40 Acres and Mustang Mesa to create a volunteer fire station to serve this area.
- Add reflective addressing to all driveways and homes.

3. Homewood Canyon

Figure 6.

Hazard Rating	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	>5 Acres
Fuel models found in the neighborhood:	15
Water supply:	None
Hazards:	Steep slopes, ravines, inadequate roads, no water supply, homes located in saddles and on ridges, not in a FPD, power lines, propane tanks

Description: Homewood Canyon is located in Searles Valley, one of the hottest and driest places in the United States. Homes consist primarily of permanently mounted mobile homes and older wood siding construction with a mix of asphalt and metal roof types. Most of the residences are on large lots, but many have cluttered yards and some have wooden decks, projections and/or outbuildings. Flammable ornamental vegetation is planted too close to some homes. There are no visible address markers or conforming defensible spaces. Although the primary access into the area is paved and wide, it is one way in and out. Most of the homes are located on long, narrow dirt driveways and private roads. There is no water for fire suppression in this community. Although Homewood Canyon is within the Southern Inyo Fire protection District, there is no fire protection in this community. The nearest fire responders would most likely be from the BLM office in Ridgecrest or from Trona (both in San Bernardino County). Mines, mining equipment and other industrial hazards exist in this community, which would create hazards for fire fighting operations. Overhead power lines and propane tanks exist, which may represent further hazards to firefighters. Fuels are moderate loads of desert shrubs and grasses. Topography is moderate to steep and complex.

HOMEWOOD CANYON RECOMMENDATIONS

- A parcel-level analysis is recommended.
- A detailed pre-plan of this area noting all hazards is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or on ridge tops and summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Mow grasses away from homes and outbuildings for at least 30 feet. Clear flammable vegetation away from power lines near homes.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- The BLM has two proposals for fuels mitigation in this community tentatively scheduled for 2008/2009. One involves biological treatment of fuels in the wilderness along adjacent private property boundaries and the other involves piling and chipping materials cut in the wilderness along private property boundaries. Both projects are highly recommended and homeowners are encouraged to participate by chipping materials cut on private land while the chipper is available from the BLM.
- The BLM is currently considering the possibility of constructing a helicopter dip site in this area. Residents are strongly recommended to encourage this construction.
- Investigate the possibility of adding one or two large (10,000 to 30,000 gallon) cisterns in this community.
- Add reflective addressing to all driveways and homes.
- Mines, hazardous materials storage and other hazards to fire fighters should be clearly marked.

4. 40 Acres

Figure 7.

Hazard Rating	**Very High**
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 2, 28
Water supply:	Draft from creek
Hazards:	Ravines, inadequate roads, inadequate water supply, not in a FPD, power lines, wood roofs

Description: This is a community of approximately 50 older homes of small to moderate size on small lots. Wood siding with an asphalt or metal roof is the most common construction type, although there are some wood shake roofs in this community. Some homes have been mitigated and have defensible space, but some others have vegetation growing right up to the structure. There are also some residences with large quantities of flammable yard clutter. Most homes have address markers; however they are generally not reflective and may be difficult to spot in dark or smoky conditions. There are some poor roads in this community and some long narrow driveways. Almost all of the roads are dead ends and there are few turnarounds for apparatus. The only water for fire suppression in the community is from a creek and requires drafting. This area is not in a fire protection district, but is within the Bishop FPD sphere of influence. Fire response would be from Cal Fire, Paradise VFD and Bishop FD. Fuels are moderate to heavy loads of tall shrubs and old hardwoods, primarily cottonwoods and locust trees, with grass and timber litter in the understory. This community has overhead power lines which may be a hazard to fire apparatus. A fire in the early 1980s between here and Rovana resulted in the loss of two homes. This area has a history of winter fires. The topography in the area is flat to low slope.

40 ACRES RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of adding a large (10,000 to 30,000 gallon) cistern in this community.
- There is an existing fuelbreak 50 to 100 feet wide on the north side of this community which should be inspected and maintained annually.
- Consider partnering with Rovana and Mustang Mesa to create a volunteer fire station to serve this area.
- Add reflective addressing to all driveways and homes.

5. Aspendell

Figure 8.

Hazard Rating	High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 6, 8
Water supply:	Hydrants (may not be functional)
Hazards:	Steep slopes, ravines, propane tanks, wood roofs

Description: This is an isolated community of small to moderate size homes on small lots. Wood siding or log construction with metal or asphalt roofs is dominant, although there are some homes with shake roofs. Many homes have flammable decks and projections, and quite a few need flammable materials cleared from under the deck. There has been fire mitigation work done in Aspendell and some homes have defensible space. There are still many homes with grass, shrubs and ornamental plantings too close to the structure. Some homes have wood piles and other flammable yard clutter that should be removed. There is only one way in and out of this community, but in general access roads are good and most driveways are short. Most homes have address markers, but most are not reflective and a significant number may be hard to find at night or in fire conditions. There are hydrants in Aspendell and a good dip site below the community. Aspendell has a private fire department with aid available from Bishop Rural Fire Department. The dominant fuel surrounding this community is sage, but within Aspendell fuels transition to grasses and riparian shrubs and hardwoods. Aspen, willows and high-moisture annuals, which are usually most receptive to fire in the fall, are the most common types. The general topography is steep to moderate slope and is complicated by ravines and drainages.

ASPENDELL RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Turnarounds should be constructed at the end of long driveways and dead-end roads.
- There is a fuelbreak on the west side of Aspendell which should be maintained on an annual basis.
- Add reflective addressing to all driveways and homes.
- Ensure the testing and maintenance of all hydrants.
- Formalized a Mutual Aid Agreement with Bishop Rural Fire Protection District.

6. South Lake

Figure 9.

Hazard Rating	High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 6, 8
Water supply:	Hydrants
Hazards:	Steep slopes, ravines, possible inadequate water supply, no fire protection, power lines, wood roofs

Description: South Lake is located on the opposite side of Bishop Creek from Aspendell and many of the same comments apply. There are approximately 25 to 30 homes built in this community. Homes are small to moderate on small lots and they are a mix of new and old construction styles. Some homes have shake roofs. Roads are generally good. Most homes have address markers, but generally they are not reflective and a significant number may be hard to find at night or in fire conditions. There are hydrants in South Lake, but they are not regularly tested and are of unknown quality. This community is not in a fire protection district and the Aspendell fire department does not respond here. The nearest fire response would be from Bishop Rural Fire Department or the USFS. Fuels are lighter than in Aspendell but of similar composition. The general topography is moderate to steep slopes complicated by ravines and drainages.

SOUTH LAKE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Some homeowners have been spraying sage and not removing the dead plants. This practice should be strongly discouraged since the dead sage is more flammable than the live plants. Any sage, or other shrubs, killed with herbicides should be removed from areas near homes, access roads or other values.
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Turnarounds should be constructed at the end of long driveways and dead-end roads.
- A contractor should be engaged to test the hydrant system and verify flows are adequate for fire suppression. If the existing hydrants are found to be inadequate the system should be upgraded or augmented with cisterns. Verifying the water supply is a critical need in South Lake.
- Investigate the possibility of partnering with Aspendell for local fire protection.
- Add reflective addressing to all driveways and homes.

7. Old Wilkerson

Figure 10.

