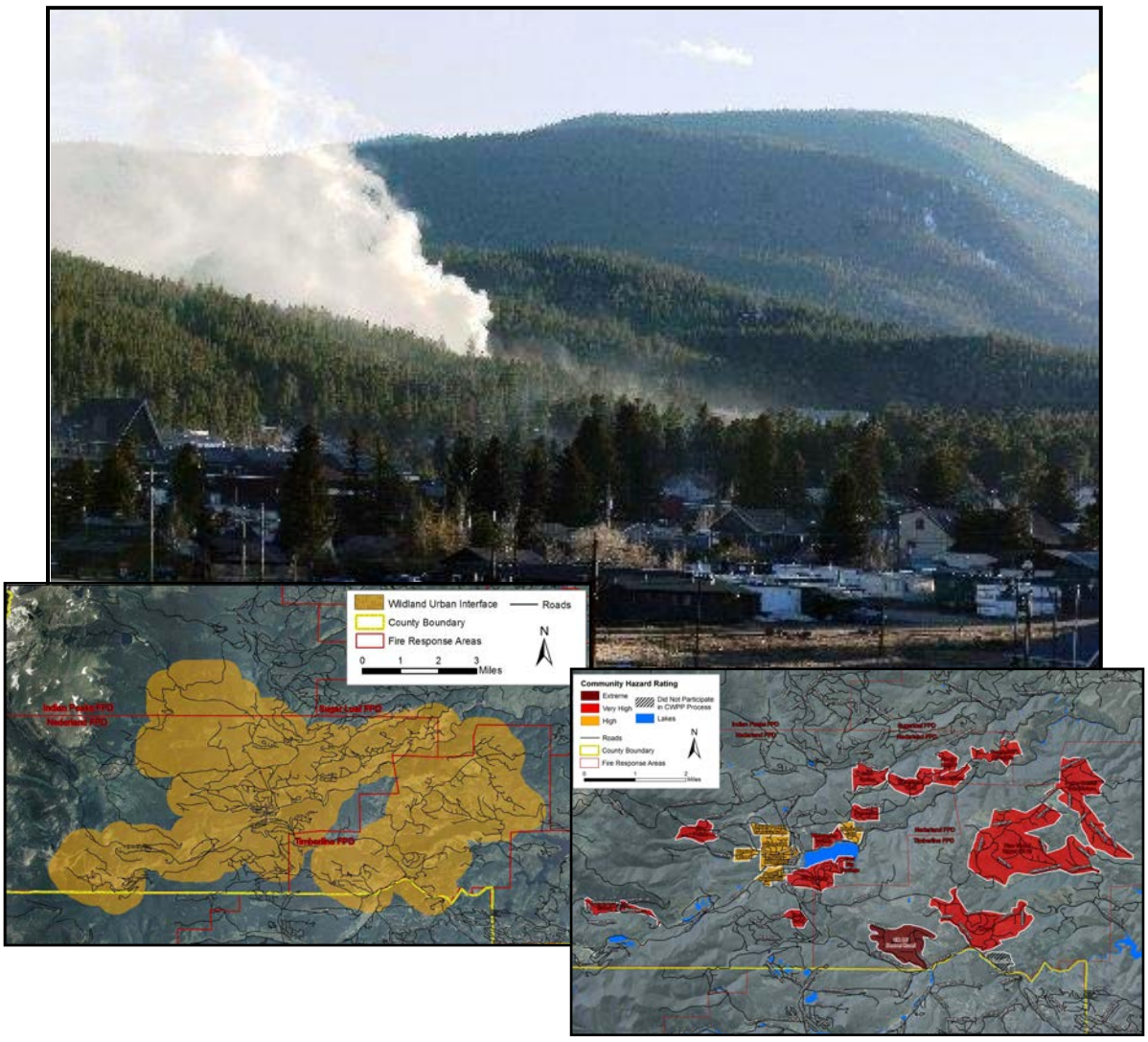
NEDERLAND FIRE PROTECTION DISTRICT

COMMUNITY WILDFIRE PROTECTION PLAN



Prepared for:
Nederland Fire Protection District and
Timberline Fire Protection District
Nederland, Colorado

Submitted by:
Anchor Point Group
Boulder, Colorado
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EXECUTIVE SUMMARY

This document provides a comprehensive analysis of wildfire related hazards and risks in the Wildland-Urban Interface (WUI) areas of the Nederland Fire Protection District (NFPD) and along upper Magnolia Road, which is covered by Timberline Fire Protection District (TFPD). The analysis is delivered in the form of a Community Wildfire Protection Plan (CWPP), which strives to follow standards for CWPPs established by the Healthy Forests Restoration Act (HFRA).

This report complements local agreements and existing plans for wildfire protection to aid in implementing a seamless, coordinated effort in determining appropriate fire management actions in the study area. The NFPD CWPP is a guiding document that will facilitate the implementation of future mitigation efforts.

The CWPP is the result of a district-wide fire protection planning effort that includes extensive field data, a compilation of existing documents, scientific analysis of the fire behavior potential of the study area (based on fuels, topography and historical weather conditions), and collaboration with homeowners and officials from several agencies, including the NFPD, TFPD, USDA Forest Service (USFS), Colorado State Forest Service (CSFS), Indian Peaks Forest Alliance, Boulder County and various representatives from local communities.

This CWPP provides a comprehensive assessment of the wildfire hazards and risks in the study area. Its goal is to reduce hazards through increased education about wildfires, hazardous fuels reduction and improved levels of fire suppression response. Detailed recommendations for specific actions that will aid stakeholders in preventing and/or reducing the threat of wildfire are included herein. It is important to note that this CWPP is a working document, and as such, will need to be updated annually, and/or after a major “event” such as wildfire, flood, insect infestation or even significant new home development.

TAKE HOME MESSAGE

The CWPP and associated appendices provide an overview of the Values at Risk on which a significant wildfire would have an impact. These values include: life safety, homes and property values, infrastructure, recreation and lifestyle, and especially environmental resources.

Within the study area, the overall fire risk is high. Light, flashy fuels on south-facing slopes may ignite easily and spread quickly. North-facing slopes, as found in communities such as Big Springs are wetter but have higher fuel loads. While not as easily ignitable as south slopes, if the north slopes were to burn, the fire behavior is expected to be extreme. Suppression activities would be significantly more difficult than in other areas. The high density of homes in much of the study area increases the probability of structure-to-structure ignition, and hence, multiple structures are likely to be lost. Projects can be prioritized by community/planning area hazard rating, the probability of getting community involvement to accomplish the project, or ease of a project. It is up to the stakeholder group to give priority ratings to the projects, establish a community representative and work with that person to accomplish the project.

Recommendations in the report address five broad categories: public education, structural ignitability/defensible space, water supply, access/evacuation, and street and home addressing. While many of the recommendations are general in nature, specific recommendations regarding landscape-scale fuels treatments are in the Community Descriptions section of the report. As a result of the extensive work that has already been initiated in the county, the fuels reduction recommendations include continuing and maintaining the projects that have already been started. Other recommendations in this CWPP should be brought to the local community for involvement with the project to ensure that the project is valuable and viable for the area. Additional fuels reduction projects are also encouraged, especially as previous recommendations are completed.

HOW TO USE THIS DOCUMENT

The main CWPP document provides much of the pertinent information for communities. A general narrative of the Healthy Forests Restoration Act and the background for CWPPs is discussed first, followed by information more specific to Nederland. This includes an analysis of fire department capabilities and specific community write-ups. Each set of community write-up pages can be regarded as an individual document. These pages can be delivered to a community independently of the overall document. As a result, specific recommendations for each community are listed first, followed by recommendations that apply to all communities, such as defensible space. With this format, each community has all the pertinent information available in three to four pages, separate of the overall document. Combined with Appendix A, an individual or community should have the information necessary to begin working.

Because much of the information contained in the report is extensive and/or technical in nature, detailed discussions of certain elements are contained in the following appendices:

Appendix A: Solutions and Mitigation
Appendix A gives both general and specific recommendations. General defensible space guidelines, which are applicable for every property, are described at length. Public education recommendations are also found in this appendix.

Appendix B: Project Collaboration
One of the main requirements of the HFRA is to assure community participation. Public collaboration was achieved through meetings, an online survey for residents and an opportunity to comment on the draft report. A summary of the collaborative process undertaken for this project is found here.

Appendix C: Fire Behavior Methodology
The purpose of this appendix 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 potential fire behavior potential.

While the graphics provide general information regarding the overall hazard and risk rating for specific communities, they are not adequate to describe fully the specific information that went towards forming the rating. At a minimum, it is necessary to review the individual community write-ups and recommendations near the end of the document. The rating alone may not capture the mitigation needs of the community. As an example, some communities may have a low or moderate rating, but may have a few specific areas that require attention. True understanding can only be captured by reading the accompanying text, in addition to looking at the graphics.

A CWPP is a living document; it should change based on the needs of the communities as projects are completed or additional projects are added. It is recommended that the stakeholder group involve the communities to identify projects and implement the CWPP.

INTRODUCTION

The NFPD CWPP is the result of a community-wide planning effort that included extensive field data gathering, compilation of existing documents and GIS data, and 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 that will be valuable to residents, policy makers and public agencies throughout Boulder County, Colorado. Participants in this project include Nederland Fire Protection District, USFS, CSFS, Indian Peaks Forest Alliance and Boulder County.

The assessment portion of this document estimates the hazards and risks associated with wildland fire in proximity to WUI areas. This information, in conjunction with identification of the Values at Risk (page 8), defines areas of special interest 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 planning efforts.

Wildfire hazard data is derived both from the 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. This approach is designed to make the plan more readable while establishing a reference source for those interested in the technical elements of the Nederland 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 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.

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

This document has the following primary purposes:

- Provide a comprehensive, scientifically-based analysis of wildfire-related hazards and risks in the WUI and areas of special interest within the NFPD response area.
- Using the results of the analysis, generate recommendations designed to prevent and/or reduce the damage associated with wildfire to values in the study area.
- Create a CWPP document that conforms to standards for CWPPs established by HFRA.

THE NATIONAL FIRE PLAN AND THE HEALTHY FORESTS RESTORATION ACT

In 2000, more than 8 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, N.M., destroyed more than 235 structures and threatened the U.S. 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 U.S. 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. Another severe fire season ensued in 2002: more than 1,200 homes were destroyed and more than 7 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 Healthy Forests Initiative, which enhanced measures to restore forest and rangeland health and reduce the risk of catastrophic wildfires. In 2003, the Healthy Forests Restoration Act was signed into law.

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

This CWPP strives to meet the requirements of the HFRA by:

- Identifying and prioritizing fuels reduction opportunities across the landscape
- Addressing structural ignitability
- Assessing community fire-suppression capabilities
- Collaborating with stakeholders

GOALS AND OBJECTIVES

Goals for this project include the following:

- Enhance life safety for residents and responders
- Mitigate undesirable fire outcomes to property and infrastructure
- Identify Communities at Risk and Values at Risk
    - Reduce fuel hazards and prevent fires in these communities
        - Consider fuels treatment prescriptions and locations
        - Continue fuels treatment projects already initiated
- Mitigate undesirable fire outcomes to the environment, watersheds and quality of life
- Improve the district's position as it competes for grants

To accomplish these goals, the following objectives have been identified:

- Establish an approximate level of risk (the likelihood of a significant wildfire event in the study area)
- Provide a scientific analysis of the fire behavior potential of the study area.
- Group Values at Risk into areas that represent relatively similar hazard factors
- Identify and quantify factors that limit (mitigate) undesirable fire effects on the Values at Risk (hazard levels)
- Recommend specific actions that will reduce hazards to the Values at Risk

Other Desired Outcomes

1. Promote community awareness:

   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. Improve wildfire prevention through education:

   Community awareness, combined with education, will help to reduce the risk of unplanned human ignitions. This type of education can also limit injury, property loss, and even unnecessary death.

3. Facilitate and prioritize appropriate hazardous fuel reductions:

   Organizing and prioritizing hazard mitigation actions will provide stakeholders with the tools and understanding to bring to these projects to ensure that they are valuable and viable for the local community.

4. Promote improved levels of response:

   The identification of specific community planning areas and their associated hazard and risk rating will improve the focus and accuracy of pre-planning and facilitate the implementation of cross-boundary, multi-jurisdictional projects.

COLLABORATION: COMMUNITY AND AGENCIES

The names of the representatives involved in the development of the Nederland FPD CWPP are included in the table below, along with their organizations and various roles and responsibilities, both currently and in the future. For more information on the collaborative process, see *Appendix B*, *Nederland FPD CWPP Collaborative Effort*.

Name	Organization	Roles / Responsibilities
Rick Dirr, Chief	Nederland Fire Protection District	Initiate stakeholder group; point of contact during the CWPP process
Ryan Roberts, Chief Galen Koepke John Carder Randy Ralphs Dave Hitchcock	Timberline Fire Protection District	Local information and expertise, including community risk and value assessment; development of community protection priorities and action plan, including establishment of fuels treatment project areas and methods; approval of CWPP minimum standards
Allen Owen Bob Bundy	CSFS	Facilitation of planning process and approval of CWPP minimum standards
Barry Bennett Rick Dirr Marca Hagenstad Lex Ivey Ryan Ludlow Keith Nowicki Mikki Osterloo	Indian Peaks Forest Alliance	Local information; verification of field work; assistance in developing treatment priorities
Chris White, Urban Interface Specialist Rod Moraga, Fire Behavior Analyst Kerry Malm, WUI Program Specialist Matt Lloyd, Forestry/Fire Technician Mark McLean, GIS Project Manager	Anchor Point Group	Development of the CWPP; decision-making; Community Risk and Value Assessment; development of community protection priorities; establishment of fuels treatment project areas and methods

Table 1. CWPP Development Team

Indian Peaks Forest Alliance (IPFA) is the only non-governmental group involved with the NFPD CWPP. From the group's website (www.indianpeaksforest.org/), IPFA is:

A nonprofit organization that promotes forest ecosystem health and safe communities in the Nederland/Indian Peaks region of Colorado.

- IPFA's primary goals are to:
  - Encourage natural ecosystem structures, function and composition of forests
  - Manage forest fuels to reduce the probability of catastrophic fire
  - Develop and demonstrate key ecological, economic and social dimensions of forestry health efforts

STUDY AREA OVERVIEW

Nederland is a statutory town located 17 miles west of Boulder and the urban expanse of the Colorado Front Range. Situated at an elevation of 8,200 feet, this mountain community exhibits the typical rural sprawl akin to many other Colorado mountain communities. The population of Nederland is approximately 1,445 people, though many residents who associate themselves with the town live beyond the town limits. Like many small towns scattered throughout the Colorado mountains, Nederland began first as a trading post and later as a promising cluster of mining camps.[1] Despite several mining booms and busts, the Nederland area never became a ghost town. Today, Nederland is a popular tourist destination and self-contained community. Additional development throughout the study area has occurred over the years, as new homes and businesses have been built to accommodate growth. Other destinations in the area include the nearby Indian Peaks Wilderness, Arapaho-Roosevelt National Forest, multiple Boulder County Open Space properties, Rocky Mountain National Park and the Eldora Mountain Resort ski area.[2]

For the purposes of this project, 18 communities were identified in the NFPD, and 5 were identified along Magnolia Road within the TFPD response area, resulting in 23 in all. These communities represent the most densely populated areas of the study area. Each community exhibits 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 hazards, both natural and manmade, are considered in the overall hazard ranking of these communities.

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 the promotion of extreme fire behavior.

The community-level assessment for the entire study area has identified 16 of the 23 communities in the study area as being at extreme or very high risk. In these communities, a parcel-level analysis should be implemented as soon as possible to ensure the ongoing safety of residents and survivability of structures. Please refer to the graphics on the following pages for a color-coded hazard ranking reference.

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. The WHR model combines physical infrastructure such as structure density and roads, and fire behavior components such as fuels and topography, with the field experience and knowledge of wildland fire experts.

In addition to these 23 communities, 13 “areas of special interest” (ASIs) have been identified: Arapaho Ranch, Barker Reservoir, the Boulder Valley School District bus depot, Caribou Ranch – Guercio property, Caribou Ranch Open Space, a new cellular phone tower, Boulder County Transportation Department infrastructure, Eldora Mountain Resort ski area, Mud Lake Open Space, Nederland Middle-Senior High School, the Nederland Water Treatment Plant, USDA Forest Service Work Station, and the Silver Lake Watershed/hydro plant, all

[1] “Nederland, Colorado,” 2010, <http://en.wikipedia.org/wiki/Nederland,_Colorado> (accessed Nov. 9, 2010).
[2] Eldora Survey 2007-08. Historitecture LLC. <www.historitecture.com/projects/eldora.html> (accessed Dec.3 23, 2010).

indicated in gray on Figure 58. Although these areas may not include residences, they contain critical infrastructure, buildings and/or other structures that necessitate serious attention from a fire mitigation standpoint.

DEFINING THE WILDLAND URBAN INTERFACE

For the purpose of this CWPP, the entire NFPD response area, including a 1-mile buffer outside of the area is defined as wildland urban interface. For TFPD, which also includes land in Gilpin County, a half-mile buffer surrounding the communities and areas of special interest is defined as wildland urban interface.