Hazard Rating	High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	Yes
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 15
Water supply:	10,000 Gallon cistern on Cottonwood Drive
Hazards:	Ravines, inadequate roads, inadequate water supply, power lines, no fire protection

Description: This community consists primarily of small homes and permanently mounted mobile homes on small lots. Most construction is older wood siding or stucco with asphalt or metal roofs. Flammable decks, projections and outbuildings are common. Several homes have very cluttered yards and there are few, if any, defensible spaces. Street signage and address markers are missing or worn and difficult to read and/or interpret (e.g. group mailbox markers not clearly tied to a home). This community has poor access. Most homes are accessed by narrow, rutted dirt roads. There is limited water supply for fire suppression. This community is within the Bishop Rural Fire Protection District (BRFPD). There are some agricultural properties and animal evacuation may be an issue. Power lines and propane tanks exist which may be a hazard to firefighters. Fuels are moderate loads of sage and grasses with heavy ornamental plantings near most homes. Topography is low to moderate slope, but complicated by ravines and drainages. The Keough Hot Springs property, a summer resort with approximately 15 seasonal residences, is located nearby and has hazards similar to Old Wilkerson.

OLD WILKERSON RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Turnarounds should be constructed at the end of long driveways and dead-end roads.
- Investigate the possibility of adding a large (10,000 to 30,000 gallon) cistern in this community.
- Add reflective addressing to all driveways and homes.

8. Bishop Tribal Lands

Figure 11.

Hazard Rating	High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	10, 2
Water supply:	Hydrants (may have limited fire flow in commercial areas)
Hazards:	Man-made hazards, power lines, inadequate roads, wood roofs

Description: This community borders the City of Bishop on the north and east side. Lot size and construction styles vary somewhat, but small to moderate size homes on small to moderate size lots are dominant. The most common construction type is wood siding with asphalt roofs, but mobile homes are also common in this community. There are many properties with flammable yard clutter and/or heavy vegetation which need cleanup. Most homes do not have defensible space and many have vegetation growing right up to the structure. Although most streets are flat and of adequate width, there are some narrow roads and driveways with vegetation encroaching. Some homes have missing address markers and most existing markers are non-reflective and inconsistently located. Fire suppression in this community is provided under contract by the Bishop Rural Fire Protection District which has three fire stations and adequate hydrant coverage. Power lines exist which may be a hazard to firefighters. Moderate to heavy fuel beds of sage, annual grasses and other shrubs extend deeply into the residential areas of this community, however fuel beds are broken by some irrigated lawns, pastures and agricultural plots. A parcel-level analysis is strongly recommended to identify areas where risks to homes from wildland fire would be significantly greater than the average hazard of the total interface. Topography is flat to low slope.

BISHOP TRIBAL LANDS RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

9. Seven Pines

Figure 12.

Hazard Rating	High
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 8
Water supply:	Draft water from Independence Creek
Hazards:	Steep slopes, ravines, inadequate water supply, inadequate roads propane tanks, not in fire protection district

Description: This is a community of approximately 15 leased cabins on small lots. Wood siding with composition roofs is the dominant construction type. There is only one way in and out of this community. Within the community most roads and driveways are narrow with vegetation encroaching on the driving surface. Most of the cabins have address markers, but they are not reflective or conforming. The only water for fire suppression is from Independence Creek which can be drafted with a portable pump. This area is not within a fire protection district, but is within the Independence Fire Department sphere of influence. Fire response would be from Independence Fire Department, Cal Fire, and USFS. There are propane tanks which may be a hazard to firefighters. Electric power is supplied by individual generators. Fuels near the residences consist primarily of Jeffrey pine with riparian shrubs, oak and sage in the understory. Fuel loads are moderate to heavy. Fuels surrounding this community are primarily moderate loads of sage. Sage near the community has been modified by burning and thinning. Fuel breaks are planned to extend all the way around the community. This community is built in a canyon and the general topography is steep and complex.

SEVEN PINES RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider adding at least one large (10,000 to 30,000 gallon) cistern for fire suppression use in this community. Water supply is a critical need in Seven Pines.
- Create a maintenance program for the existing and planned fuelbreaks.
- Add reflective addressing to all driveways and homes.

10. Keeler

Figure 13.

Hazard Rating	High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	15
Water supply:	None
Hazards:	No water supply, not in a fire protection district, wooden roofs, above ground fuel tanks, power lines, mines, other man-made hazards

Description: Most of the homes in Keeler are older structures or mobile homes. Older wood siding construction with a metal, asphalt or shake roof is dominant. There are many abandoned buildings and flammable yard clutter is common. Flammable ornamental vegetation is planted too close to some homes and few homes have any defensible space. Power lines, above-ground fuel tanks and other hazards exist which may be a hazard to firefighters. Addressing is poor in this community. Some homes have no address markers and others are not easily visible. Many homes are missing address markers and the markers that are present are generally not reflective and inconsistently placed. Road surfaces are generally good and the main access roads are wide with adequate turnarounds. Keeler is not within a fire protection district and is at the edge of the sphere of influence of the Lone Pine FPD. Response times from the nearest Lone Pine Fire Department station are likely to be long. There is no water for fire suppression. Fuels are light to moderate loads of desert shrubs and grasses. Topography is flat to low slope.

KEELER RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider adding at least one large (10,000 to 30,000 gallon) cistern for fire suppression use in this community. Water supply is a critical need in Keeler.
- Identify and preplan all manmade hazards such as above-ground fuel tanks and mine shafts.
- Consider forming a local volunteer fire department. Structural extension is a greater threat to this community than wildland fire.
- Add reflective addressing to all driveways and homes.

11. Starlite

Figure 14.

Hazard Rating	High
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	< 1 Acre
Fuel models found in the neighborhood:	5, 6, 8
Water supply:	Hydrants
Hazards:	Ravines, not in a fire protection district, wood roofs

Description: Starlite consists of small to moderate size homes on small to moderate size lots. There is a mix of new and older construction, but most of the homes are older wood siding constructions with a metal or wood roof. There are many homes here with defensible space; however there are some homes with ornamental vegetation and/or wood piles too close to the structure. Streets are generally wide with good surfaces, but there are many dead-end roads with inadequate turnarounds for apparatus. There is a secondary access which goes to the Rocking K community, but this is a rough 4WD road which may be more useful for firefighter access than evacuation. There is a hydrant network in this community. Starlite is not within a fire protection district and is near the southern end of the sphere of influence of Bishop FPD. Response times from the nearest Bishop Fire Department station are likely to be long. There is an active Fire Safe Council in Starlite. Fuels are light to moderate loads of sage and other shrubs broken by irrigated lawns. Aspen and riparian shrubs are also present in drainages. The general topography is complex and moderately steep.

STARLITE RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider the possibility of improving the existing 4WD road to Rocking K for use as a secondary escape route.
- Add reflective addressing to all driveways and homes.

12. Aberdeen

Figure 15.

Hazard Rating:	**High**
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	15
Water supply:	None
Hazards:	No water supply, not in a fire protection district, inadequate roads, power lines

Description: This community consists of approximately 20 residences, all mobile homes, and a campground. Homes are small on small lots. There are some homes with small irrigated lawns, but most are located in native fuels, primarily sage, or with ornamental plantings too close to the structure. Some residences have flammable projections and outbuildings. There are no address markers and the only street signs are at the intersection of county roads. The main access roads, Old Highway 395 and Goodale Road, are generally wide enough with good surfaces; however there are some narrow dirt driveways and secondary roads. Apparatus access and turnaround would be difficult for some properties. There is no water supply for fire protection. Aberdeen is not within a fire protection district and is near the southern end of the sphere of influence of Big Pine FPD. Response times from the Big Pine Fire Department station are likely to be long. There are overhead power lines which may be a hazard to fire apparatus. Aberdeen is surrounded by large continuous fuel beds with moderate loads of sage, desert shrubs and grasses. This area has a history of fires. Terrain is generally flat to low slope.

ABERDEEN RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace any shake roofs (even on outbuildings) with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider adding at least one large (10,000 to 30,000 gallon) cistern for fire suppression use in this community. Water supply is a critical need in Aberdeen.
- Add reflective addressing to all driveways and homes.

13. Alabama Hills

Figure 16.