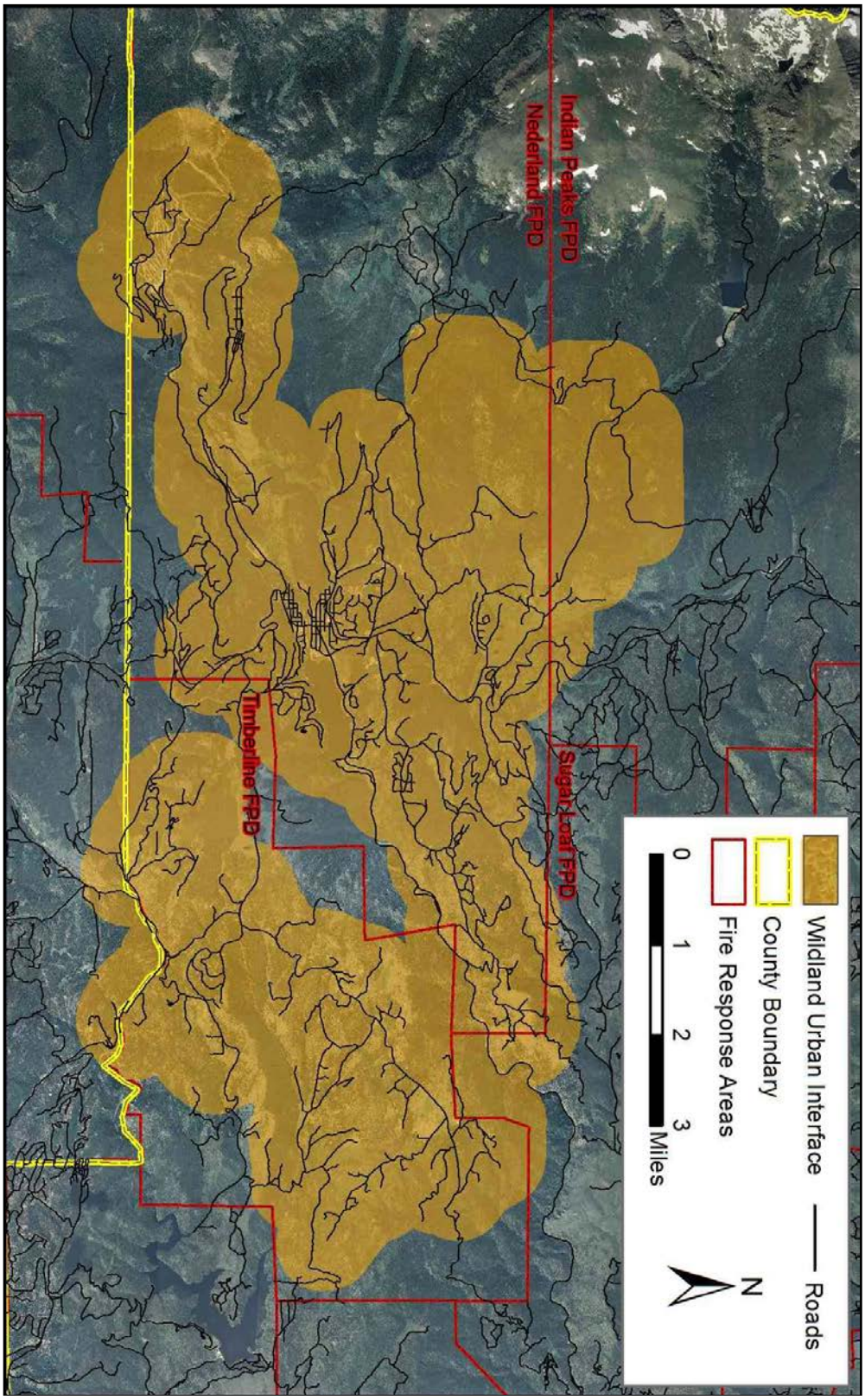


Figure 1. Area defined as "wildland-urban interface" for Nederland Fire Protection District and upper Magnolia Road area.

VALUES AT RISK

LIFE SAFETY AND HOMES

Nederland is a typical mountain community on the Front Range. Little additional building is ongoing, as the town is surrounded by open space, wilderness and Forest Service property. There are approximately 750 housing units as of the 2010 census, 657 of which are currently occupied.

The risk of fire to the community stems from several different sources, including people recreating in the adjacent national forest, structure fires transitioning into the forest surrounding the homes, and natural causes such as lightning.

Although fires occurring in the study area are uncommon, when one occurs, it is likely to be under extreme weather conditions. As a result, a wildfire would likely impact homes and other structures. There is a likelihood of rapid increases in fire intensity and spread within some of the communities due to dense fuels, large quantities of ember-cast and other topographic features that contribute to channeling winds and promotion of extreme fire behavior. These areas may also represent a serious threat to life safety due to difficult access and the likelihood of heavy smoke, heat and/or long response times from suppression resources.

Most of Nederland is vulnerable to some form of natural disturbance, and wildland fire is one of the main concerns; it is an issue that officials and residents should be aware of. Recent national disaster events have focused increased attention at both local and state government levels on the need to mitigate such events where possible, and to prepare to cope with them when unavoidable.

COMMERCE AND INFRASTRUCTURE

Economic Values

Tourism is an important part of Nederland's economy, with more than 67% of jobs in the area involved in the service and retail industries. Owing to its location, the town receives a large portion of the annual area tourist traffic, which includes more than 6 million visitors to the nearby Arapaho-Roosevelt National Forest, more than 200,000 visitors to the Eldora ski resort and almost 2 million vehicles traveling the Peak-to-Peak Highway. In addition to tourism, the town services a population of more than 5,000 people who visit weekly for goods and services. Large employers in Nederland include the Boulder Valley School District, Eldora Mountain Resort, the Town of Nederland, TESCO and the USDA Forest Service. Nederland also has a relatively large portion of residents who work from home, which is estimated at over 20% of the population.[3]

Critical Infrastructure

The Nederland community study area has a mix of private and public lands. Aside from the obvious negative impacts to tourism from wildfire, there is additional infrastructure within the community that could be adversely affected. Barker Reservoir serves as both a source of hydroelectric energy and provides up to 40% of the drinking water for the City of Boulder. Ash and associated runoff from a wildfire could reduce water quality and impact energy production. Other important sources of infrastructure include the Silver Lake Pipeline, Nederland's water treatment plant, an abundance of power lines, and transportation systems that include Regional

[3]"Nederland Area Market Analysis and Action Plan," 2004, www.town.nederland.co.us/webfm_send/686, (accessed Nov. 9, 2010).

Transportation District service sites, roads and highways, and an assortment of trails. The impact of wildfire to infrastructure within the study area must be a consideration for wildfire prevention and planning.

Within TFPD, there is a main gas line that runs along Magnolia Road. In general, gas lines are not considered to be at risk from wildfire but do constitute an exposure during work/repair times. Firefighting equipment should be readily available near all welding operations. When welding, cutting or other hot work is performed in locations where anything other than a minor fire might develop, a person should be designated as a fire watch. The area surrounding the work should be inspected at least one hour after the hot work is completed. In addition, increased human activity and public access could result in a higher potential for wildfires in the vicinity of the line.

Railroads are a known source of ignition within the area. Sparks from the wheels or improperly maintained turbo chargers easily ignite fine flashy fuels along the sides of the tracks. Tracks run east-west, directly along the communities of Pinecliffe, Lazy Z and CR99/Beaver Road. The railroad line is south of the NFPD boundary within Gilpin County. Mowing along the railroad lines is imperative to reduce the risk of fire spreading into the communities.

ENVIRONMENTAL RESOURCES

Watershed and River Concerns

The Nederland study area lies within the Boulder Creek Watershed, which is a part of the larger South Platte Watershed. Tributaries of Boulder Creek include Middle Boulder Creek and Sherwood Creek, both of which lie within the study area. Stream flow starts off primarily as high-elevation snowmelt, so discharge varies seasonally depending on snowpack depth and sustained air temperatures. In order to protect water quality and supply, the City of Boulder owns and prohibits entry to nearly 8,000 acres in the headwaters of North Boulder Creek. Moreover, the adjacent Indian Peaks Wilderness Area is off-limits to all motorized equipment. The Town of Nederland is situated near the top of the watershed geographically, so minimizing impacts to stream and creek corridors is vital to ensuring appropriate water yields and quality for downstream users. As noted in the Middle Boulder Creek Water Source Management Plan, wildfires can cause substantial erosion, thereby impacting aquatic and terrestrial life, creating filter clogging problems at water treatment plants and potentially shutting down hydroelectric power generation.[4]

The South Boulder Creek drainage begins along the Continental Divide from James Peak to near Corona Pass. Approximately 30% of the entire Boulder Creek Watershed is contained in this drainage. The Creek flows into Gross Reservoir, where some water is stored as Denver's drinking water. South Boulder Creek continues from Gross Reservoir through Eldorado Canyon State Park.[5]

Vegetation associated with riparian areas present in the watershed provide valuable habitat for mammals, fishes, amphibians, reptiles and birds. The native greenback cutthroat trout *(Oncorrhyncus clarki stomias)*, a federally listed threatened species, is found within the watershed area. Additionally, there are 13 avian Species of Special Concern and several threatened mammal species, including lynx *(Felis canadensis)* and the state-listed endangered

[4] Murphy, Sheila F. 2006. State of the Watershed: Water Quality of Boulder Creek, Colorado. USGS Circular 1284.
[5] http://bcn.boulder.co.us/basin/watershed/southboulder.html

wolverine *(Gulo gulo)*. Indirect impacts to watershed ecosystems associated with wildfire include the use of retardants and soil damage from fire apparatus. Taking action to prevent wildfire in these areas is critical for maintaining biodiversity and ecosystem function.[6]

CURRENT RISK SITUATION

Within Boulder County, the Town of Nederland is listed in the Federal Register as a community in the vicinity of federal lands at risk from wildfire.[7]

The surrounding federal lands report an active, but far from extreme, fire history. Fire occurrences for the Boulder Ranger District of the Arapaho-Roosevelt National Forest (See

Fig. 2 below) were calculated from the USDA Forest Service Personal Computer Historical Archive for the 39-year period from 1970-2009. These areas represent federal lands adjacent to and within the study area but do not include any data from state, country or private lands. The data have been processed and graphed using the Fire Family Plus software program and are summarized below.
The upper left section of Figure 2 shows the number of fires (red bars) and the total acres burned (blue hatched bars) in the Boulder Ranger District for each year. While the number of annual fires ranges from approximately 5 to more than 30 per year, there is little year-to-year pattern to the variation. Between 1969 and 2009, there were three fires that burned more than 100 acres in the ranger district. The total number of acres burned was greatest in 1988, when two large fires accounted for 3,922 acres burned. That same year also had the highest number of fires in the Boulder Ranger District during the study period. A portion of the Black Tiger Fire burned 1,804 acres in the Boulder Ranger District in 1989.

Starting September 7, 2010, the Four Mile Canyon Fire burned 6,182 acres. While this fire did not burn within the study area, it did reach within several miles of Comforter Mountain and extended into the Roosevelt National Forest. The fire was the most destructive in Colorado's history, destroying 166 homes. Residents were evacuated to Nederland and members of the Nederland Fire Department responded to the fire.

The graphic in the upper right shows the percentage and number of fires between 1970 and 2009 occurring in each month. Historically, July has had the greatest number of fires, followed by August and June. The fewest fires occurred between the months of November and April, a fact that reflects seasonal weather conditions for the area. Autumn and winter fires within the ranger district have occurred infrequently. Fires outside of the summer months are typically wind driven and can have rapid rates of spread.

The bottom left section of Figure 2 shows the size class distribution of fires. Approximately 73% of the reported fires were less than 10 acres in size. These statistics reflect the widely held opinion that throughout the Western United States, the vast majority of fires are controlled during initial attack.

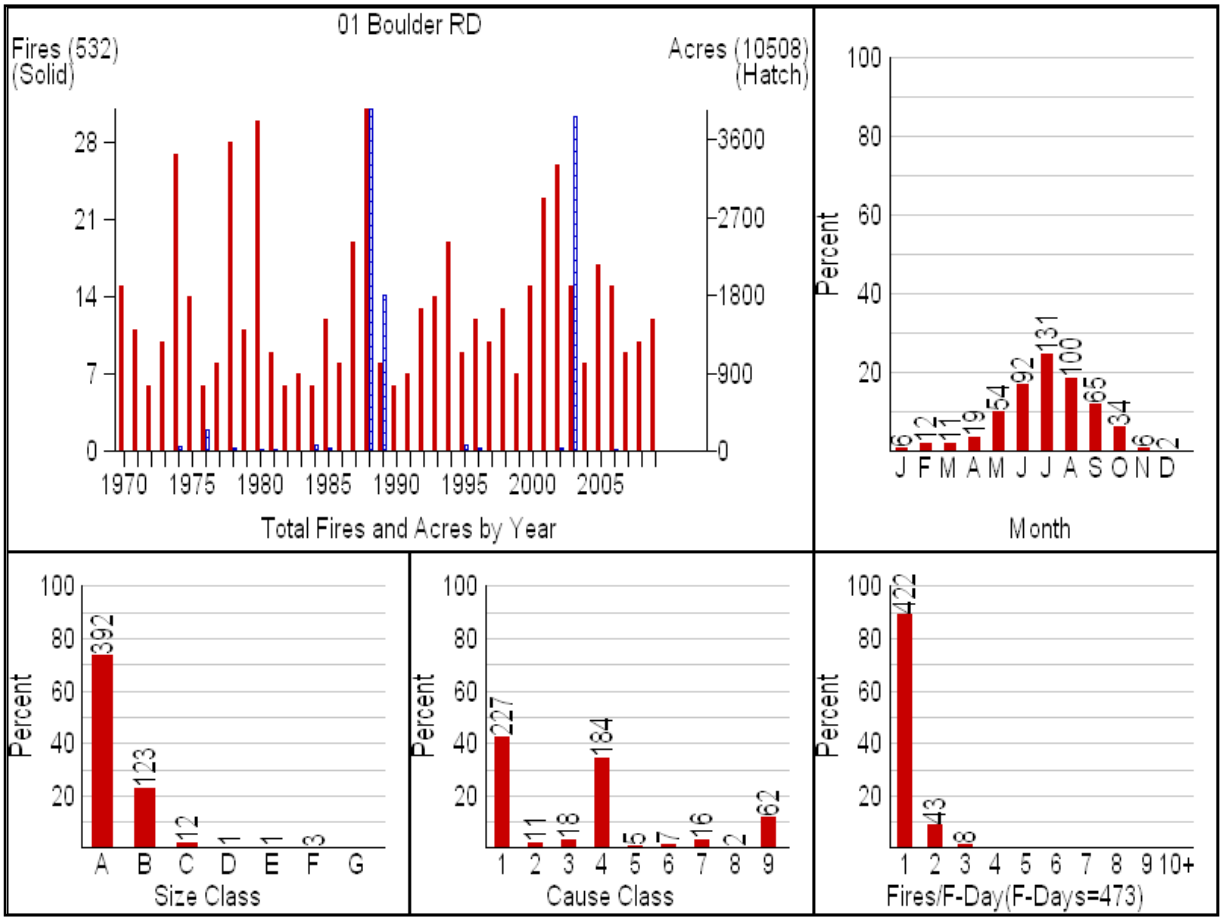
The bottom middle figure shows the number of fires caused by each factor. The most common cause of ignitions is lightning; however, the next most common cause is campfires. If the miscellaneous cause category is removed, natural causes still represent the majority of

[6] City of Boulder, Middle Boulder Creek Water Source Management Plan. 2002.

[7] Federal Register: Urban Wildland Interface Communities within the Vicinity of Federal Lands that are at High Risk from Wildfire. 2001. www.forestsandrangelands.gov/resources/documents/351-358-en.pdf.

ignitions, but it should be noted that these numbers are for national forest areas, which lack the concentrated development and many other risk factors present in the portions of the study area where private land is dominant. While natural causes remain the primary cause, there are multiple camping areas and places used as shooting ranges throughout the Nederland area. Increased use of Forest Service property increases chances of ignition. Educating users of the campgrounds and monitoring these areas will reduce this risk. Another significant exposure comes from motor vehicle accidents on Colorado Highway 119. Steep, south-facing slopes have fine fuels that, when ignited, could spread fire into the communities on the slopes above.

Finally, the bottom right box represents the number of fire starts for each day that a fire start was recorded. Most fires (422) occurred on days that only had one fire start. Approximately 9% (43) of fire days had two fire starts recorded. Days with three or more fire starts are a rare occurrence compared to fire days with a single ignition.



Size Class (acres)	A <1/4	B 1/4-9	C 10-100	D 100-299	E 300-999	F 1000-4999	G 5000+		
Causes	1 Lightning	2 Eqpmt.	3 Smoking	4 Campfire	5 Debris Burning	6 Railroad	7 Arson	8 Children	9 Misc.

Figure 2. USFS fire statistics (Boulder Ranger District).

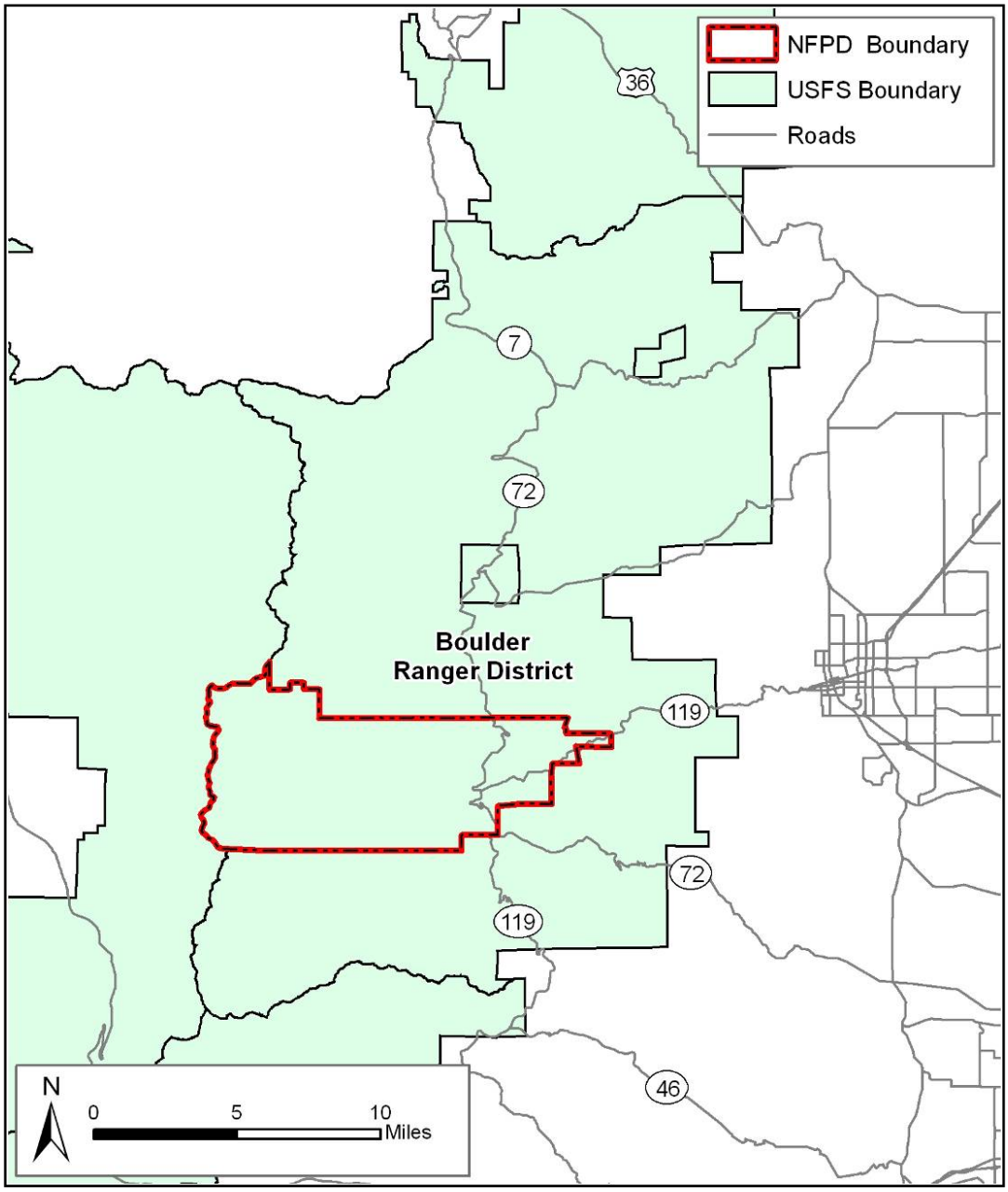


Figure 3. NFPD in relation to the USFS Boulder Ranger District.