Hazard Rating:	Moderate
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	15
Water supply:	one hydrant, cistern at the fire station
Hazards:	Ravines, inadequate water supply, propane tanks, power lines, wood roofs

Description: Alabama Hills is a community of small to moderate size homes, most of older construction types (wood siding with an asphalt roof is dominant). Lot sizes vary greatly, but in general, lot sizes are moderate and the spacing between homes is good. There are a few ignition resistant homes, but there are also some homes with shake roofs. Some homes have defensible space, but most have vegetation growing too close to the structure. Roads are generally flat and of adequate width. Although there is only one way in and out presently, there is a one-lane road which could be improved to create a secondary access. The only water supply for fire suppression is located at the fire station, which is in the community. There are overhead power lines and propane tanks that may be a hazard to firefighters. Heavy to moderate loads of sage and other desert shrubs and grasses extend through this community and are continuous in the surrounding wildlands except for where they are broken by boulder fields. The general topography is low to moderate slope with ravines and boulder fields.

ALABAMA HILLS RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (in saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments.
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of improving Tuttle Creek Road as a secondary access.
- Consider adding at least one large (10,000 to 30,000 gallon) cistern for fire suppression use in this community.
- Add reflective addressing to all driveways and homes.

14. Shoshone

Figure 17.

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	15
Water supply:	None
Hazards:	Power lines, inadequate water supply

Description: Moderate size homes on small lots. Shoshone is located in the Amargosa Desert east of Death Valley National Park. This community is a mix of mobile homes, wood siding structures with a metal or asphalt roof and cinder block, or other ignition resistant, building types. Most of the homes are small on small lots and are generally older construction. A few homes have defensible space due to irrigated lawns, but most have ornamental and native vegetation growing too close to the structure. Roads are flat and of adequate width. Some homes do not have address markers and where markers exist, they are generally non-reflective and may be difficult to locate. There is no water for fire suppression. A creek runs through Shoshone, but the vegetation is too thick for engines to get close enough to draft from a creek weir. In 2006, there was a water tender permanently parked at the intersection of Hwy 127 and Old State Highway. Although Shoshone is located within the Southern Inyo Fire Protection District, the nearest fire station is in Tecopa, about 10 miles away. Fuels surrounding this community are primarily moderate loads of sage and desert grasses, however within the community tamarisk, cattails, razor grass and other riparian vegetation is common. The topography is flat to gently sloping.

SHOSHONE RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of adding a large (10,000 to 30,000 gallon) cistern in this community. A reliable water supply for fire suppression is a critical need in Shoshone.
- Add reflective addressing to all driveways and homes.

15. Big Pine

Figure 18.

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	1, 15
Water supply:	Hydrants
Hazards:	Power lines

Description: Like Independence, Big Pine has a small urban center surrounded by wildland fuels. Most of the homes are older wood siding and asphalt roof constructions on small lots. There are also newer, larger homes and some mobile homes mixed in. Although most homes have irrigated yards, sage fuels surround Big Pine and extend into town in several areas. In these areas most of the homes need defensible space. Some homes have ornamental vegetation too close to the structure. A few homes have wood piles and other flammables too close to the structure. Roads are generally flat and of adequate width, but there are a few narrow access roads and driveways. Most homes have address markers present but few, if any, are reflective. Marker placement is inconsistent and some markers are hard to find. Big Pine is hydranted and has its own fire department. Power lines exist that may be a hazard to firefighters. Fuels are primarily moderate loads of sage and grasses with heavier loads of riparian shrubs and hard woods in the drainages. The topography is flat to gently sloping within Big Pine, but climbs steadily from the western edge of town.

BIG PINE RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs, including roofs on outbuildings, with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

16. New Wilkerson

Figure 19.

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	5
Water supply:	Cistern on Sierra Grande; water tank on Gerkin Road, hydrants

Description: Construction types in New Wilkerson vary from older mobile homes to new custom homes, but most homes are small to moderate size on small lots. Newer wood siding and asphalt roof construction will become dominant as this community is built out. There are several properties with flammable yard clutter which may be a hazard to firefighters. Many homes have irrigated lawns, but most still have ornamental vegetation too close to the structure. Roads are good and of adequate width. Most homes have some type of address marker, but few, if any, are reflective. There is one cistern with a fire department connection and an emergency water tank that may not be a permanent installation. New Wilkerson is within the Bishop Rural Fire Protection District. Fuels consist of moderate loads of short sage with ornamental plantings close to most homes. Topography is low to moderate slope.

NEW WILKERSON RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs, including outbuilding roofs, with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Wherever possible road surfaces should be improved and vegetation thinned along access roads and driveways. This is especially important for narrow driveways and road segments
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider adding additional water sources to accommodate the additional homes being built in this community.
- Consider constructing and staffing a fire station to service New Wilkerson, Old Wilkerson and Keough Hot Springs.
- Add reflective addressing to all driveways and homes.

17. Bishop

Figure 20.

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	No
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	1, 15
Water supply:	Hydrants, cisterns and dry hydrants
Hazards:	Inadequate roads, power lines, wood roofs

Description: Bishop has a significant urban center that does not have wildland fuels, but all around the edges of town homes are located in and bordering native vegetation (see **Figure 20**). In some areas pockets of sage, annual grasses and other shrubs extend deeply into residential areas. Fuel loads are moderate to heavy. This is especially true on the north and west sides of Bishop. Even in these areas fuel beds are broken by irrigated lawns, pastures and agricultural plots. A parcel-level analysis is strongly recommended to identify areas where risks to homes from wildland fire would be significantly greater than the average hazard of the total interface. In most of the interface areas lot size and construction styles vary, however small to moderate size homes on small to moderate size lots are dominant. The most common construction type is wood siding and asphalt roof, but there are also several homes with shake roofs. Some yards have flammable yard clutter and most homes need defensible space, especially homes adjacent to native fuels. There are many homes with flammable vegetation, both native and ornamental too close to the structure. Although most streets are flat and of adequate width, there are some narrow roads and driveways with vegetation encroaching. Most homes have address markers, but they are primarily non-reflective, and some are difficult to locate. Bishop Rural Fire Protection District has three fire stations and hydrant coverage is adequate in some areas for wildland fire management. Fuels are moderate loads of sage and grasses, with ornamental plantings near homes. Topography is flat to gently sloping.

BISHOP RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs, including outbuilding roofs, with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.
- Improve or establish water supply in areas with inadequate fire flow for wildfire suppression.

18. Lone Pine

Figure 21.

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	15
Water supply:	Hydrants
Hazards:	Cedar roofs, power lines

Description: Lone Pine is in a valley, but its outer edges back up to hills formed by old lava flows. Unlike Bishop or Independence, Lone Pine's urban center is quite small and does not offer much of a barrier to fire. Homes vary in size and age, but older small to moderate size homes on small lots are dominant. Construction styles are mixed, but wood siding with asphalt roofs is the most common. Most homes need defensible space and many have flammable ornamentals too close to the structure. There are several horse and ranch properties in Lone Pine, especially on the edges of town. Animal evacuation may be an issue during a wildfire event. Address markers are generally present, but few, if any, are reflective. Marker placement is inconsistent and some markers are hard to locate. Most of the access roads are flat and of adequate width, but there are some long narrow driveways with inadequate turnarounds for apparatus. Lone Pine has a fire department and hydrants. In town, fuels are primarily grass and ornamental plantings, except in drainages where riparian shrubs and hardwoods dominate. These fuels are broken by some agricultural plots and irrigated lawns. Further out, moderate to light loads of sage and desert grasses form a continuous fuel bed and persist into the lava flows. The general topography is flat to gently sloping.

LONE PINE RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs, including outbuilding roofs, with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- An animal evacuation pre-plan should be developed with the ranches and horse properties in this community.
- Add reflective addressing to all driveways and homes.

19. Rocking K

Figure 22.