RELATED HISTORICAL WILDFIRE HAZARD PROJECTS

Several wildfire studies have been done throughout the history of Nederland. While not all of these data are available in full, below is a description of some of the studies completed prior to this CWPP.

Karle Seydel & Associates

The earliest map set available from this study is dated from 1976, and was produced in cooperation with the Colorado State Forest Service (CSFS), and funded by House bill 1041, which was adopted in 1974. This map set consists of five maps: slope, aspect, vegetation type, vegetation density and a "wildfire hazard" map, which is a compilation of the other four maps. It also includes an appendix, which includes references and a section on "Hazard Mitigation." Of note is a brief discussion of beetle effects: "The presence of beetle kill or forest disease, slash ladder fuels and/or fine fuels were not considered in this evaluation because they were not in continuous areas."

Perhaps more interesting is a section on fire history in the area, "On June 11, 1976, fires struck closer to home, in the area of Comforter Mountain. After two days of fighting by more than 250 men and women, this fire was finally brought under control. When it was over, 250 acres of timber had been destroyed and one 29 year-old Denverite who volunteered to help fight the fire later died in his sleep".

- "In fact, over 1,600 acres are known to have burned near Nederland in July 1912" and "Between 1949 and 1975, 60 forest fires were reported in the Nederland region. 85% of these were man-caused."

The recommendations of this plan included hazard mitigation (defensible space guidelines) and cooperation among the various land-management agencies and private property owners.

Boulder County Wildland Hazard & Identification Mitigation System (WHIMS)

In 1997, approximately 75 Wildfire Hazard Questionnaires were completed for the Town Site of Eldora and Fourth of July Road areas. The surveys were conducted by Nederland Fire Department volunteers and staff. Each survey consisted of 29 questions, divided into three sections. Section 1 had 15 questions addressing: address, topography, construction, access, utilities and landscape. Section 2 was the "Fire District Chief Section" and addressed water supply, access, and utilities. Section 3 was the "GIS (Computer-Derived) Response Section," which addressed topography. On nearly all questionnaires, only Section 1 was completed. It is believed that this data was provided to Boulder County, which at some point produced some WHIMS-related maps. The methodology used for modeling is no longer known or accessible at the county level. It is believed that one of the goals of this project was to provide a relative defensibility rating for each property within the survey area. Unfortunately, any maps produced listing certain addresses as "red rock, green rock, etc…" would require constant updating and present certain liabilities if used without updates. The data that we have is 14 years old is unlikely to be of benefit at this time.

MOUNTAIN PINE BEETLE (MPB)

This CWPP is not an ecosystem management plan, nor is it a plan dedicated to insect and disease issues. However, because of the intensity of the mountain pine beetle (*Dendroctonus ponderosae Hopkins*) epidemic and the impact it could have on life-safety and fire behavior, it is important to include information on beetle impacts in this document to educate the public. The MPB has become a prominent forest pest in lodgepole pine stands on the west and east side of the Continental Divide in northern Colorado. With more than 2 million acres of trees killed since 1996, the forests around Nederland are among the areas where trees are being attacked and dying. Trees are attacked by MPB during the summer months and into early fall. By the following summer, successfully attacked trees will begin to fade. From a fire perspective, it is at the 'red needle' phase that the forest is at the greatest risk in the event of an ignition. The probability of having an ignition source (lightning or human caused) does not increase, but the probability of a tree igniting does. The dry needles catch fire more easily and fire may spread quickly through the crowns, especially considering the high winds common to the area. Because there is less moisture and therefore less heat when burning, fire in a beetle-killed stand extinguishes more readily. Within 3-5 years, the needles will fall off of the trees. Fire risk is significantly diminished at this point, since there are no needles in the crown to support burning. The risk then comes from blow-down because of the shallow root system of lodgepole pine. The combination of gusty winds and high levels of recreational use in the Nederland area creates a dangerous situation, as trees could potentially fall on individuals utilizing the forest. Without removal of the wood, the downed trees create a heavy fuel load on the forest floor that could generate intense fire.[8]

Recommendations

There is no way to combat the mountain pine beetle outbreak at this point. Instead, the best option is to remove trees that have been "hit" and that are dead. Please note that the remaining living trees may still be susceptible to blow-down. With mortality rates from pine beetle reaching upwards of 90% in stands, the future composition of the forests is unknown. A pine beetle forest management plan should be developed in concert with the CWPP to address the goals of public and private landowners in the area.

[8] Romme, W.H., J. Clement, J. Hicke, D. Kulakowski, L.H. MacDonald, T.L. Schoennagel, and T.T. Veblen (2006). Recent forest insect outbreaks and fire risk in Colorado forests: A brief synthesis of relevant research. Colorado Forest Research Institute, Report (refereed), 24 pp. Available as PDF: www.cfri.colostate.edu/reports.htm

OTHER AGENCY TREATMENTS

Because of the multiple ownerships that exist within the study area, various agencies have actively managed the land within the study area. City of Boulder, Boulder County, Denver Water, Colorado State Forest Service, and the U.S. Forest Service all have planned projects and completed projects in the vicinity. One of the most comprehensive projects is the Winiger Ridge Ecosystem Management Project. This extensive project area ranges from 5,500 feet to 8,500 feet elevation and covers a variety of ecosystems. The goals of the Winiger Ridge Project are multi-faceted, including reducing wildfire risk, removal of invasive species, increased wildlife habitat and overall improved ecosystem function. For more details on the project, visit http://lamar.colostate.edu/~csfsbo/winiger/index.htm.

Additional work has been completed on Boulder County Open Space, including Reynolds Ranch. The primary objectives of these projects were to increase aspen density, create a mosaic of species and age classes within the mixed conifer stands, reduce crown fire potential and protect existing ponderosa pine and Douglas fir trees from insects and disease.

The American Recovery and Restoration Act has funded a 5-acre project for the Wild Bear Mountain Ecology Center to reduce lodgepole pine density and promote ponderosa pine, Douglas fir and limber pine growth. This project completes a fuel-reduction project carried out by Boulder County Open Space on the Mud Lake property.

The USFS has completed patch cuts and other thinning projects in the area that serve to reduce extreme fire behavior and the risk to adjacent communities. By reducing the fuels, specifically decreasing the aerial continuity, areas are created from which firefighters can begin burn-outs, back-burns or where air resources can drop retardant.

Figure 4. Examples of recent (top) clear cuts, bottom project completed approximately 10 years ago.

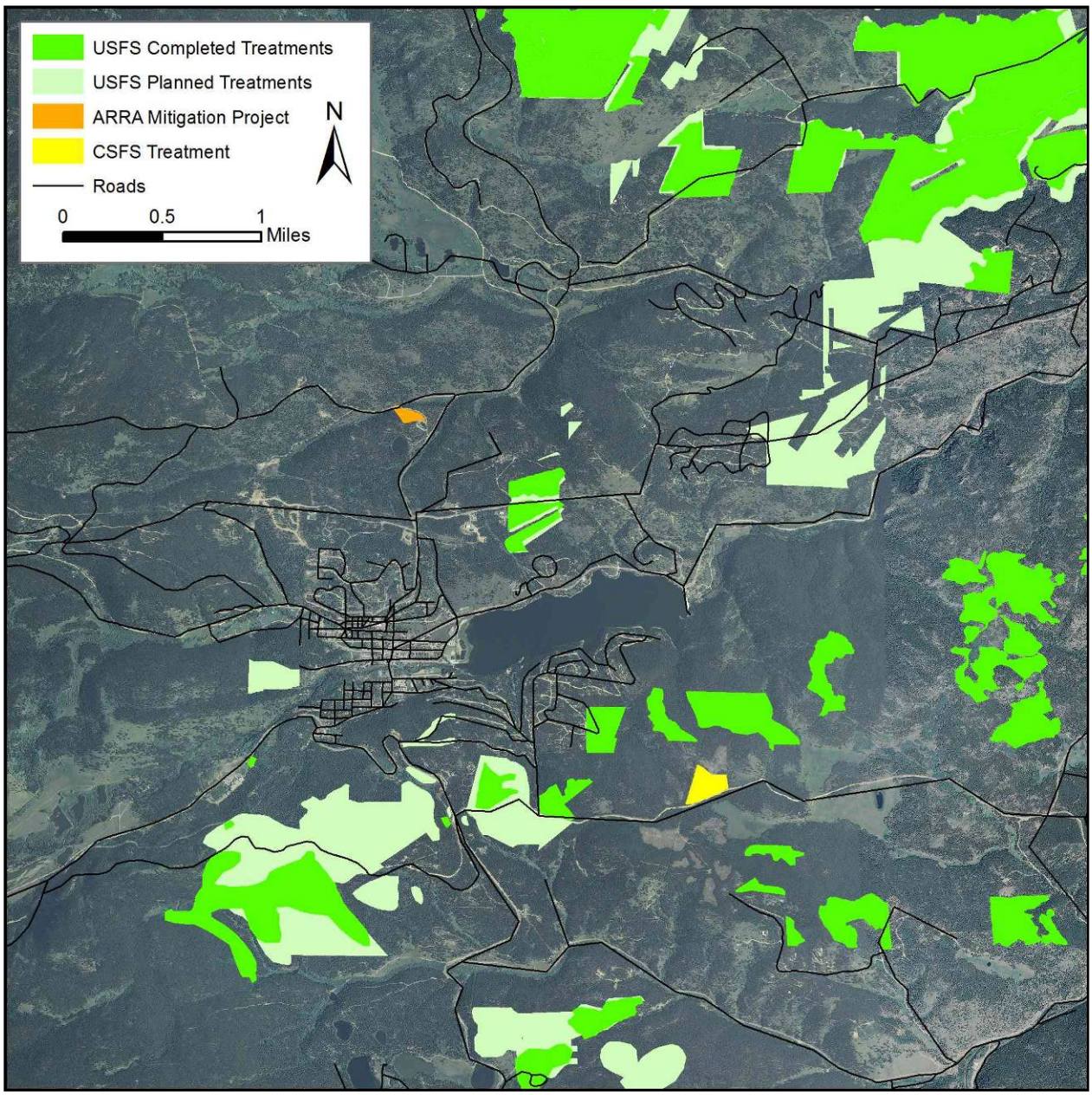


Figure 5. Other agency treatments occurring within the study area.

FIRE BEHAVIOR DISCUSSION

Nederland Fire Protection District has had few wildland fires greater than 10 acres. Fires are infrequent and usually small. However, under the right conditions (low relative humidity, high winds and temperatures, drought), extreme fire behavior is possible. The probability of a large fire is low, but when the environmental conditions align, the potential for a large, intense fire is greatly increased. Combined with the current infrastructure and home construction, the area has a high to very high risk from wildfire. If such an event were to happen, it is likely that the community would experience multiple structure losses.

Fire risk and fire behavior characteristics are defined by three major variables: fuels, weather and topography. For a more complete discussion of the fire behavior potential methodology, including fuels customization, see Appendix C.

FUELS

The Nederland Fire Protection District area is typical of montane and upper montane ecosystems. Vegetation ranges from sparse grassy meadows to dense mixed conifer forests. Any vegetation that can burn is considered a fuel. Fuels are categorized into "fuel models," each with a unique set of characteristics when burned.[9]

The most common fuel models in the study area are listed below. Other fuel models may be present but constitute less than 5% of the land area. These were included for the purposes of fire behavior modeling and zonal statistics but are not described in detail below, although the percentage of each fuel model is broken down by community in Table 2.

- **TU5 (165) Very High Load, Dry Climate Timber-Shrub**
  Includes ponderosa pine and Douglas-fir between 7,000'-9,000' and Engelmann spruce and sub-alpine fir between 9,000'-12,000'

  TU5 is any mixed conifer forest with an understory of live plants. In the lower elevations of the study area, this is mostly found on north-facing slopes where either ponderosa or lodgepole pines grow together with Douglas fir. Representative areas are found on the west side of Big Springs, Cold Springs and CR99/Beaver Road. In the higher elevations, the forests are a mix of limber pine, bristlecone pine, Engelmann spruce and subalpine fir. Representative areas are found mostly above 10,000 feet to the south and north and below the divide. These forests will burn more or less intensely depending on the density and amount of undergrowth. The forests are sheltered from the wind, shaded and moist, so they usually do not carry fire very well under moderate conditions. A strong wind can cause the fire to penetrate into the stand and move up into the crown if undergrowth is present (ladder fuels). Limited torching of one or a group of trees would be likely. These forests have long fire return intervals (300+ years) and will be more prone to large fire as their health declines from age, drought or insects. However, when they are susceptible, they burn intensely and large areas experiencing crown fire would be expected. Under these conditions, fires are very difficult to extinguish. As lodgepole forest become decadent and have heavy fuel loading from downed trees, they will also burn with similar characteristics.

[9] Scott, J.H. and R. Burgan. 2005. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model, U.S. Department of Agriculture Forest Service, RMRS-GTR-153.

- **TU1 (161) Low Load Dry Climate Timber-Grass-Shrub**
  Forest types include aspen and lodgepole pine stands

  TU1 represents the aspen stands and the managed lodgepole pine stands that have mostly leaf/needle litter and little dead and down wood. During moderate conditions, fires are low intensity and creep and smolder in the leaf/needle litter. There are not many ladder fuels to carry the fire up into the tree crowns. Only under extremely dry conditions will these areas be of concern from fire. Representative areas of these lodgepole stands are on the east side of Big Springs. Aspen stands are scattered throughout the study area.

- **GS2 (122) Moderate Load, Dry Climate Grass-Shrub**
  Native and non-native grasses and low shrubs like sage and common juniper

  GS 2 represents two types of areas with a grass and shrub mix: dry sites such as Comforter Mountain and Hurricane Hill, and wet sites such as Arapahoe Ranch on Eldora road and lower Caribou Ranch. Under moderate weather conditions, the dry sites can burn, since open unsheltered areas are very susceptible to drying from wind and solar radiation. Under moderate weather conditions, fires can burn and spread quickly. While grass fires can ignite and spread quickly, they are usually relatively easy to extinguish. The grass is the primary carrier of fire into other vegetation, so if conditions are dryer, grasses act as the catalyst for igniting shrubs and trees.

  The riparian areas would not burn under moderate conditions as they are found mostly in wet areas and hold moisture the longest. However, under high fire danger conditions, during dormancy, drought and high winds, they present a greater challenge to extinguish because they have more mass and can generate embers.

- **TL8 (188) Long-Needle Litter**
  Stands dominated by ponderosa pine

  TL8 represents the denser ponderosa pine stands with “dog hair” trees and needle litter. These areas are lower elevation and are more reactive to weather conditions. They can burn under moderate conditions and will torch trees because of the low limbs that are common. As conditions become dryer and windier, short crown fire runs are likely. Representative areas are in Pine Glade/Twin Sisters and Lazy Z.

  Other vegetation exists in the area, although in lower quantities, and remains a concern for firefighting as rates of spread and flame lengths can be high.

	Fuel Model (%)*										
Community Name	**91**	**101**	**102**	**121**	**122**	**141**	**161**	**165**	**183**	**186**	**188**
Beaver Creek	17.5	7.2	3.4	4.1	13.7	2.1	12.7	12.7	17.5	1.4	7.9
Big Springs	19.3	0.0	0.1	3.9	1.9	0.0	36.5	14.0	16.2	5.9	0.2
Bonanza	0.0	0.0	0.0	0.0	9.7	0.0	8.4	38.9	37.1	0.0	5.9
Cold Spring	0.0	0.0	0.5	0.4	17.4	0.3	16.6	37.0	16.0	0.0	11.5
Comforter Mountain	0.0	0.0	1.3	3.6	32.7	19.8	29.7	11.5	0.8	0.0	0.6
CR 99/Beaver Road	0.1	0.2	0.5	3.1	14.4	1.3	7.0	24.1	39.4	0.2	9.8
East Big Springs	19.6	0.0	0.0	11.9	1.4	0.0	30.1	16.1	10.5	6.3	1.4
Eldora	0.0	0.0	1.9	1.4	23.2	4.3	37.3	8.7	23.1	0.0	0.1
Five Points	0.0	0.0	0.5	2.4	16.0	1.1	8.6	8.0	62.8	0.0	0.5
Haul Road	3.5	0.0	0.9	0.3	4.7	0.3	4.1	4.7	81.1	0.3	0.0
Hurricane Hill	1.9	0.0	3.9	8.1	25.0	5.8	7.1	26.6	17.2	0.0	3.6
Indian Peaks/Caribou Ridge	0.5	0.0	0.5	0.8	6.3	0.0	2.5	2.3	85.8	0.8	0.3
Lazy Z	0.3	0.1	1.5	1.0	17.7	0.7	12.7	25.1	32.7	0.1	7.9
North Nederland	40.4	3.2	0.0	29.5	3.4	0.0	2.3	7.0	5.3	4.3	4.7
Pine Glade/Upper CR 68	0.0	2.5	2.3	2.7	16.5	2.8	15.8	29.3	11.3	0.4	10.9
Pinecliffe	5.0	0.2	0.2	0.5	20.0	0.0	16.3	16.6	38.2	0.7	1.9
Porter Ranch/Twin Sisters	0.0	4.9	1.9	1.3	27.2	2.3	17.0	16.4	26.7	0.0	1.4
Shady Hollow	0.0	0.0	0.2	0.0	25.9	0.0	19.9	29.4	22.8	0.0	1.5
South Nederland	34.0	0.3	0.3	9.1	3.0	0.0	12.4	16.0	14.5	9.1	1.3
St. Antons	0.0	0.0	0.0	0.2	26.4	0.5	42.4	20.9	8.7	0.0	0.9
St. Antons West	0.0	0.0	0.3	0.6	21.8	0.0	17.7	18.2	37.7	0.0	3.6
Sunnyside	28.7	1.8	0.4	18.9	4.4	0.0	6.1	5.9	17.3	14.2	2.0
Whispering Pines	10.2	0.3	0.3	9.4	14.2	0.8	8.9	28.5	22.0	3.0	1.6

*Fuel models that comprised less than 5% of the area were not included in this table

Fuel Model	Description
90s (NB)	Non-burnable; fire will not spread
100s (GR)	Grasses; fire carrier is grass
120s (GS)	Grass-shrub; primary fire carrier is grass & shrubs combined
140s (SH)	Shrub; fire carrier is live and dead shrub twigs and foliage
160s (TU)	Timber-understory; fire carrier is forest litter and herbaceous or shrub fuels
180s (TL)	Timber litter; fire carrier is dead and down woody fuel

Table 2. Percent of each fuel model within the communities and description of the primary fire carriers for each set of fuel models.

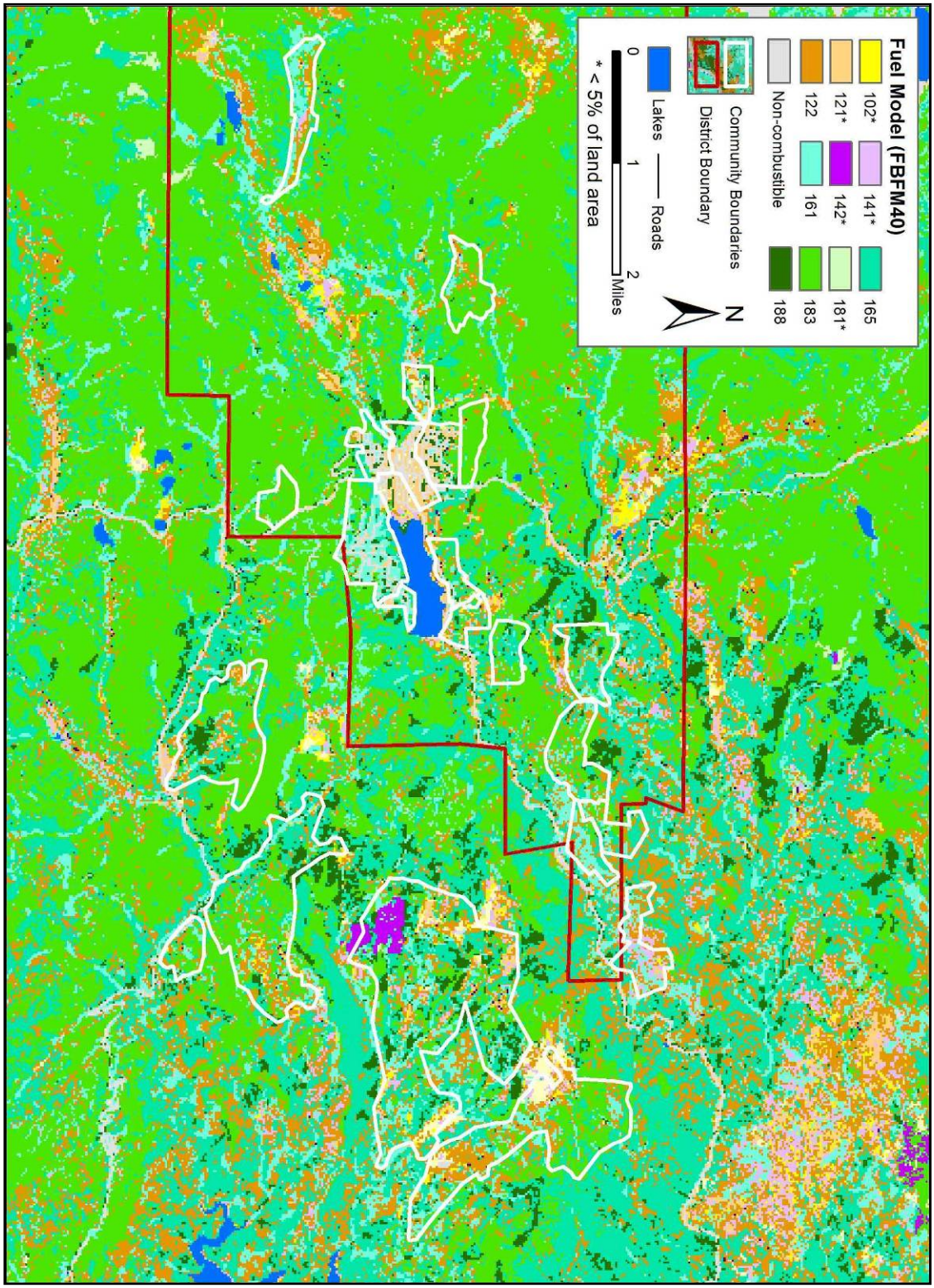


Figure 6. Fuels map for the study area.

WEATHER

The weather analysis for the area shows that there are very few days that support large fire growth. At higher elevations, the temperatures are lower and the relative humidity is higher. The daily window of opportunity for ignition is short. The season is also short, with winter snows coming earlier to these areas. The biggest concern is drought or low snowpack coupled with high winds. Generally, forests above 9,000 feet burn when there is prolonged drought. These conditions can also increase the chance of insect and disease outbreaks, which will further increase the likelihood of extreme fire behavior.

Winds are the main cause of large fire events in Boulder County. Strong winds are common within the NFPD. The community sits at the edge of the Continental Divide, and most weather events will create some level of winds as they crest over the mountains and move to the east. Nederland is known for gusty winds, with gusts exceeding 40 mph on a windy day. Strong, gusty winds can penetrate the dense stands and transition a fire from the ground into tree canopies.

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TOPOGRAPHY

The elevation varies from 7,000 to 13,000 feet within the study area boundaries. Much of the area is mountainous, with steep, narrow canyons and drainages. A fire will move faster as it travels up steeper slopes. These narrow, steep chutes also funnel winds and further increase the rate of spread of a fire. Slopes in the study area are often greater than 45 degrees, or 100%.

The area has flat valley bottoms surrounded by steep, forested hillsides. The position on the slope where a fire starts can make a significant difference in how fast it spreads and grows. Steep slopes increase fire behavior as a result of preheating of uphill fuels. A fire originating on the top of the slope can be expected to have the most minimal fire behavior, as it backs down the hill with low flame lengths and rates of spread. This is typically where lightning strikes and single tree ignitions occur but do not typically spread. The biggest concern would be a fire starting at the base of the slope and then spreading quickly uphill, especially under extreme weather conditions. Some of the areas that are of greatest concern are the communities uphill from Colorado Highway 119. Discarded cigarettes and overheating cars can act as ignition sources. Some areas of the canyon have steep rock walls, which may prevent fire from running uphill, but vegetation is continuous from the highway in other areas. Steep slopes are common throughout the study area, including places such as Winiger Ridge, Hurricane Hill and Big Springs. (Larger graphics are attached in Appendix C.)

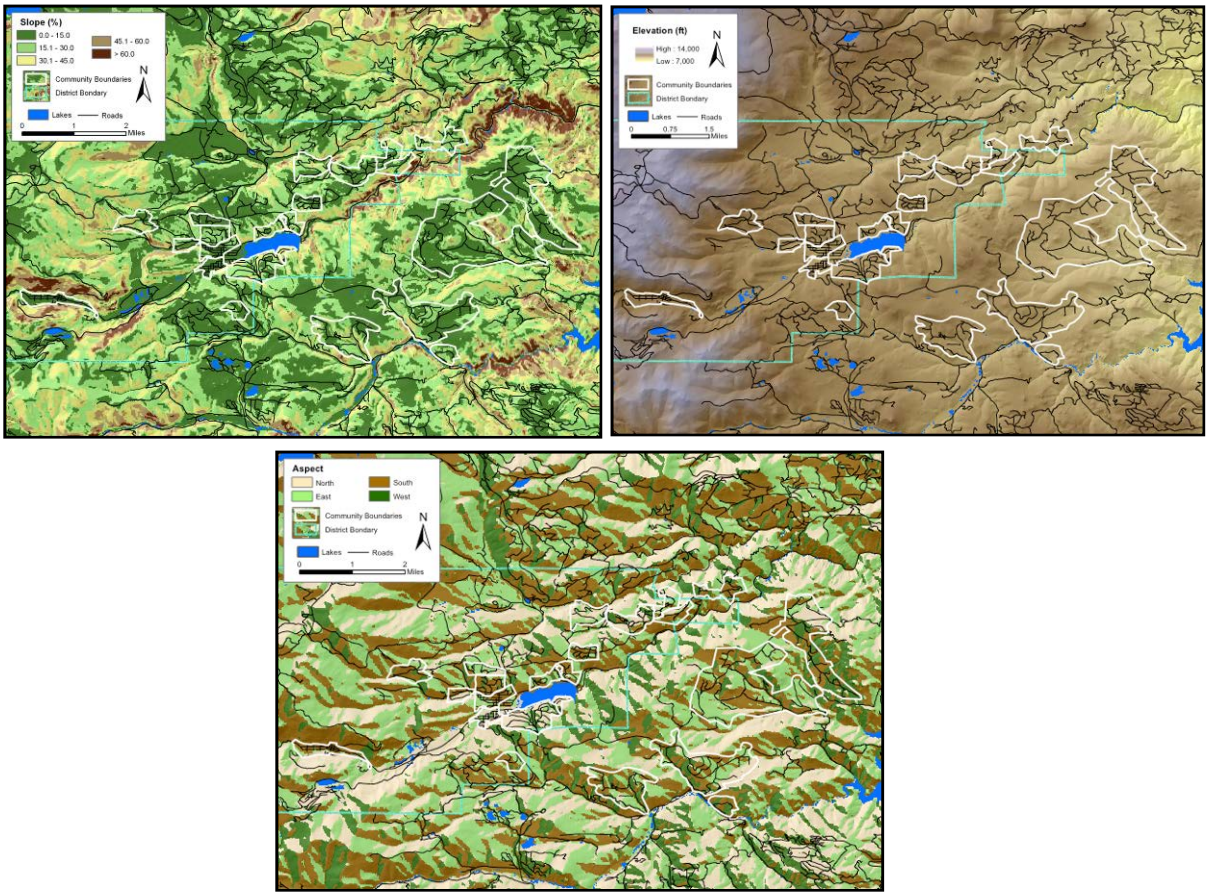


Figure 7. Slope, elevation and aspect within the study area. Larger images are available in the LCP critique.

LOCAL PREPAREDNESS AND FIRE DEPARTMENT CAPABILITIES

NEDERLAND FIRE PROTECTION DISTRICT

The Nederland CWPP study area encompasses two fire protection districts: the Nederland FPD and the area of Magnolia road covered by Timberline FPD.

Station Locations & Apparatus

Station 1: 650 West 4th St., Nederland

Figure 8. NFPD Station 1

Station 1 has the following apparatus:
1 Type 1 Engine
1 Pumper with 60' aerial ladder
1 Rescue with water (300 gallons)
1 Type 6 Engine
2 Water Tenders (1,000 and 3,000 gallons), one of which is a CSFS 6x6 Tactical Tender

Station 2: 2815 Ridge Road, Nederland

Figure 9. NFPD Station 2

Station 2 has the following apparatus:
1 Type 1 AWD Engine
1 Type 6 Engine
1 Water Tender (2,200 gallons)

Station 3: Main Street, Eldora

Figure 10. NFPD Station 3.

Station 3 has the following equipment:
1 Type 2 Engine
1 Type 6 Engine
1 Water Tender (1,500 gallons)

Training

Members of the Nederland FPD participate in an active training program. All firefighters must take the entry-level wildland fires courses (S130/190), and annual wildland fire refresher training (RT-130) is required for all members. All department career firefighters and volunteers are also required to take an annual pack test at the arduous level. Trainings take place every other Saturday throughout the year and often involve a degree of wildland training, especially in the summer months.

Water Supply

The availability and location of water resources is a critical problem throughout the study area. Because of the rural location of many communities, fire hydrants are few and far between, except in areas close to the Town of Nederland. While some homes have cisterns available for fire department use, they are often small in capacity. Creeks and ponds are available in many areas, but they require time and effort to draft water from them. Moreover, shuttle trips will need to be setup to bring water back to the fire area, which takes personnel and apparatus away from firefighting efforts. Due to the availability of hydrants, the town limits of Nederland have an ISO rating of five; everywhere else in the study area, the rating is greater than five due to limited water resources. (See the individual community/planning area write-ups for details on water supply within the community/planning area.)

Recommendations

The Nederland Fire Protection District has done a laudable job of providing a baseline of wildland qualifications that all its firefighters must achieve. Other recommendations below can further improve the wildland fire response capability of the district.

FIREFIGHTER TRAINING

- Provide structural and medical training opportunities to meet district needs.
- Provide red card documentation for all qualified personnel.
- Additional recommended wildland class for all interested firefighters include: NWCG S-215 Fire Operations in the Urban Interface; S-290 Intermediate Fire Behavior; and I-200 and I-300 Basic and Intermediate ICS.[10]
- Encourage Type 3 Incident Management Team participation.
- Encourage personnel to seek higher qualifications and participate in out-of-district fire assignments.
- Encourage and work on providing training opportunities with adjacent districts.

EQUIPMENT AND RESOURCES

- Provide standard wildland “Personal Protective Equipment,” in compliance with NFPA 1977 standards for all firefighters.
- Provide new-generation fire shelters for all firefighters with appropriate consideration for regular or large size needs.
- Any dry and municipal hydrants in the district should be inspected and serviced on an annual basis.
- Apparatus should be equipped with portable water storage, and engine checks including drafting tests should be performed monthly.

TIMBERLINE FIRE PROTECTION DISTRICT

There are two Timberline Stations within Boulder County, Stations 1 and 4.

Station Locations & Apparatus

Station 1: 3992 Colorado Highway 72

Figure 11. TFPD Station 1.

Station 1 has the following apparatus:
1 Type 1 Engine
1 Type 6 Engine
1 Water Tender (1,250 gallons)

Personnel: Station 1 has three firefighters and one trainee. One of the firefighters is an EMT, two have S-130/190 certifications, and one has a Firefighter I certification (structure).

Station 4: 5927 Magnolia Road

Figure 12. TFPD Station 4.

Station 4 has the following apparatus:
1 Type 2 Engine
1 Type 6 Engine
1 Water Tender (1,250 gallons)

Station 4 has five firefighters and one trainee. All five have S130/190 certification. Everyone with S-130/190 has passed the arduous pack test to receive their Red Cards. One firefighter is a squad boss and Faller A. Nobody responding from Station 4 has any medical certifications.

Training

While not required, all firefighters of the Timberline FPD are encouraged to take the entry-level wildland fire courses S-130/190. Qualified wildland firefighters are also strongly encouraged to take the annual fire refresher and pack test. While medical training is not a primary focus of a CWPP, working towards EMT training for active wildland firefighters can be beneficial for fellow firefighters and residents within the district.

Water Supply

Water availability and abundance is also a critical issue in the Magnolia area. Fire hydrants are nonexistent, and firefighters must rely on locally available water from home cisterns and adjacent water bodies. Cisterns usually have low capacities and may not provide adequate water in the event of a wildfire. Creeks and ponds exist through the Timberline FPD, but they

require time-consuming shuttle trips and drafting. The district has identified water supplies within its boundaries by documenting latitude, longitude, type of supply and volume. At this point, this information needs to be moved from an Excel spreadsheet to a map so it is easily accessible by firefighters responding to calls.

Recommendations

FIREFIGHTER TRAINING

- Create a Cooperator Resource Rate Form (CRRF) agreement with the CSFS. This form documents rates for Colorado county, local and rural department resources used for reimbursable responses on wildfires, prescribed fires or other incidents. As an attachment to the county Annual Operating Plan (AOP) and through existing mutual-aid agreements with the county, the CRRF links the cooperator to other agreements with CSFS and to the federal agencies responsible for fire suppression.
- Establish structural and medical training requirements to meet district needs.
- All firefighters should be comfortable with basic engine operations such as pumping and drafting.
- Require NWCG S-130/190 for all firefighters.
- Annual wildland refresher NWCG RT-130 and pack-test for seasonal red card status for all firefighters.
- Additional recommended wildland class for all interested firefighters include: NWCG S-215 Fire Operations in the Urban Interface; S-290 Intermediate Fire Behavior; and I-200 and I-300 Basic and Intermediate ICS.[11]
- Encourage Type 3 incident management team participation.
- Encourage personnel to seek higher qualifications and participate in out-of-district fire assignments.
- Encourage training with adjacent districts.

EQUIPMENT AND RESOURCES

- Provide standard “Personal Protective Equipment” known as bunker or turnout gear for all firefighters.
- Provide standard wildland “Personal Protective Equipment,” in compliance with NFPA 1977 standards for all firefighters.
- A strategic water resource analysis should be conducted. All subdivisions found to be lacking local emergency water sources should be considered for installation of at least one 30,000-gallon cistern, preferably at an accessible area near the intersection of the subdivision entrance and main access road.
- Any dry and municipal hydrants in the district should be inspected and serviced on an annual basis.
- Map already identified water sources and make accessible in all apparatus.
- Apparatus should be equipped with portable water storage such as porta-tanks.