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	5, 15
Water supply:	Hydrant on Running Iron
Hazards:	Limited water supply, wood roofs

Description: Rocking K is a community of moderate to large homes on moderate sized lots located west of Bishop. Typical construction is wood siding with asphalt roofs, but wood shake roofs are also common in this community. Most of the homes are of newer construction, but there are clusters of older residences. There are several residences with defensible space, but there are also some homes with flammable vegetation too close to the structure. There are also some residences with flammable yard clutter that needs to be cleaned up and moved away from the structure. Address markers are generally present, but few, if any, are reflective. Marker placement is inconsistent and some markers are hard to locate. Most of the access roads are flat and of adequate width, but there are some long narrow driveways with inadequate turnarounds for apparatus. There are several horse and ranch properties in Rocking K and animal evacuation may be an issue during a wildfire event. Rocking K is in the Bishop Fire Protection District and most of the homes are within three miles of the nearest fire station, however there is no water supply for fire suppression in this community. Several irrigated lawns and ornamental plantings break up the continuity of the fuels. Fuels are light to moderate loads of sage and grasses. The general topography is low to moderate slope.

ROCKING K RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Extended defensible space is recommended for homes located in dangerous topography (saddles, above natural chimneys, mid-slope on steep slopes or summits) with heavy fuel loads near or below the home.
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- An animal evacuation pre-plan should be developed with the ranches and horse properties in this community.
- Investigate the possibility of adding one or two large (10,000 to 30,000 gallon) cisterns. A reliable water supply for fire suppression is a critical need in Rocking K.
- Add reflective addressing to all driveways and homes.

20. Cartago

Figure 23.

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	15
Water supply:	Hydrants
Hazards:	Power lines

Description: Cartago is a mix of old and new construction, but older homes are dominant. Most of the homes are small on small lots, but some of the outlying properties are on much larger lots. There are many homes with flammable vegetation and/or flammable yard clutter too close to the structure. Address markers are generally present, but few, if any, are reflective. Marker placement is inconsistent and some markers are hard to locate. Most of the access roads are flat and of adequate width, but there are some rough dirt surfaces. This area is at the edge of a dry lake bed (Owens Lake) and fuels are characterized by sparse desert shrubs and grasses. Flammable ornamentals ignited by grass fires represent the greatest threat to homes. Cartago is at the northern edge of the Olancha CSD and fire response times may be long. This community has a good hydrant network. The topography is generally flat.

CARTAGO RECOMMENDATIONS

- A parcel-level analysis is recommended.
- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs, including outbuilding roofs, with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations. Clear flammable vegetation away from power lines near homes. Clear weeds and flammable vegetation to at least 30 feet away from propane tanks.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of improving rough/rutted sections of the dirt access roads.
- Add reflective addressing to all driveways and homes.

21. Mustang Mesa

Figure 24.

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	15
Water supply:	None
Hazards:	No water supply, not in a fire protection district

Description: Mustang Mesa is a development of approximately 90 homes northwest of Bishop. Most of the homes are newer and this area is still being built out. Construction styles vary from mobile homes to moderate sized customs, but the majority of homes are wood siding with an asphalt roof. Many homes have defensible space, but there are some with flammable vegetation growing too close to the structure. Address markers are generally present, but few, if any, are reflective. Marker placement is inconsistent and some markers are hard to locate. Roads are wide and paved and there are adequate turnarounds in most of the cul-de-sacs. Mustang Mesa is outside the Bishop Fire Protection District, but within the Bishop FPD sphere of influence. The nearest fire station is 12 miles away and response times are likely to be long. There is a Cal Fire station at the Owens Valley Conservation Camp which would respond to vegetation fires jointly with Bishop FD. There is no water for fire suppression. Fuels are light loads of desert shrubs and grasses. This area has had some small vegetation fires, mostly in winter, but in general the fire occurrence in this area has historically been low. Mustang Mesa is built on the top of a long flat mesa. Although the edges of the mesa slope away steeply, the topography near the homes is generally flat.

MUSTANG MESA RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Investigate the possibility of adding one or two large (10,000 to 30,000 gallon) cisterns in this community. A reliable water supply for fire suppression is a critical need in Mustang Mesa.
- Consider partnering with Rovana and 40 Acres to create a volunteer fire station to serve this area.
- Add reflective addressing to all driveways and homes.

22. Independence

Figure 25.

Hazard Rating	Moderate
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	15
Water supply:	Hydrants
Hazards:	Power lines

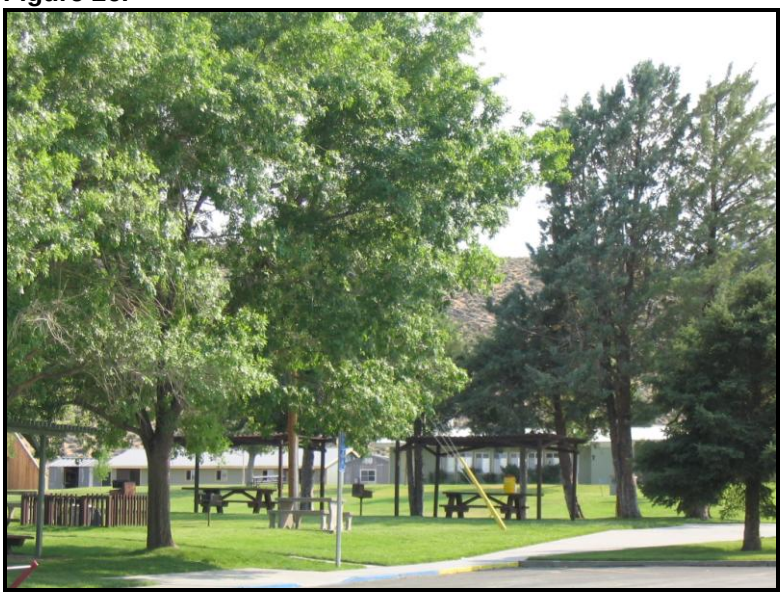
Description: Like Bishop, the town of Independence has a substantial urban core that does not have wildland fuels, however Independence is surrounded by moderate loads of sage and desert grasses that abut the residential areas. Most homes have irrigated yards, but there are some homes with flammable ornamental vegetation growing too close to the structure. Most of the homes are older wood siding constructions with asphalt or metal roofs. Homes tend to be small to moderate size on small lots. Most of the roads are wide, flat and paved. Independence has a fire department and hydrants. The nearby Fort Independence Paiute lands are more hazardous with heavier fuel loads and few, if any, defensible spaces. Topography is generally flat to gently sloping in this area.

INDEPENDENCE RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy fuels. Replace all shake roofs with non-combustible types such as metal or composite shingle.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Add reflective addressing to all driveways and homes.

23. Owens Valley Conservation Camp

Figure 26.



Hazard Rating	Low
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acre
Fuel models found in the neighborhood:	5, 15
Water supply:	Hydrants
Hazards:	Power lines

Description: This community consists of approximately 20 mobile homes housing state employees and a correctional facility with approximately 120 inmates. The correctional facility buildings are of ignition resistant construction and all of the mobile homes have defensible space. The mobile homes in the state trailer park are numbered and have good access. There is only one way in and out, but the roads are paved and of adequate width. There is a Cal Fire station here and inmates staff a hand crew. There is on-site water for fire suppression from hydrants. Fuels surrounding this area consist of light to moderate loads of sage and desert shrubs. The grounds of the correctional facility and the state trailer park are irrigated greenbelt. The general topography is low to moderate slope.

OWENS VALLEY CONSERVATION CAMP RECOMMENDATIONS

- Maintain defensible space and greenbelt.
- Keep native vegetation trimmed away from the access road.

24. Tecopa

Figure 27.