[10, 11] S-290 is available online at www.meted.ucar.edu. Click on “Fire Weather” under topics. Registration is required but it is free. The class is provided by a Boulder-based program funded by NOAA/National Weather Service.

COMMUNITY ANALYSIS AND SPECIFIC RECOMMENDATIONS

PURPOSE

The purpose of this section is to examine the communities in greater detail. Of the 18 Wildland Urban Interface (WUI) communities defined in the NFPD study area, none were found to represent an extreme hazard. Twelve were rated as very high hazard, and six were rated as high hazard (

Table 3 and Figure 13). It is important to remember that these communities are rated relative to what is customary for this specific type of interface. While adhering to proven methodology, an attempt is made to approach each community as a unique entity with its own characteristics, so that the most accurate, safe and useful assessments possible are provided.

Very High	High
Big Springs	Beaver Creek
Bonanza	Hurricane Hill
Cold Spring	Indian Peaks/Caribou Ranch
Comforter Mountain	North Nederland
East Big Springs	Sunnyside
Eldora	South Nederland
Five Points	
Haul Road	
St. Antons	
St. Antons West	
Shady Hollow	
Whispering Pines	

Table 3. Community hazard ratings within NFPD

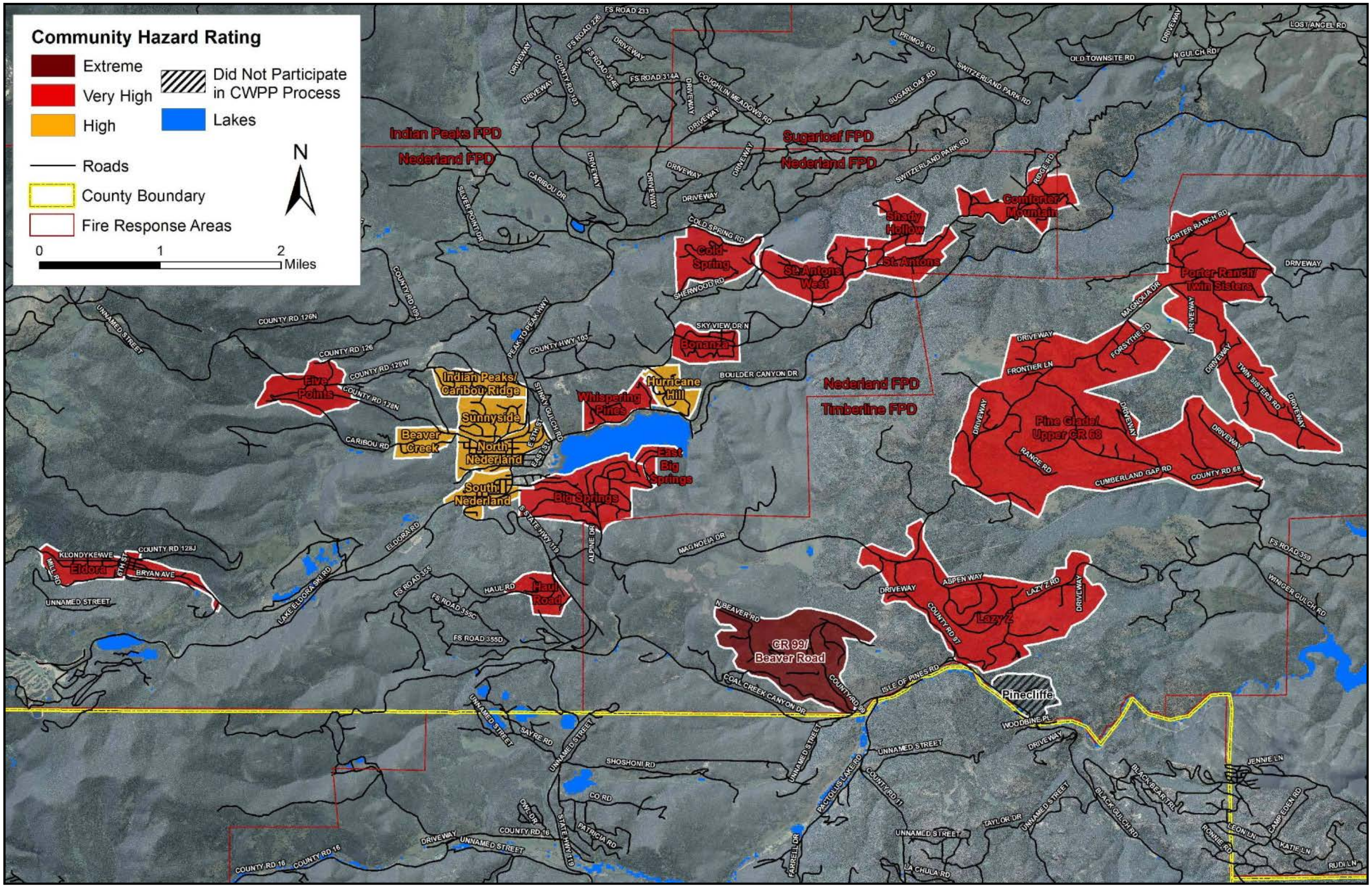


Figure 13. NFPD communities including ratings.

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 WUI for their relative wildfire hazard.[12] The WHR model combines physical infrastructure, such as structure density and roads, fire-behavior components such as fuels, topography, rate of spread and flame length, with the field experience and knowledge of wildland fire experts. Modeled values for flame length and rate of spread during extreme weather conditions are incorporated into the rating sheet for each community. The WHR model has been proven and refined by use in rating thousands of neighborhoods throughout the United States. Much of NFPA 1144 has been integrated into this methodology to ensure compatibility with national standards. Additionally, aspects of NFPA 1142 regarding water supply for rural and suburban firefighting are included in the assessments by looking at proximity and capacity of the water supply. The fire modeling in combination with the expertise of the field personnel are what create a more robust rating system than NFPA 1144 or NFPA 1142 used on their own.

Defined communities are the centerpiece of the CWPP. The definition of a community, for the purposes of a CWPP, has been refined by Anchor Point over the last 10 years while producing these plans. In doing so, state and federal requirements/definitions have been taken into consideration. The Colorado State Forest Service requires that each community have representation during the planning process. This representation can be a fire department official, an HOA leader or an involved community member. Because each community must have representation, it must be a cohesive enough community to support a single representative. Thus, a community should be a single geographic area that shares similar infrastructure, vegetation, topography, and as a result, similar recommendation needs. Lot/parcel sizes should be small enough that actions taken by individual residents will likely have an effect on their neighbor's fire risk and may motivate further action. Close proximity is an easy way to encourage collaboration.

Because the areas have similar requirements in terms of needed fuel-reduction projects, the community boundaries can also serve as planning unit boundaries. Within these planning units, there are acute, well-defined projects described and presented graphically. These projects are considered to be the first priority within the project areas. However, additional, larger landscape-scale projects in and out of the boundaries should also be considered. Identifying larger projects in the surrounding influence zones will be meaningful for obtaining grants to help fund all of the projects, especially the small-acreage projects. Although large fuel breaks are not always as effective for individual home protection as defensible space, if carried-out correctly, they can act as anchor points for suppression activities to begin. Backburn or burn-out operations can begin at a fuelbreak, and they are also useful places for tankers to drop retardant or water. An overarching recommendation applicable throughout the NFPD and TFPD response areas is completing treatments along roads. A few specific planning units and roads were identified in the plan (Colorado. Highway 119, Ridge Road and roads within Five Points) because they were identified as crucial due to fuel loading and high amount of use. However, all roads within the district boundaries are viable options for fuels treatments, as they are used for access and egress.

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

Table 4, below contains the general statistics for each of the communities/planning areas identified in this plan. It is useful for comparing communities and average predicted modeled fire behavior in each. These data are another way to help prioritize fuels-reduction projects.

				Mean			
Community Name	**Size (ac)**	**Slope**	**Aspect**	**High Flame Length (ft)**	**Moderate Flame Length (ft)**	**High Rate of Spread (ch/hr)**	**Moderate Rate of Spread (ch/hr)**
5 Points	147.7	13.3	South	3.8	2.4	5.3	2.6
Beaver Creek	66.5	11.8	North	4.0	3.0	5.9	2.7
Big Springs	274.3	12.7	North	7.4	3.6	5.2	2.0
Bonanza	98.4	8.4	South	10.8	3.5	10.0	2.2
Cold Spring	162.0	11.4	Northeast	7.6	3.6	9.4	2.7
Comforter Mountain	160.4	12.7	South	14.2	2.8	56.9	6.6
East Big Springs	433.0	17.2	East	4.9	3.0	3.5	1.7
Eldora	33.1	6.9	North	4.9	2.1	14.9	3.5
Haul Road	160.9	7.9	South	6.2	1.8	7.3	1.3
Hurricane Hill	75.5	12.3	South	8.7	2.6	30.7	5.3
Indian Peaks/Caribou Ridge	67.9	5.6	South	6.2	2.3	5.7	1.5
Lazy Z	87.5	8.8	East	8.2	2.4	13.8	2.5
North Beaver/ CR 99	706.0	10.5	East	11.5	2.7	20.3	3.1
North Nederland	118.8	8.0	Southeast	6.7	3.0	7.2	1.9
Pine Glade/Upper CR 68	1478.2	8.2	North	7.4	1.4	21.2	1.2
Pinecliffe	92.4	9.9	Southeast	4.1	1.8	5.6	2.1
Porter Ranch/Twin Sisters	703.0	7.7	South	10.1	4.0	22.3	2.4
Shady Hollow	101.0	9.8	Southwest	19.1	1.7	21.6	1.3
South Nederland	87.9	6.9	Northeast	3.2	2.0	4.2	2.7
St. Antons	96.6	13.8	South	21.7	3.7	28.9	3.3
St. Antons West	196.4	7.5	North	16.9	3.1	24.3	2.5
Sunnyside	120.5	9.4	South	8.3	3.7	6.1	2.1
Whispering Pines	83.4	12.7	East	9.0	2.8	18.2	3.5
Total Acreage:	**5,551.4**						

Table 4. Community summary table.

The purpose of a CWPP is to protect values-at-risk. Frequently, there is so much focus on homes that the watershed concerns are neglected. This is especially important within the study area since the City of Boulder's watershed could easily be impacted by wildfire. Landscape fuel breaks could not only help protect the Town of Nederland from a fire spreading into the community, but they also can protect the watershed from fires originating from Nederland.

Each community write-up can be regarded as an individual document. These pages can be delivered to a community independently of the overall document. As a result, there may be specific recommendations for each community listed first, followed by recommendations that apply to all communities, such as defensible space. While seemingly repetitive, with this format, each community has all the pertinent information available in three to four pages, separate from the overall document.

Not every community has specific fuels projects identified (see Haul Road, Eldora, Sunny Side, and Porter Ranch/Twin Sisters, for example). Defensible space is determined to be the greatest benefit for the least cost for landowners. This does not mean that a larger, landscape-scale project within the community/planning area could not be beneficial for the area, but it was not identified as the most important step in protecting life-safety and values at risk.

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, also known as prioritizing, on a threatened community in the path of an advancing wildfire with moderate fire behavior. The WHR surveys and fuel models ground-truthing are accomplished by field surveyors with WUI fire experience.

The rating system assigns a hazard rating based on five categories: topographic position, fuels and fire behavior, construction and infrastructure, suppression factors (fire department capabilities, water supply, etc.), and other factors, including frequent lightning, railroads, campfires, etc.

It is important to note that every hazard rating does not necessarily 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.

WUI COMMUNITIES IN NEDERLAND

1. Big Springs

Hazard Rating: Very High

Figure 14. Homes on extremely steep slopes in the Big Springs area.

Big Springs is one of the largest planning areas/defined communities in the NFPD response area. The area contains homes tucked within dense forest on north-facing slopes. There are several access and egress routes into the community, including Lakeview Drive and Peakview Road. Peakview is the only paved road in the community; the rest are fairly well-maintained dirt roads. The road network is confusing and road signs are difficult to read. Evacuation during a wildfire could become difficult, especially if an individual were unfamiliar with the area or panicked. Steep roads, some greater than 10% grade, are 20-24 feet wide and do not provide adequate turnarounds for emergency vehicles or residents. Roads dead-end but are not consistently marked (Barker Road, for example). Driveways to homes are very steep and narrow, making structure protection more difficult for firefighters.

Figure 15. Home with combustible deck and open area under the deck.

Steep slopes, ravines and small chimneys are all topographic features that make the community increasingly at risk from wildfire. Structures have asphalt or metal roofs and combustible wooden siding. Some of the newer homes have non-combustible siding and roofing, such as stucco and metal. Very few homes have had any defensible space cutting around them; there are continuous fuels from the surrounding forest to the structures. Open decks are common, with wood and other debris stored underneath. Utility lines are above ground and residents use propane for central heating. There are fire hydrants scattered throughout the community, but spacing is greater than 1,000 feet and many have thick vegetation surrounding them and water flow is inconsistent.

Lodgepole pine is the dominant species in the community. Mountain pine beetle activity is visible on the larger diameter trees: pitch tube and red needles are present. Engelmann spruce is found in drainages. Because the community is situated on a north aspect, it does not receive as much sunlight and therefore does not experience as much drying of fuels. Shade-tolerant understory fuels are dense, especially in ravines, and could foster the spread of fire into tree canopies. While the community has a lot of vegetation accumulation, north-facing slopes limit the drying, and as a result, extreme fire behavior is unlikely except in the most extreme weather conditions and during drought. The combination of ladder fuels, mountain pine beetle mortality and dense stands could support active crown fire more readily without drought, but it would still require multiple factors aligning just right for this to occur, such as high temperatures, low relative humidity, high winds and lack of precipitation. The drainage between Big Springs and East Big Springs is likely to funnel fire, allowing for faster rates of spread. A fire starting in this drainage would limit access and egress and would likely spread onto federal lands to the west.

Fuels Reduction Recommendations

- Thin the drainage along Alpine Court to diminish extreme fire behavior and allow for safer access and egress. Thin from below, removing smaller diameter trees and regeneration to reduce ladder fuels and decrease the potential fire spreading into tree canopies. As a general rule, reduce basal area by 30-50%. Any work that is to be done should be completed in conjunction with a forester to ensure best practices.

- Work with the USFS to push for additional patch-cuts as a continuation of existing patch-cuts. This will reduce the chance of fire spreading further into agency property and more importantly protect the community from a wildfire initiating on USFS land.

- Tie-in USFS patch-cuts to Magnolia Road to provide for safer access and egress, as well as to limit fire spread.

- An additional escape route was considered for both Big Springs and East Big Springs communities, but the analysis of the fire behavior has shown that the cost-benefit ratio of the work involved was not adequate to ensure for life-safety. There is a “road” from the hairpin turn on Big Springs that extends to Magnolia Road (marked by the star on the map below). It is currently blocked by large boulders. Because this drainage is extremely dense and could experience fire below the road, it is not a viable option for an additional escape.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the “Fuelbreak Guidelines for Forested Subdivisions & Communities” document included within Appendix A.

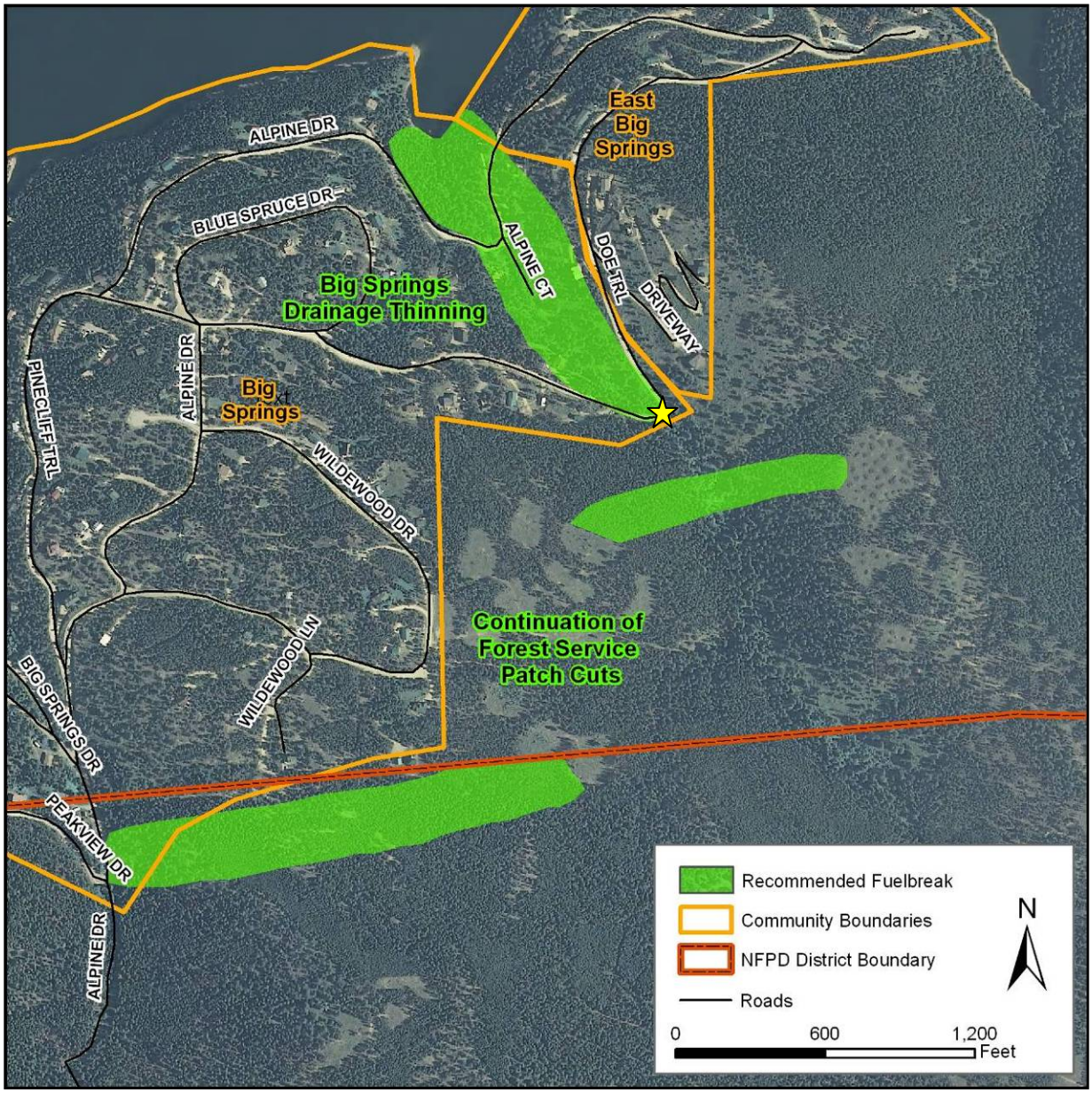


Figure 16. Map of recommended fuels treatments for Big Springs. The star represents the considered secondary evacuation route.

General Recommendations

- Consider renaming roads to eliminate confusion when trying to access or evacuate the community. At a minimum, add missing signage and replace existing, illegible road signs.

- Work on obtaining funding to bury overhead power lines, as ignitions are common with downed lines from high winds.

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

2. Bonanza

Hazard Rating: Very High

Figure 17. Overview of homes in Bonanza.

Ridge Road is the main thoroughfare through the Bonanza community. The other main roads include Bonanza Drive, Sky View Drive South, Valley Road and Blue Spruce Road. For the most part, structures are located on the top of hillsides. Some structures, however, are situated in-line with ravines and along the middle of the slope. Lot sizes are under an acre, but the structures are fairly dispersed. Long driveways provide access to many of the homes. Roofs have high fire resistance since they are asphalt shingle; siding and decks are constructed with combustible materials, and little defensible space work has been done.

Similar with the other communities in the study area, home addresses are present but not reflective. There are overhead utility lines and liquid propane tanks, all which need to be considered for mitigation. Within the community, Ridge Road is the only paved road. There are two ways in and out of the community along Ridge Road. Because the road markers are not reflective or not present, it would be easy to get confused and potentially lost if trying to evacuate under stressful conditions. Road widths are less than 20 feet and road grades greater than 10%. The lack of turnarounds and non-reflective or absent road signs make emergency response increasingly difficult. There are no hydrants present, but there is a cistern within the community.

The vegetation in Bonanza is denser than some of the other communities. Ponderosa pines are found in the overstory with Douglas fir regeneration in the understory. Lodgepole pine is also a common tree found in the Bonanza community. The smaller Douglas firs will act as ladder fuels, carrying fire into the ponderosa, especially when wind speeds and temperatures are high. Under moderate conditions, torching may occur, but active crown fire is not expected. Because of the lack of surface vegetation, rates of spread are not predicted to be fast, even when wind speeds are high.

Fuels Reduction Recommendations

- Thin forested areas in the drainage between Bonanza and Hurricane Hill. Because high flame lengths and rates of spread are expected in the drainage, high limb the trees, being sure to remove the slash from the drainage. This may potentially reduce the risk of crown fire and extreme fire behavior. Thin from below, and try to reduce basal area by 30-50%. All work should be completed in conjunction with a forester to ensure best practices.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

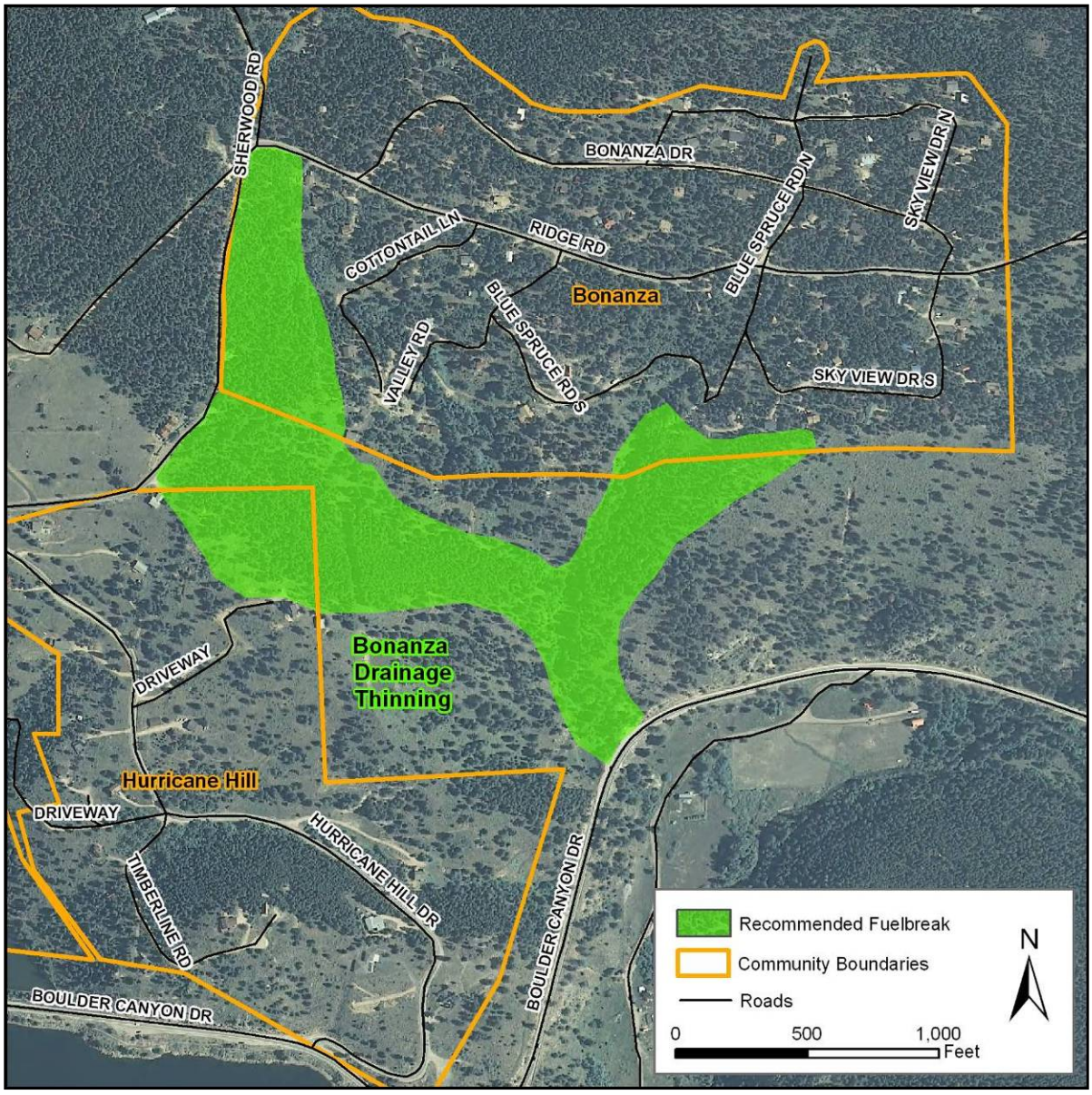


Figure 18. Map of recommended thinning in the drainage between Bonanza and Hurricane Hill.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

3. Cold Spring

Hazard Rating: Very High

Figure 19. Overview photos of Cold Spring.

The community of Cold Spring is east of Peak to Peak Highway and has Cold Springs Drive (CR 128E) as its northern border and an unnamed road north of Sherwood Road for its southern border. Hummer Drive winds through the middle of the community, and many of the structures are accessed via this road. Newer construction has been ongoing within the community, so some of the homes have defensible space, which is now required by Boulder County. The older homes in the community have trees directly in contact with the structures, so they do not have adequate defensible space. Older and newer homes have been built using asphalt roofs and combustible wood or vinyl, siding.

Addresses are marked on homes but aren't reflective, which would make it difficult to identify homes in smoky conditions or at night. Driveways are often steep and narrow, creating issues for apparatus access. Utility lines run above ground over the roads and are buried from the road to the house. Power lines are in danger of coming down because of encroaching trees in several places along the main roads. Propane tanks pose an additional risk, especially if surrounding vegetation has not been cleared. The community has narrow (<20 feet) dirt roads with slopes of 10% or greater in some areas. Wooden road signs are combustible, not reflective and not always present. Road names are confusing because map names are not necessarily

what the road is referred to locally, and intersections and forks are not consistently marked. Individual home cisterns provide water, as there are no hydrants within the community. A 15,000-gallon cistern, supplied from the City of Boulder's Lakewood raw water line, is piped to a hydrant located on Cold Springs Drive, approximately ¼ mile west of Hummer Drive. A dry hydrant is located on North Boulder Creek at Hummer Drive but is limited due to seasonal water flows.

Fire behavior in the Cold Spring community is likely to include surface fire under moderate weather conditions. Higher wind speeds, lower relative humidity and high temperatures typical of more rare weather events may support fire transitioning from the surface fuels into the tree canopies. The north-facing slope between CR 128E and Hummer Drive is an area of special concern from a fire behavior perspective. The steeper slope and dense cover would likely produce active crown fire and longer flame lengths more than anywhere else in the community.

Fuel Reduction Recommendations

- No specific fuel reduction project is recommended for Cold Spring. This does not mean that there are not projects that could be established, but from the initial assessment, defensible space and home construction is the most beneficial action that the community/planning area can pursue. For example, the north-facing slope between CR 128E and Hummer Drive is prime example of an area that should be considered for a large-scale project.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

4. Comforter Mountain

Hazard Rating: Very High

Figure 20. Overview photos of Comforter Mountain including the cistern on Ridge Road.

There is low housing density in the Comforter Mountain community at this point; lots have been platted but homes have not been built. Most of the community is within the Nederland Fire Protection District, but a section is part of Sugar Loaf Fire's response area. Because access to Comforter Mountain is from Ridge Road, it is being included as part of this CWPP. Structures are positioned on the top of the hill, with continuous grass fuels below. The homes are constructed with high fire-resistant roofs and combustible siding, but there is good defensible space that should be maintained. Utilities to the lots are buried.

Addresses are present but non-reflective. The road into the community is dirt, and it is narrow; there are no turnarounds except at the driveways. There is only one way in and out of the community, so access could be compromised if there were a fire. The road signage is inconsistent, and although usually present, it is often posted on flammable posts or the signs are made out of wood. No hydrants are located in close proximity, but there is a cistern within the community. The 30,000-gallon cistern on the east end of Ridge Road is well marked. This community is one of the furthest away from a staffed fire station. Combined with the difficulty of

traveling on the roads, response times are expected to be longer than 10 minutes. Additional risk factors in the area include lightning and extremely high winds.

Comforter Mountain experienced a 256-acre fire in June of 1976. The eastern area is still mainly void of ponderosa pines and the vegetation is almost exclusively grass. Under moderate weather conditions, the rate of spread is expected to be slow. However, this continuous grass layer could allow fire to spread much more quickly across the landscape, especially with strong winds, which are common in the area. Surface fire is likely in the grass vegetation, and individual trees may torch. With hotter conditions, higher winds and lower fuel moistures, increased flame lengths are possible, and it is likely that fire could travel into the tree crowns. There is potential for torching and active crown fire, especially in the more densely forested western part of the community.

Fuels Reduction Recommendations

- Thin along Ridge Road, removing small saplings and high-limbing larger trees. This road provides access to many residences and critical infrastructure in Nederland. Improving the road will provide for safer ingress and egress for residents and firefighters.

- Thin along Summer Road to provide safer egress for individuals and ingress for firefighters. Regeneration and limbing are recommended reduce the risk of a surface fire transitioning into the tree crowns.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the “Fuelbreak Guidelines for Forested Subdivisions & Communities” document included within Appendix A.

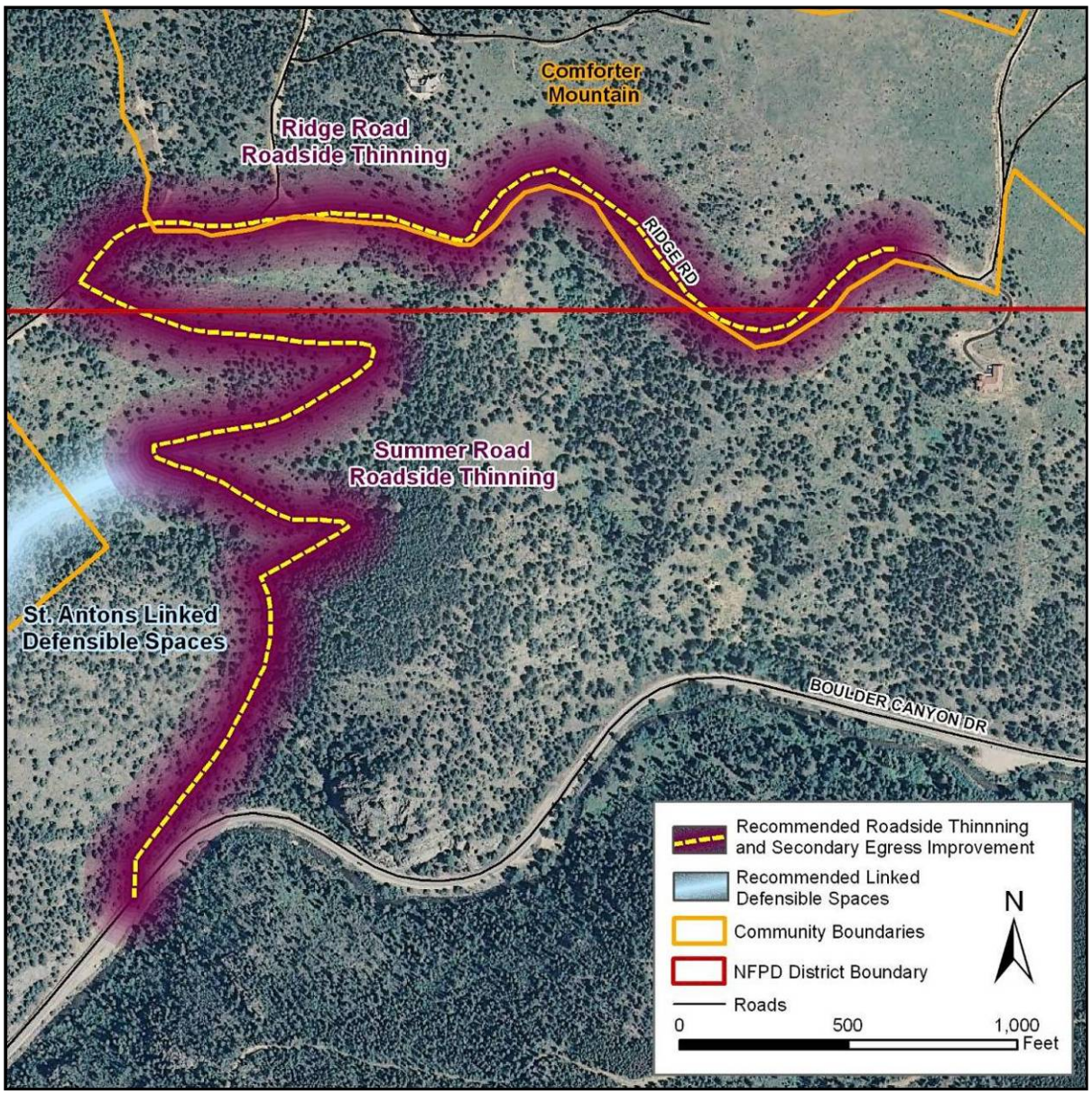


Figure 21. Recommended fuels reduction along Ridge Road and Summer Road.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

5. East Big Springs

Hazard Rating: Very High

Figure 22. Steep and narrow driveway, common in East Big Springs.

Bordering the Arapaho-Roosevelt National Forest and Big Springs, the East Big Springs community has a northwest aspect and some areas of less dense fuels than Big Springs. The slopes are steep, and there are ravines and chimneys that would intensify fire behavior. The infrastructure in East Big Springs is typical of most of Nederland: combustible siding and decks and asphalt roofs. Larger lot sizes allow for more space between structures. Very little defensible space work has been completed. Some addresses are non-reflective and made from combustible materials, some are metal and reflective and others are not present.

Distinguishing this community from several others is the single ingress/egress route and resulting distance from the fire station. Although the distance on a map is not far, accessing East Big Springs takes considerable time because the roads are steep dirt, have confusing or no signage, and have sharp curves. Except for Alpine Drive, there are few places with adequate turnarounds. Low-hanging overhead power lines span the roads, which would make fire department access difficult. Hydrants are dispersed throughout the community, but water pressure is limited and several out-of-service hydrants were noted. Clearing vegetation and using reflective marking would help make the hydrants stand out more. Fuels mitigation has been conducted by the USFS on land to the southeast of the community. Patch cuts have been created to limit fire spread from the community into the forest and to protect East Big Springs from a fire to the east.

Figure 23. Typical home construction in East Big Springs.

The dominant tree species in the community is lodgepole pine. Mountain pine beetles have been attacking larger diameter trees in the community, evident by pitch tubes and red needles. Douglas fir trees are growing in the understory, acting as ladder fuels that could potentially carry fire into the overstory and cause torching. Fire behavior in East Big Springs is likely to be similar to Big Springs but with fewer areas of active crown fire, as vegetation is not as dense in this community. The drainage between Big Springs and East Big Springs is likely to funnel fire, allowing for faster rates of spread.

Fuels Reduction Recommendations

- Thin the drainage along Alpine Court to diminish extreme fire behavior and allow for safer access and egress. Thin from below, removing smaller diameter trees and regeneration to reduce ladder fuels and decrease potential for fire spreading into the tree canopies. As a general rule, reduce basal area by 30-50%. All work should be completed in conjunction with a forester to ensure best practices.

- Additional patch cuts should be continued between existing USFS patch-cuts. This will reduce the chance of fire spreading further onto FS property.

- Tie-in USFS patch-cuts to Magnolia Road to provide for safer access and egress, as well as to limit fire spread.