Hazard Rating	Low
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	1-5 Acres
Fuel models found in the neighborhood:	5, 15
Water supply:	Fire station in Tecopa may have on-site water
Hazards:	Inadequate water supply, power lines

Description: This community is composed of the towns of Tecopa and Tecopa Hot Springs (about three miles away). Like Shoshone, this community is located in the Amargosa Desert east of Death Valley National Park. Homes are mostly older wood siding or stucco constructions with an asphalt roof and mobile homes. Most homes are small and are on small to moderate size lots. Most homes have defensible space due primarily to light, spotty native fuels rather than any active mitigation; however there are some homes with ornamental plantings and native grasses too close to the structure. There are also some homes with flammable yard clutter. Most homes do not have a visible address marker and those that do are generally non-reflective and are randomly located. Streets and wide and flat and apparatus turnarounds are generally not a problem. Tecopa is in the Southern Inyo Fire Protection District and there is a fire station in Tecopa which may have on-site water. There are no hydrants and no other water sources for fire suppression were located. Fuels are light loads of sage and desert grasses and the fuel beds are broken by bare ground and alkali flats. The topography is generally flat.

TECOPA RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details). In Tecopa this generally requires only mowing grasses away from foundations and limbing ornamental trees within 30 feet of structures.
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Clear flammable materials in yards to a distance of at least 30 feet away from structures.
- Investigate the possibility of adding one large (10,000 to 30,000 gallon) cistern in Tecopa and one in Tecopa Hot Springs for fire suppression.
- Add reflective addressing to all driveways and homes.

25. Foothills

Figure 28.

Hazard Rating	Low
Does the neighborhood have dual access roads?	No
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	<1 Acres
Fuel models found in the neighborhood:	15
Water supply:	Hydrant; draft from creek
Hazards:	Power lines

Description: Foothills is a permanent community of mobile homes located about five miles south of Lone Pine. There are approximately 30 homes on small lots. Some homes do not have address markers. Many of the markers that do exist are hard to locate and none are reflective. There is only a single dead-end access, but it is wide and flat with an adequate turnaround for apparatus. Foothills is in the Lone Pine Fire Protection District. There is a single hydrant with a 2.5 inch fitting; however this may be adequate for the small number of homes in this community. There is also creek located near this community which has a good draft site (visible in the foreground of **Figure 28**) Fuels surrounding this community are light loads of sage and desert grasses broken by rocky terrain. Within the community grasses and other surface fuels are light and patchy, but there are ornamental plantings, including flammable conifers, located too close to structures. The topography in and surrounding this community is flat.

FOOTHILLS RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Discourage the planting of flammable ornamentals such as conifers within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Add reflective addressing to all driveways and homes.

26. Olancha

Figure 29.

Hazard Rating	Low
Does the neighborhood have dual access roads?	Yes
Are there road grades > 8%?	No
Are all access roads of adequate width?	Yes
Average lot size:	>5 Acres
Fuel models found in the neighborhood:	5, 6
Water supply:	One water tank with FDC
Hazards:	Inadequate water supply, power lines

Description: Olancha is a mix of older homes, mobile homes and ranch properties most of which are on large lots. Other than the mobile homes, the dominant construction type is wood siding with a metal or asphalt shingle roof. Many of the homes have flammable vegetation (primarily ornamental plantings) that is too close to the structure, and several have flammable yard clutter. Several properties also have flammable projections and/or outbuildings. Olancha has very poor addressing. Most homes do not have an address marker that is visible from the street and those that do are inconsistently located and generally not reflective. Most of the access roads are wide and flat and apparatus turn-around is not usually a problem, but there are some long driveways, many of which are dirt. Olancha is located within the Olancha CSD and there is an interagency fire station located in this community. Other than possible on-site water at the fire station, there is only one small water tank with a fire department connection for fire suppression. Fuels are light to moderate loads of sage and desert grasses and are broken by irrigated lawns, agricultural plots and bare earth. The topography is flat.

OLANCHA RECOMMENDATIONS

- Adequate defensible space is recommended for all homes (see **Home Mitigation** in the main report for details).
- Discourage the use of combustible materials for decks, siding and roofs.
- Open areas below decks and projections should be enclosed or screened to prevent the ingress of embers and kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.
- Clean leaf and needle litter from roofs and gutters and away from foundations.
- Remove wood piles and any flammable yard clutter to at least thirty feet from structures. Wood piles should be located uphill or even with homes, never downhill.
- Discourage the planting of flammable ornamentals within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings especially within 30 feet of homes (see **Home Mitigation** in the main report).
- Wherever possible, on driveways and private roads longer than 300 feet, add pullouts for emergency apparatus. Turnarounds should be constructed at the end of all driveways and dead-end roads.
- Consider supplementing the small water tank with one or two large (10,000 to 30,000) community cisterns.
- Add reflective addressing to all driveways and homes.

APPENDIX C: STRUCTURAL TRIAGE AND PREPARATION

Size Up Considerations

- What is the current and expected weather?
- Are fuels heavy, moderate, or light? What is the arrangement and continuity of fuels?
- Note any hazardous topography.
- What have fires in this area done before?
- What is the fire's current and expected behavior?
  - What is the rate and direction of spread?
  - What is the potential for spotting and firebrands?
  - Will topographical features or expected weather changes affect the rate of spread?
- What are the number and density of structures threatened?
- What are the available resources?
- Will you have to evacuate people or animals?
  - Are there residents who will not evacuate?
- How hazardous is the structure?
  - What is the roofing material?
  - Are the gutters full of litter?
  - Are there open eves and unscreened vents?
  - Does the structure have wooden decking?
  - Is there defensible space?
  - Are there large windows with flammable drapes or curtains?
  - What is the size and location of propane tanks and/or fuel storage tanks?

Fire Fighter Safety

- What are the routes of egress and ingress?
  - What is the largest engine that can access the structure safely?
  - Are the roads two-way or one-way?
  - Are there road grades steeper than 8%?
  - Are the road surfaces all-weather?
  - Are there load-limited bridges?
- Are there anchor points for line construction?
- Are there adequate safety zones?
- What are the escape routes?
- Are there special hazards such as hazardous materials, explosives, high-voltage lines, or above- ground fuel tanks?
- Are communications adequate?

Structural Triage Categories

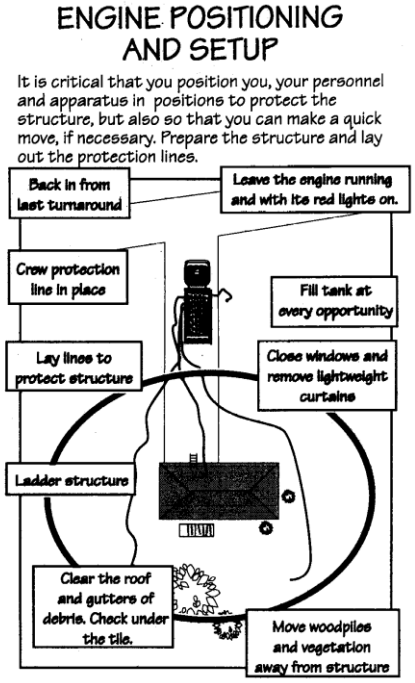
Sort structures into three categories:
1. Stand Alone or Not Threatened
2. Defendable
3. Not Defendable.

- Factors that may make an attempt to save a structure too dangerous or hopeless:
  - The fire is making sustained runs in live fuels and there is little or no defensible space
  - Spot fires are too numerous to control with existing resources
  - Water supply will be exhausted before the threat has passed
  - The roof is more than ¼ involved in flames
  - There is fire inside the structure
  - Rapid egress from the area is dangerous or may be delayed

Apparatus Placement Considerations

Common Ignition Points (remember, in windy conditions, firebrands can enter almost any opening)

- Flammable roof coverings and debris
- Unscreened vents, windows, or holes
- Open doors, windows, or crawl spaces
- Wooden decks, lawn furniture, stacked wood, and trash piles
- Openings under porches or patio covers



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[1] Teie,William C.,1995, Firefighter's Guide, Urban/Wildland Situations. Deer Valley Press

APPENDIX D: ACCESS AND WATER SUPPLY RECOMMENDATIONS

INTRODUCTION

This appendix has been designed with public education in mind, and is intended to help familiarize homeowners, contractors, and developers with the general principles of the access and water supply needs of firefighters. The recommendations in this section are based on proven practices. However, they are not meant to be a substitute for locally adopted codes.