- As with Big Springs, an additional escape routes was considered for the community, but analysis of the fire behavior has shown that the cost-benefit ratio of the work involved would be high relative to improving life-safety. There is a “road” from the hairpin turn on Big Springs that extends to Magnolia Road (marked by the star on the map below). It is currently blocked by large boulders. Because this drainage is extremely dense and could experience fire below the road, it is not a viable option for an additional escape.

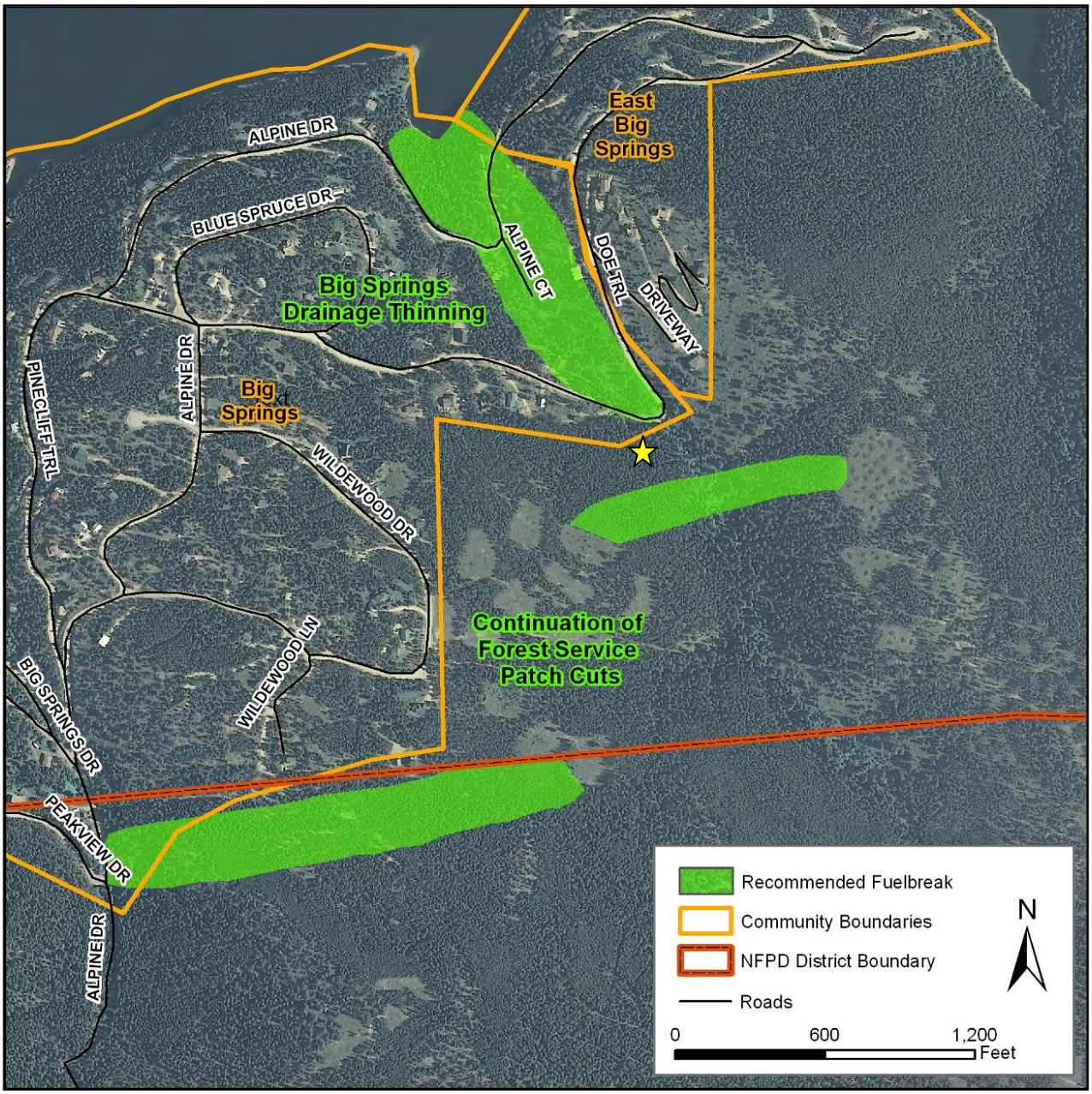


Figure 24. Map of fuels projects for East Big Springs, which is the same as for Big Springs. The star represents the considered secondary evacuation route.

General Recommendations

- Work on obtaining funding to bury overhead power lines, as ignitions are common with downed lines from high winds.

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential of extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

6. Eldora

Hazard Rating: Very High

Figure 25. Overview of the Town of Eldora

The Eldora town site sits in the bottom of Happy Valley along Middle Boulder Creek; steep, heavily forested walls rise to the north and south. Many of the cabins and buildings are quite old, dating back to the late 1890s. Defensible space is non-existent. Old siding and log construction is common, especially with historic buildings. Many of the roofs have been replaced and are fire-resistant asphalt or metal. Lot sizes under an acre are a result of larger mining claims being subdivided and sold to individuals as mining prospects diminished. The structures are close together and often have dense trees and vegetation between them. Home-to-home ignition is a concern because of the close proximity and lack of defensible space.

Address markers are non-reflective and difficult to see. There is only one way in and out of the town of Eldora, a paved road that turns to narrow dirt. Side streets are unpaved. In addition to being less than 20 feet wide, the roads through town are not always maintained. Some road markers are metal and reflective, but others are wood and non-reflective. This, in combination with poor road conditions could make travel through town slow and difficult for fire apparatus. Although there is a fire station on Eldorado Avenue, it is staffed with volunteers only. Response time to a wildland fire could be prolonged, since the on-duty crews would be responding from Nederland. There are no municipal hydrants in the town of Eldora. Drafting from Middle Boulder Creek may be an option, and a 15,000-gallon cistern is attached to a hydrant on the western

end of the paved portion of the main road. Historical standing needs to be considered when work is done to improve structures, including new roofs, windows or siding.

There is dense forest surrounding Eldora. Within the valley bottom, small groves of small-diameter aspen line many of the streets, and much of the area is grass. Within the town, some conifer trees have been planted in yards and directly impinge upon the cabins. The slopes to the north, south and west are heavily forested with various conifer species, including ponderosa pine, lodgepole pine, Engelmann spruce and Douglas fir. The topographic position of the community makes for a wet valley bottom. Fire behavior is not expected to be extreme because the vegetation is wet on the north slopes. Lack of ground fuels and ladder fuels reduce the risk of torching and active crown fire. Grass may burn under moderate or extreme weather scenarios, but the mostly flat aspect would limit the rate of spread. High winds and steep topography could lead to extreme fire behavior on the slopes around the town. Adequate defensible space should be sufficient to control fire from impacting cabins and homes.

Fuel Reduction Recommendations

- No specific fuel reduction project is recommended for Eldora. This does not mean that there are not projects that could be established, but from the initial assessment, defensible space and home construction is the most beneficial action that the community/planning area can pursue.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the “Fuelbreak Guidelines for Forested Subdivisions & Communities” document included within Appendix A.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Organize community-based “forest watch” program to mitigate risk from abandoned campfires.

- Work with USFS in patrol and enforcement of campfire issues and burn ban regulations.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

7. Five Points

Hazard Rating: Very High

The Five Points community is named for the intersection of five roads within the study area: CR 128, CR128N, CR 128W, CR 126 and Caribou Road. The housing density within the community is low, but there are a few clusters of homes with variable construction. Newer structures are much larger and have defensible space; older homes/trailers do not. Many of the older structures are trailers that have been brought onto the property. The siding on the houses is combustible, and there are some open decks, but the roofs are asphalt shingle. Utility lines run above ground over the roads.

None of the roads are paved and the level of road maintenance varies. The wider roads are generally 20-24 feet across and have less tree cover encroaching the right-of-way. Several of the more narrow roads have dense trees on either side, and the roads are less than 20 feet across, making access difficult. The longer driveways are often steep, and adequate turnarounds do not exist except at the intersection of the five roads. Liquid propane tanks are an additional hazard within the community, especially since not all are stored clear of vegetation. There is a 30,000-gallon cistern located at the intersection of the five major roads mentioned above.

Figure 26. There is a variety of homes in Five Points, as shown in the two photos above.

Lodgepole pines are dense on the north aspect. Understory vegetation is thick, which would act as a ladder fuel, potentially carrying fire into the crowns of the lodgepole. The south aspect has lighter, flashier fuels, such as grass. Surface fire and small areas of torching are predicted with both moderate and extreme weather events. Rates of spread would be higher on the grassy south aspect than in timber. Along the steepest southwest drainages, long flame lengths, greater than would be approached by firefighters, would be expected during extreme weather conditions. These weather conditions would also promote torching and potentially active crown fire. To the west of the community, more active fire behavior would be expected, but a fire would most likely back into the community, rather than make an uphill run into it, thus limiting fire intensity.

Fuels Reduction Recommendations

- Vegetation along the roads within the community is thick. Larger trees should be high-limbed and seedlings and saplings should be removed to provide better access and egress for firefighters and residents. This would reduce the risk of crown fire by removing the ladder fuels. Thinning should also include County Road 128 N.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

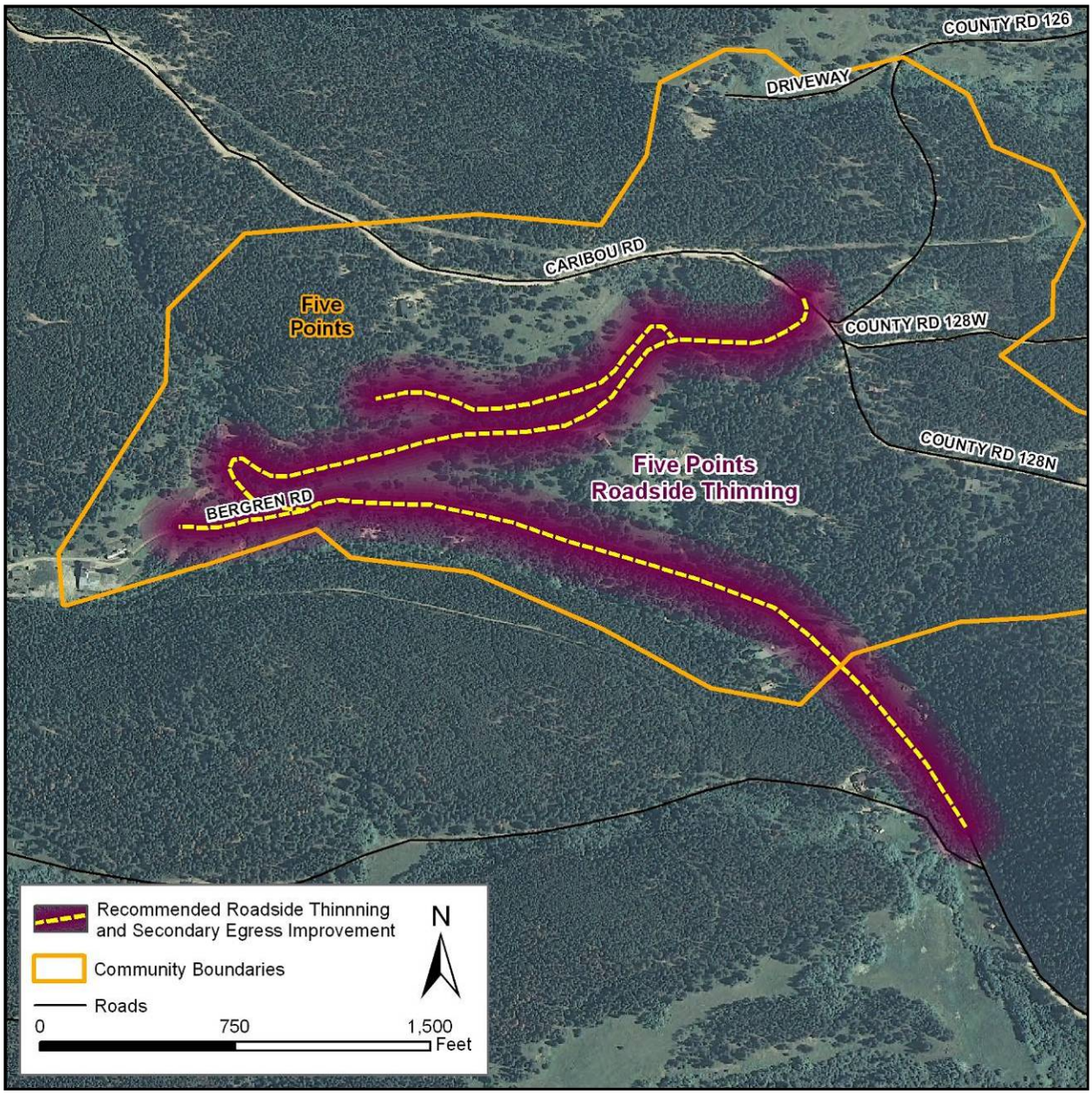


Figure 27. Areas where roadside thinning in the Five Points area would be beneficial.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially those located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be kept clean of flammable materials, especially where such openings are located on slopes above heavy fuels.

- Clean leaf and needle litter form roofs and gutters and away from foundations.

- Discourage planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

8. Haul Road

Hazard Rating: Very High

Figure 28. Non-reflective road signs and typical homes in the Haul Road area.

Figure 29. Typical home construction and some defensible space work along Haul Road.

Housing density in the Haul Road community is low, but the area experiences a high volume of people passing through as a result of access to mountain biking, hiking, and camping that require traveling through the community. There is a trailhead at the intersection of Haul Road and Colorado Highway 119, and the area adjacent to the west is U.S. Forest Service land. Unattended campfires pose a risk of starting a wildfire and spreading into the community. Lot sizes are typically under an acre. The houses in the community have combustible siding and generally asphalt shingle roofs. Overall, little defensible space has been completed around most of the properties, but there are some that have cut trees and cleared the vegetation directly next to the house. Utility lines are above ground for much of the area, and then run underground to the structures.

While present, addresses are not generally reflective and difficult to see at night or in smoky conditions. Well-maintained dirt roads are the only access to the community, and Haul Road is the single point of access and egress. Evacuations during a fire are likely to be complicated by the number of people using a single egress. Most of Haul Road is 20-24 feet wide and relatively flat, but driveways and private roads are steep and less than 15 feet wide. Road signs can be confusing, especially since Haul Road begins as CR 132W. There are no hydrants in the community, only home cisterns and a 10,000-gallon cistern at the east end of Haul Road.

The dominant tree species in the community is lodgepole pine. Dense canopy closure has limited understory growth. The lodgepole stands in the area are currently being attacked by

mountain pine beetles. Many of the trees have been attacked as evident by the red needles. Needle loss, and as a result, loss off crown fuels will be expected within the next three to five years. Until the needles have fallen off of the trees, however, the trees can ignite easily and burn rapidly. A lack of ladder fuels in the understory minimizes the potential transfer of fire into the tree crowns, so, crowning would not be expected during moderate weather conditions. Only during exceptionally high winds and temperatures are more extreme fire behavior forecasted. Camping sites in the area increase the risk of ignition from a campfire.

Fuel Reduction Recommendations

- Remove dead lodgepole pines as they begin to fade in order reduce the risk of ignition and chance of a hazard tree falling and injuring bikers, campers and hikers in the area.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

General Recommendations

- Adequate defensible space is recommended for all homes. Please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

9. St. Antons

Hazard Rating: Very High

Figure 30. Typical home construction and vegetation in St. Antons.

Located along Ridge Road, St. Antons incorporates structures on Cougar Run and Rocky Knob Lane. The structures are well built, having high fire resistant asphalt roofs and combustible siding. Combustible decks have open space underneath that should be cleaned out regularly. Defensible space has been completed for some of the homes on Shady Hollow, but in general, it is lacking. Addresses are non-reflective, making response difficult at night or when visibility may be limited because of smoke. Utility lines run above ground, often hanging low across roads. Homes have liquid propane gas tanks used for central heating.

There are multiple ways in and out of St. Antons, but they are along narrow (less than 20 feet) dirt roads. Summer Road, to the east of the community, is a major commuter route and is maintained by an HOA. As a result, it is an important evacuation route that the community is likely to use. Because of the dense vegetation along the side of the road, however, it should not be relied upon as a secondary evacuation route unless the trees are limbed and thinned. Narrow roads would make turning around difficult for fire apparatus; intersections and some driveways provide the only places to turn around. As with addresses, street signs are often not reflective. No fire hydrants are present in St. Antons. There is a 30,000-gallon cistern along Ridge Road, but it serves a larger area than just the community. Water supply and turn-around time for fire equipment may be long.

The fuels in the community are variable. Along Ridge Road and downhill to the south, trees are less dense and there is a higher grass component. The area north of Ridge Road has denser stands of trees, including ponderosa pine and some lodgepole. Dwarf mistletoe is causing deformation on many of the ponderosa pines, so these are likely candidates for removal from a forest health perspective. Increased mountain pine beetle presence is expected over the next several years. Ignitions may occur from the highway, but the cliff walls of the canyon limit fire spread into St. Antons. A fire starting near one of the homes on the slope could allow flames to spread quickly to uphill structures through ember cast. Under extreme weather conditions, increased rates of spread and flame lengths are predicted, especially north of Ridge Road.

Fuels Reduction Recommendations

- Maintain and extend the clearing along the existing power line cut. Regeneration within the current power line cut should be removed. Greater crown spacing should be maintained close to the power line. Crown spacing can become tighter further from the power lines to create a feathering effect within the treatment area. This will help prevent a wildfire from entering the community from the north, as well as help control a fire from spreading if it started within the community.

- Residents in the community should work together with neighbors when implementing defensible space. Multiple defensible spaces around homes linked together will act as a larger, more extensive fuelbreak. This is most important for the properties closest uphill to Colorado Highway 119, as the highway is the largest ignition source.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the “Fuelbreak Guidelines for Forested Subdivisions & Communities” document included within Appendix A.