Emergency response personnel do their best to respond to calls in a timely manner, often while negotiating difficult terrain. Planning for access by emergency equipment allows for a more efficient response, improving safety for residents and their families, as well as that of the firefighters and emergency medical technicians that will arrive on scene. This is especially important in rural areas, where response times may be considerably longer than in cities.

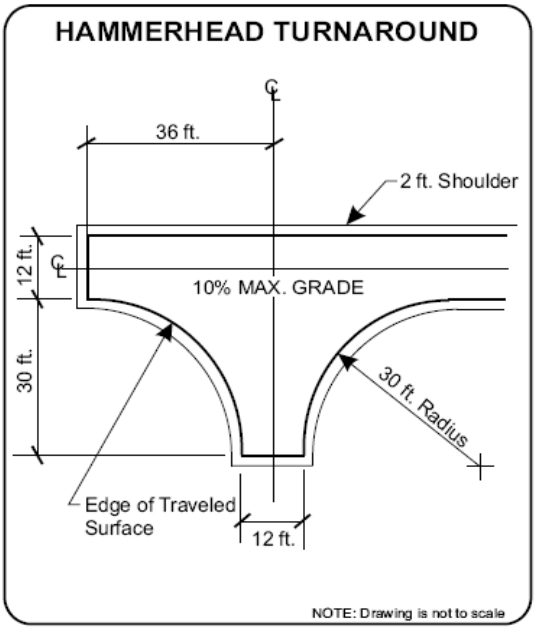
ACCESS GUIDLINES

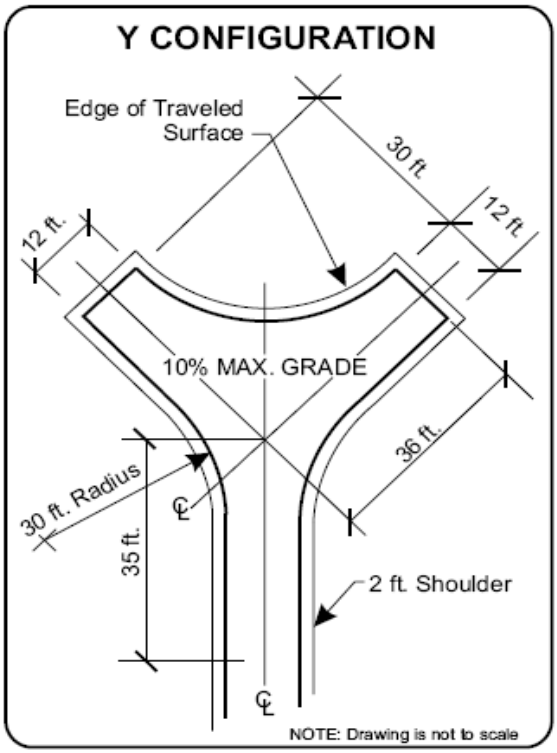
Driveway Turnarounds

Turnarounds unobstructed by parked vehicles should be located at the end of every driveway. They should be designed to allow for the safe reversal of direction by emergency equipment. The “Y” and “Hammerhead” turnarounds shown below are preferred because they provide the necessary access, while minimizing disturbance to the site.

Driveway Width and Height

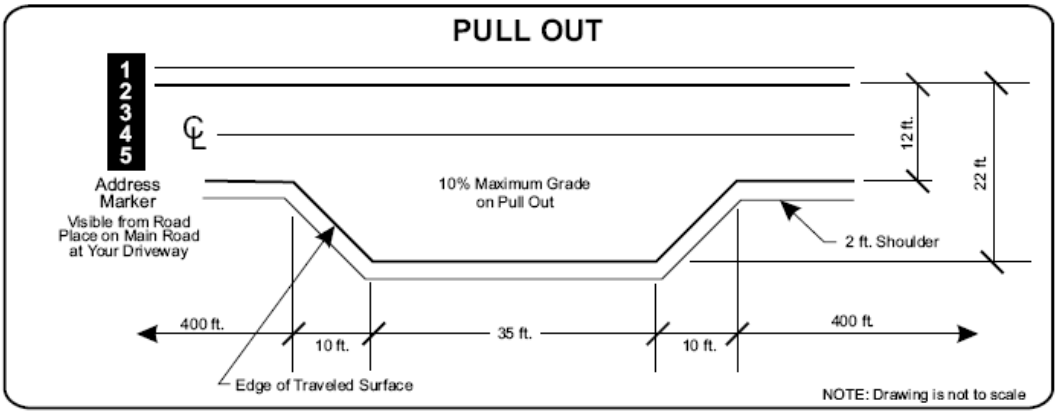
Driveways should have an unobstructed vertical clearance of 13 feet 6 inches. Trees may need to be limbed and utility lines relocated, to provide the necessary clearance. Driveways should have a 12 foot-wide drivable surface and 14 feet of horizontal clearance.





Driveway Pullouts

Driveway pullouts should be designed with sufficient length and width to allow emergency vehicles to pass one another during emergency operations. These features should be placed at 400-foot intervals along driveways and private access roads (community driveways). The location of pullouts may be modified slightly to accommodate physical barriers such as rock outcroppings, wetlands, and other natural or manmade features.



Address Markers

Every building should have a permanently posted, reflective address marker mounted on a non-combustible pole. The sign should be placed and maintained at each driveway entrance. Care should be taken to ensure that the location will not become obscured by vegetation, snow, or other features, whether natural or manmade. It is critical that the location and markings be adequate for easy night-time viewing. It is preferable to locate markers in a consistent manner within each community. A good guideline for this practice is to place the markers five feet above ground level on the right side of every driveway. Where access to multiple homes is provided by a single driveway, all addresses accessed via that driveway should be clearly listed on the driveway marker. Where multi-access driveways split, each fork should indicate all residences accessed by that fork, and the proper direction of travel to arrive at a given address. It is not adequate simply to mark addresses on a common pole in the center of the fork. Further, residential homes should have an additional reflective address marker permanently attached to the home, in clear view of the driveway or access road. Homes that are marked by lot number while under construction should have the lot number removed and a permanent address marker posted before granting a certificate of occupancy.

Bridge Load Limits

Bridge load limits should be posted with a permanently mounted, reflective marker at both entrances to the bridge. Care should be taken to ensure that these markers will not become obscured by vegetation, snow, or other features, whether natural or manmade. It is critical that the location of the markings and the markings themselves be adequate for easy night-time viewing.

APPENDIX E: DRY HYDRANT MANUAL

A Guide for Developing Alternative Water Sources for Rural Fire Protection

Dry Hydrants

Many rural areas do not have access to the pressurized hydrants for firefighting that are common in larger communities. Dry hydrants are a relatively inexpensive way to provide a ready source of water for firefighting.

A dry hydrant is a non-pressurized pipe system that allows fire equipment access to a nearby source of water such as a lake, stream, pond, residential pool, or cistern with a minimum water depth of 2 feet, or a water source such as a tank that is not directly accessible to a fire apparatus. This information is intended to offer guidance and assistance to the property owner, contractor, or developer for meeting water supply requirements for the provision of adequate water supplies for rural firefighting.

Permits

A. A review of the draft fire hydrant plans must be completed by the Fire Department having jurisdiction prior to issuing a grading permit to allow construction of a draft hydrant. A site plan review is used to determine site-specific requirements including, but not limited to, depth of pipe, required insulation materials, backfill requirements, and draft site requirement. Additionally, it may be necessary to submit information about drought conditions for the past 50 years.

B. A statement authorizing access to and use of the draft fire hydrant by the Fire Department and its agents must be signed by the owner of the property on which the draft hydrant will be located. The Fire Department having jurisdiction will be using water under the presumption of non-injury/non-consumption for fire emergency use.

Acceptance Testing

All dry hydrants are subject to acceptance testing approved by the Fire Department having jurisdiction, prior to being accepted as a water source. Acceptance testing must include GPM verification of the water source. Maintenance and testing will return water within 200 feet of its drainage.

Maintenance

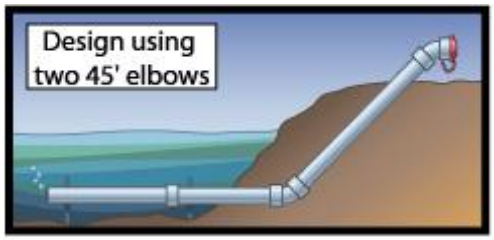
A. Draft fire hydrants require bi-annual testing and maintenance. The hydrants should be tested with a pumper. Back-flushing followed by a pumper test at a maximum designed flow rate is required, and records of each test need to be kept. Tests of this kind will not only verify that the hydrant is in proper condition, but will also ensure that the line and strainer are clear of silt, thus keeping water supply available for any fire emergency.

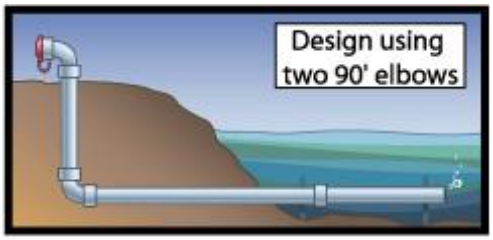
Design Requirements

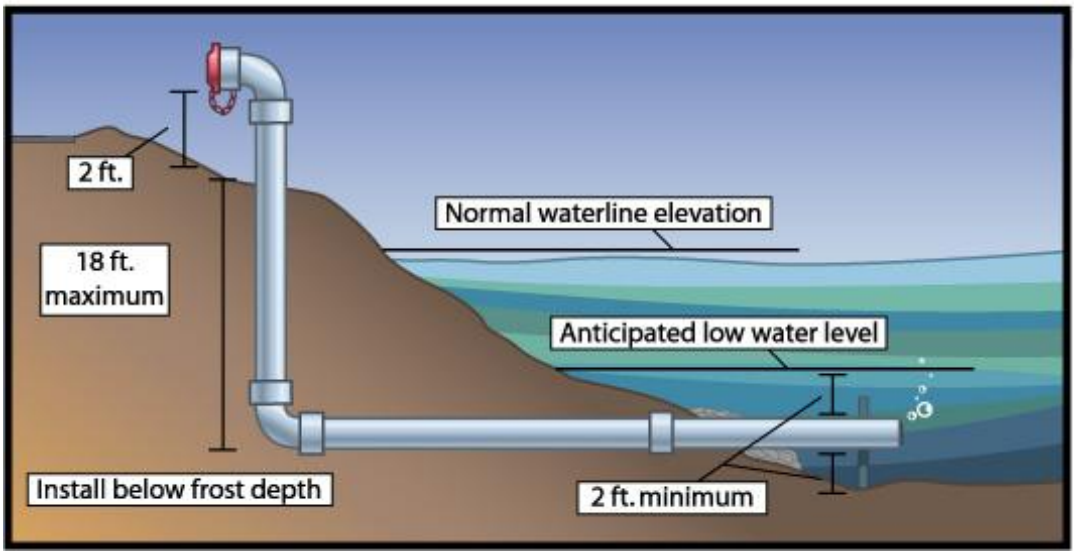
A. All dry hydrants should be located within 8 feet of a road with year-round maintenance. Access to the system must conform to local road and bridge standards.

B. All dry hydrants must have a single draft connection located no more than 30" from grade from the fire apparatus parking area. This is measured from the grade level of the roadway where the fire apparatus will be parked, to the top of the draft hydrant's threaded connection. Additionally, pipe length is determined by measuring from year-round low level of the water surface to the truck intake.

C. All dry hydrants must have a draft pipe running horizontally from the water source to the base of the riser, constructed of PVC no smaller than six inches in diameter. PVC pipe meeting AWWA specification C9000 with a SDR of 18 or more may be required through or under foundations and under driveways (schedule 80 pipe or its equivalent may be deemed necessary in some instances). All joints must be sealed to ensure that they are watertight, airtight, and root proof.







D. The piping must be placed in bedding material of ¾-inch washed or screen rock, or in native soils, providing that the native soils contain no sharp materials or stones larger than 2½ inches that may damage the piping.

E. The bedding material must be placed to a depth of 4 inches below the pipe and 6 inches above the top of the pipe.

F. The draft hydrant pipe extending from the water source to the riser pipe connection must have a minimum grade of .5% to a maximum of 2% toward the water source. (This excludes the vertical riser section immediately preceding the fire department connection).

G. All dry hydrants must have a single draft connection consisting of an approved fitting and cap. (Size and type of connection is determined by the Fire Department having jurisdiction.)

H. No more than two elbows are recommended. Elbows may be 90 or 45 degree bends.

Installation Requirements

A. The vertical, above ground sections of the dry hydrants must be painted red (using oil base paint) with reflective tape, to protect the PVC pipe from the adverse effects of sunlight and to assist in the rapid location and identification by the Fire Department.

B. All dry hydrants must be protected from damage by snowplows, motor vehicles, etc., by the installation of three steel pipes buried three feet into the ground with four feet extending above the grade level of the roadway. The entire pipe must be filled with concrete. The protective pipes must be located in a triangle configuration approximately three feet away from the draft hydrant. Steel pipes must also be painted with red oil base paint and reflective tape.

C. All dry hydrants must have a sign stating “draft hydrant” or “dry hydrant” displayed in a location acceptable to the Fire Department having jurisdiction.

Maximum Lift Considerations

Definition: Lift is determined by measuring from the lowest level of the water surface to the truck intake, which is typically 36” above grade.

Maximum vertical lift recommendations:

Elevation	Do Not Exceed
4,000 ft	13 ft
5,000 ft.	12 ft.
6,000 ft.	11 ft.
7,000 ft.	10 ft.
8,000 ft.	9 ft.
9,000 ft.	8 ft.
10,000 ft.	7 ft.

ALTERNATIVE WATER SOURCES

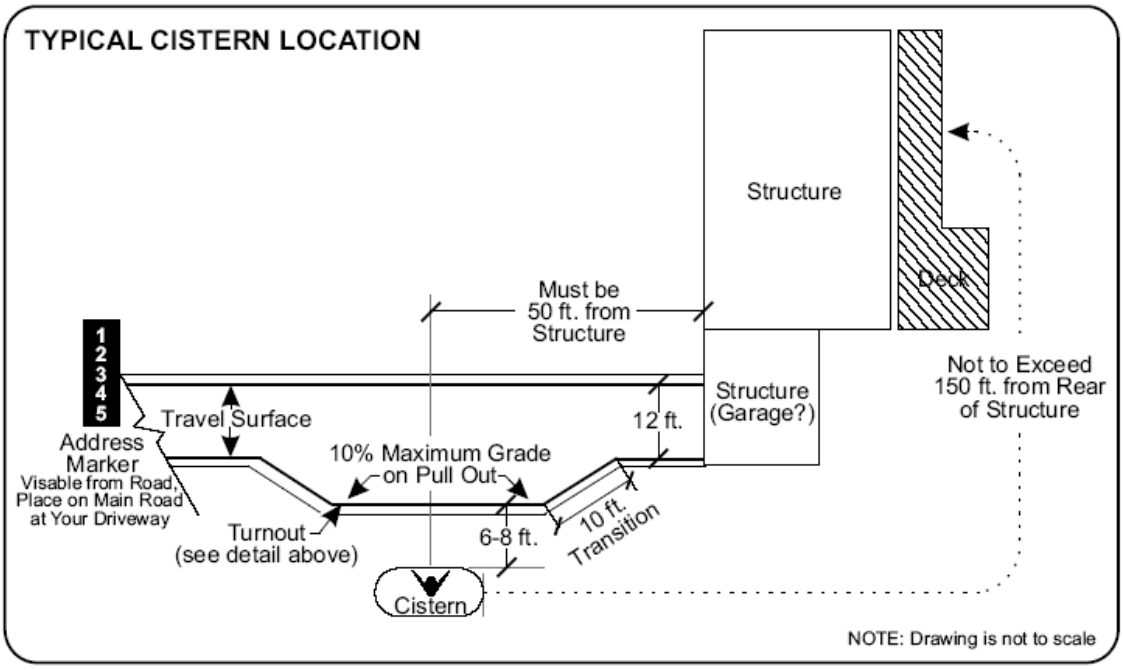
In the study area, like in many WUI areas in the west, water is a critical fire suppression issue. Although some communities in Inyo County have a good network of pressurized hydrants, the hazard assessment revealed several communities in the study area which are a considerable distance from reliable water sources for fire suppression. The following information on the use of cisterns and dry hydrant installations has been included to provide information regarding supplementing existing pressurized hydrants, cisterns and natural water sources. It is not intended to be a replacement for existing water supplies.

CISTERNS

Once emergency vehicles have arrived on site, they will need a dependable supply of water to help control the fire. Although residential wells with outdoor taps can be used by fire crews to help fill engine tanks, they are not adequate for fire control. If the property is a significant distance from a reliable water supply or fire station, it may be advisable to employ one of the following water supply options:

- An on-site 1,800 - 2,500 gallon cistern for each residence.
- A monetary contribution to a large community cistern fund.

For more information about local standards and regulations, please contact your local fire department.



APPENDIX F
INYO COUNTY CWPP COLLABORATIVE EFFORT

THE NEED FOR A CWPP

In response to the Healthy Forest Restoration Act (HFRA), and in an effort to create incentives, Congress directed interface communities to prepare a Community Wildfire Protection Plan (CWPP). Once completed, a CWPP provides statutory incentives for the federal agencies to consider the priorities of local communities as they develop, and implement forest management and hazardous fuel reduction projects.

CWPPs can take a variety of forms, based on the needs of the people involved in their development. CWPPs may address issues such as wildfire response, hazard mitigation, community preparedness, structure protection, or all of the above.

The minimum requirements for a CWPP are:

- Collaboration between local and state government representatives, in consultation with federal agencies and other interested parties.
    - Addressed in this appendix
- Prioritized fuel reduction in identified areas, as well as recommendations for the type and methods of treatments
    - Addressed in Main CWPP report (see recommendations sections)
- Recommendations and treatment measures for homeowners and communities to reduce the ignitability of those structures in the project area.
    - Addressed in Appendix B of this CWPP

INTER-AGENCY COLLABORATION

Roles and Responsibilities

To be successful, wildfire mitigation in the interface must be a community-based, collaborative effort. Stakeholders and, primarily, Inyo County and the local Fire Safe Councils, will have the greatest responsibility for implementing the recommended mitigation projects. Cal Fire and the USFS/BLM will be valuable participants in addressing cross-boundary projects throughout the area.

Nearly all of the recommendations from this report affect private land or access roads to private land. There are also mitigation recommendations for individual structures, which are the responsibility of the homeowner. Homeowners will, however, need a point of contact to help them implement these recommendations. The best defensible space will be created with oversight and expert advice from the fire department and/or government forestry personnel. One-on-one dialog will continue to build the relationship with community members. This level of involvement will allow agencies to keep track of the progress and update this plan to reflect the latest modifications at the community level.

THE COLLABORATIVE PROCESS

"The initial step in developing a CWPP should be the formation of an operating group with representation from local government, local fire authorities, and the state agency responsible for forest management. (…) Once convened, members of the core team should engage local representatives… to begin sharing perspectives, priorities, and other information relevant to the planning process."[1]

Numerous federal, State, local, and private agencies (stakeholders) participated in this CWPP. These stakeholders included:

- Inyo County residents including:
  - Tony Phillips Alpine FD (Aspendel Track 2)
  - Robin Conners Swall Meadows
  - Steve Silcott Fire Leader So Fork Bishop Crk
  - Don Leavitt President Eastern Sierra Fire Safe Council
  - Wayne Winch Financial Director Eastern Sierra Fire Safe Council
  - Dan Totheroh, Starlite Estates
- Inyo County communities including:
  - Starlite Estates
  - Bishop Creek
  - Mustang Mesa
  - Round Valley
- Aspendel FD - Ken Kuencer/Lew McConnell
- Swall Meadows FD - Dale Schmidt
- Bishop Fire Protection District
- Inyo County Supervisors
- California Department of Fire (Cal Fire)
- Bureau of Land Management
- United States Forest Service
- Anchor Point Group

The true collaborative process was initiated through a stakeholder meeting held in June, 2005. The purpose of the meetings was to bring all past, current, and future efforts and needs to the table. The primary focus was on the identification and delineation of communities, areas of concern, and Values at Risk. Best practices and anticipated "roadblocks" were identified.

A second round of stakeholder meetings was held in January of 2009 to present the results and discuss any issues or concerns with the draft report.

In addition public meetings were held to get input and feedback from residents.

[1] A handbook for Wildland-Urban Interface Communities March 2004, http://www.safnet.org/policyandpress/cwpphandbook.pdf

There was support for the projects and interest in convening community meetings to start the process. Comments were incorporated into the final document.

FUNDING CWPP RECOMMENDATIONS

There are many sources of funds available for implementing the recommendations within the CWPP. Some available grants and websites where more information can be found are provided below.

- **Agency: Homeland Security, Office for Domestic Preparedness**
  - Purpose: to assist local, state, regional, or national organizations in addressing fire prevention and safety. The emphasis for these grants is the prevention of fire-related injuries to children.
  - More information: http://www.firegrantsupport.com/

- **Agency: Federal Emergency Management Agency (FEMA)**
  - Purpose: to improve firefighting operations, purchase firefighting vehicles, equipment, and personal protective equipment, fund fire prevention programs, and establish wellness and fitness programs.
  - More information: http://usfa.fema.gov/dhtml/inside-usfa/grants.cfm

- **Agency: National Volunteer Fire Council**
  - Purpose: to support volunteer fire departments
  - More information: http://www.nvfc.org/federalfunding.html

- **Agency: Community Facilities Grant Program**
  - Purpose: to help rural communities. Funding is provided for fire stations
  - More information: www.rurdev.usda.gov/rhs/

- **Agency: Firehouse.com**
  - Purpose: emergency services grants
  - More information: www.firehouse.com/funding/grants.html

- **Agency: 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
  - More information: www.usfa.fema.gov/dhtml/inside-usfa/cfda10664.html

- **Agency: Forest Service, Economic Action Programs**
  - Purpose: Economic Action Programs that work with local communities to identify, develop, and expand economic opportunities related to traditionally underutilized wood products and to expand the utilization of wood removed through hazardous fuel reduction treatments.
  - More information: www.fireplan.gov/community_assist.cfm

- **Agency: FEMA**
  - Purpose: Assistance to Firefighters Grant Program
  - More information: www.usfa.fema.gov/dhtml/inside-usfa/apply.cfm and www.nvfc.org/federalfunding.html