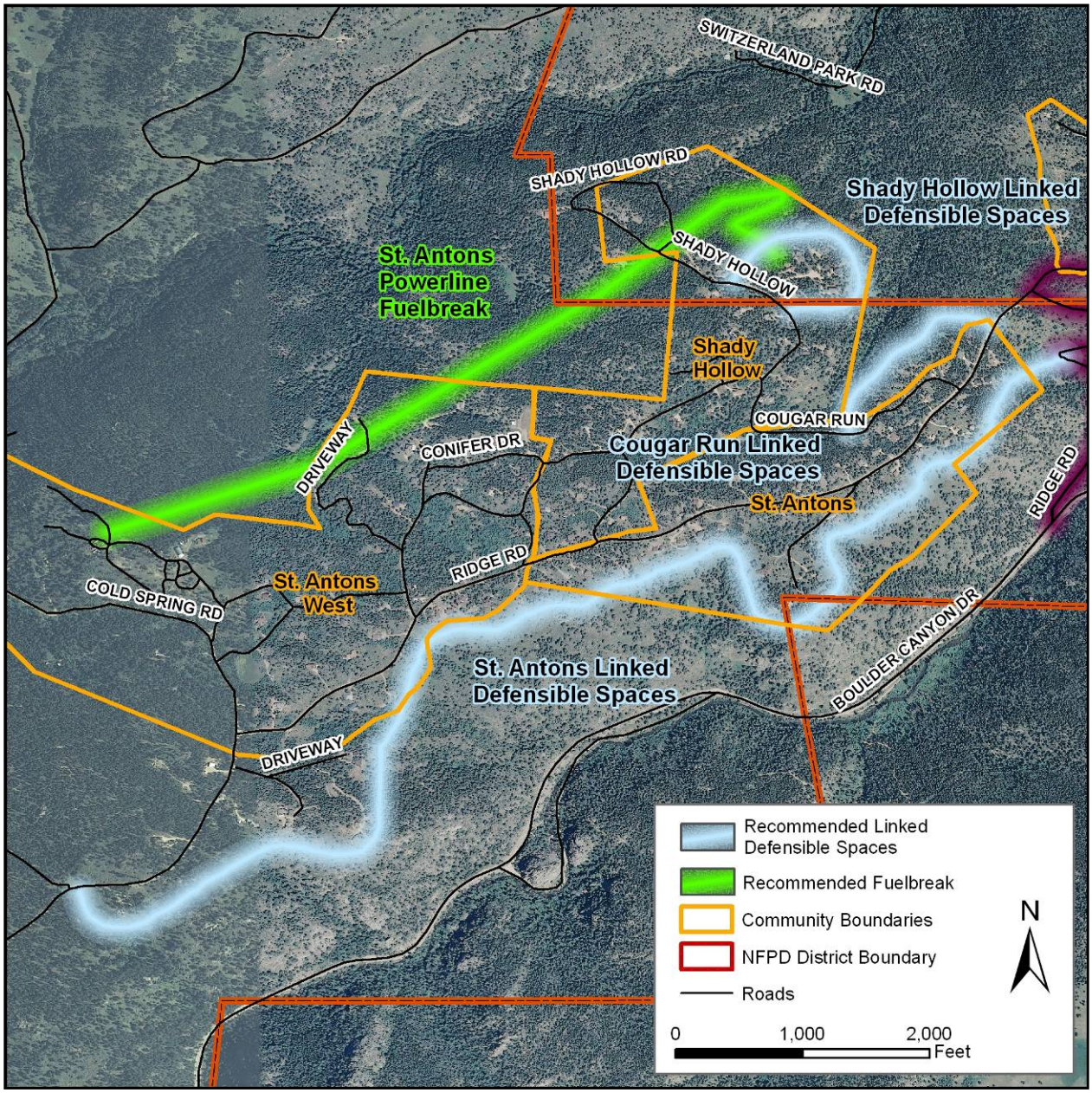


Figure 31. Map of recommended linked defensible space and fuelbreaks within St. Antons, St. Antons West, and Shady Hollow.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

10. St. Antons West

Hazard Rating: Very High

Figure 32. Reflective, but confusing address markers.

St. Antons West is a dispersed community with approximately 50 homes. Steep slopes rise from Boulder Canyon, and St. Antons West is located on top of the hill. Ridge Road is the main road through the community; other roads include Thunder Ridge Road South and CR 128 East. Located on lots under an acre, the homes have combustible siding and asphalt shingle roofs. Address markers are not reflective. Some areas have group addressing that is reflective, but it is difficult to assess which house corresponds to what address. All of the utility lines run above ground and liquid propane tanks are present. There are multiple ingress and egress routes in St. Antons West that make resident evacuation and fire department access easier during a wildland fire.

With the exception of Ridge Road, roads are dirt and less than 20 feet across, which can limit the type of equipment that is able to respond. Although some roads have reflective signage, most signs are constructed of wood and white paint. Because of the narrow roads and inadequate signage, it is difficult to determine roads from driveways. The only turnarounds available are via private driveways. Individual home cisterns are present, and there are larger cisterns along Ridge Road. There are no hydrants within the community.

Figure 33. Home with good defensible space.

The vegetation in the community is primarily lodgepole pine, ponderosa pine, and aspen. Surface vegetation is discontinuous, so fire spread across the forest floor would be limited. Predicted fire behavior in St. Antons West is not as extreme as St. Antons because there are not as many steep slopes and ravines. The flatter topography of this community would limit the rate of spread. Ladder fuels in the understory provide extension into the tree canopies throughout the community. The undeveloped area to the north of St. Antons West would likely have tree torching even under moderate weather conditions, and as a result, a wind-driven fire could spread from this direction into the community.

Fuels Reduction Recommendations

- Maintain and extend the clearing along the existing power line cut. Regeneration within the current power line cut should be removed. Greater crown spacing should be maintained close to the power line. Crown spacing can become tighter further from the power lines to create a feathering effect within the treatment area. This will help prevent a wildfire from entering the community from the north as well as help control a fire from spreading if it started from within the community.

- Residents in the community should work together with neighbors when implementing defensible space. Multiple defensible spaces around homes linked together will act as a larger, more extensive fuelbreak. This is most important for the properties closest uphill to Colorado Highway 119, which is the largest potential ignition source.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the “Fuelbreak Guidelines for Forested Subdivisions & Communities” document included within Appendix A.

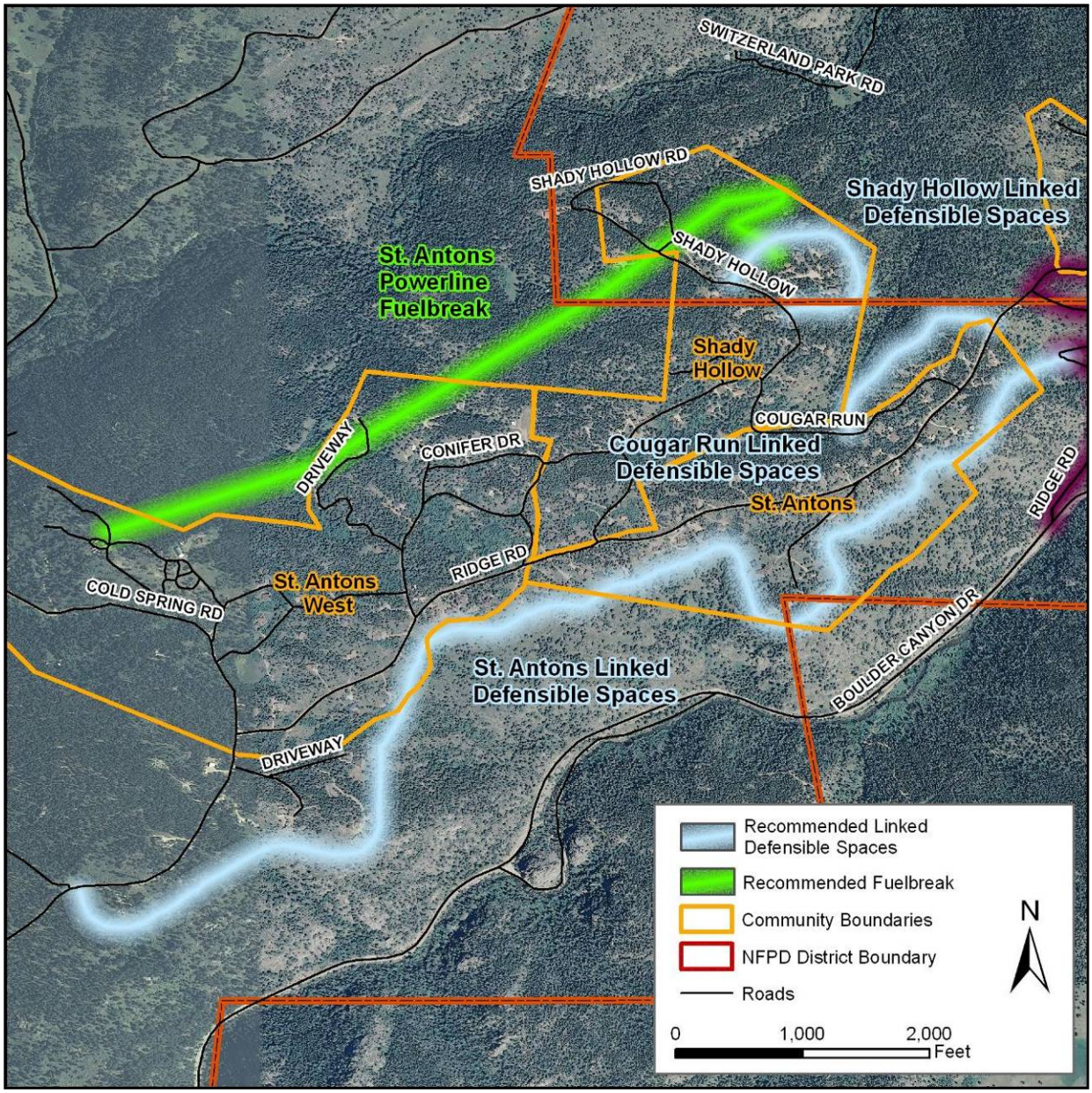


Figure 34. Map of recommended linked defensible space and fuelbreaks within St. Antons, St. Antons West, and Shady Hollow.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential of extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

11. Shady Hollow

Hazard Rating: Very High

Figure 35. Homes and vegetation in Shady Hollow area.

Shady Hollow is north of the St. Antons community and east of St. Antons West. Access to the community is from Ridge Road via Cougar Run or Conifer Drive and traveling through adjacent communities. Parcels are forested and under an acre. There are approximately 40 homes in the community that have combustible wood siding and asphalt roofs. There are open areas under decks and wood stacked in close proximity to the homes. Although there has been some cutting for development, solid defensible space work has not been completed for most structures. All of the utilities are above ground and propane is used for central heating.

A few houses have reflective house numbers for addressing but most do not. Roads are less than 20 feet wide and are not paved. Combustible wood signs are being used for road signs and are not reflective. The road grade is under 10%, which allows for easier access and egress. Adequate turnarounds are only available by using private driveways and intersections; they are not provided along the roads. Water availability is limited since there are no hydrants. A 2,400-gallon cistern is located on Cougar Drive.

Fuels within Shady Hollow are diverse. Overstory species include ponderosa and lodgepole pine. Within the area, Douglas firs are growing in the understory, and there are patches of aspen throughout. Ground cover is sparse, consisting of needle litter and some common juniper. The flatter sections of the community have continuous canopy cover except for around

structures. South and southeast aspects have higher grass components and more light, flashy fuels, capable of higher rates of spread than the forested areas. High winds and low relative humidity is expected to drive fires along Shady Hollow Drive as it turns north. Drainages to the east and north could generate significant fire behavior, capable of either spreading directly into the community or through ember cast.

Fuels Reduction Recommendations

- Maintain and extend the clearing along the existing power line cut. Regeneration within the current power line cut should be removed. Greater crown spacing should be maintained close to the power line. Crown spacing can become tighter further from the power lines to create a feathering effect within the treatment area. This will help prevent a wildfire from entering the community from the north as well as help control a fire from spreading if it started from within the community.

- Residents in the community should work together with neighbors when implementing defensible space. Multiple defensible spaces around homes linked together will act as a larger, more extensive fuelbreak. This is most important for the properties closest uphill to Colorado Highway 119, which the largest ignition source.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the “Fuelbreak Guidelines for Forested Subdivisions & Communities” document included within Appendix A.

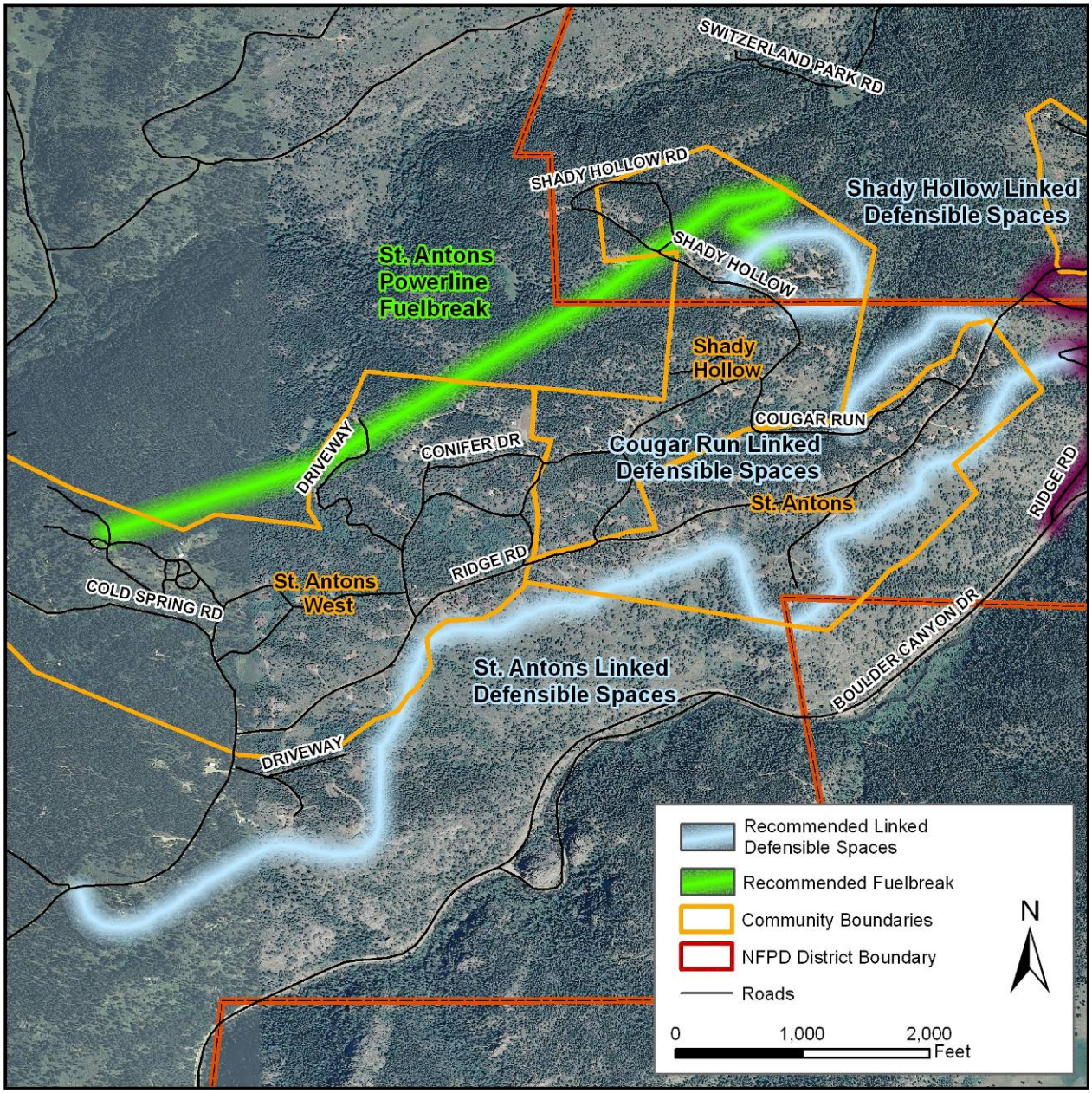


Figure 36. Map showing the fuel break and linked defensible spaces for the Shady Hollow area.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

- A large-animal evacuation plan should be developed where applicable.

12. Whispering Pines

Hazard Rating: Very High

Figure 37. Homes and vegetation in Whispering Pines Area.

The community of Whispering Pines is situated along the north side of Boulder Canyon, above Colorado Highway 119 and has a south aspect. Many of the homes in the community have been built more recently compared to other areas in Nederland. As a result, the roofs are typically metal or other materials that are highly resistant to burning, and there is adequate defensible space around the houses. The siding and decks are made out of combustible materials, but some homes have non-combustible siding, such as stucco. The decks are open below and some have flammable materials stored underneath.

Addressing is not always present, and when it is, is often non-reflective and created out of combustible materials. Structures sit at the top of steep hills and in saddles. The road network consists of narrow, steep, dirt roads that are not grated regularly. Roads are not adequately labeled and can be confusing. Low-hanging utility lines and vegetation directly along the roadway pose an additional threat for emergency response and for residential egress. Water supply is available through individual cisterns for the homes, but there are no hydrants.

The south aspect of the Whispering Pines community receives sunlight for the majority of the day, leading to high quantities of grassy fuels and dispersed ponderosa pines. Douglas fir and aspen are intermixed in the drainages; however, much of the aspen is small and diseased. At

higher elevations, dense areas of lodgepole pine are present. Mistletoe is visible in both the lodgepole and ponderosa pines. Fire spread is likely to be fast uphill. Ignitions from Boulder Canyon are less of a concern because of cliff faces that are void of vegetation that would be capable of moving the fire uphill. The most extreme fire behavior would be expected at the top of hill along the Switzerland Trail road: higher flame lengths, greater rates of spread and more crown fire activity is expected in this area.

Fuels Reduction Recommendations

- Thin the drainage to the west of Tungsten Road to create a safer evacuation route. Focus on removing regeneration and small-diameter trees. Basal area should be reduced by 30-50%.

- Grade Tungsten Road frequently during summer months to facilitate easier access and egress.

- Thin vegetation along Switzerland Trail and Horseshoe Place to minimize extreme fire behavior.

- Use the existing power line thinning, working uphill to widen the existing cut. Continue to thin trees from the cut.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the “Fuelbreak Guidelines for Forested Subdivisions & Communities” document included within Appendix A.

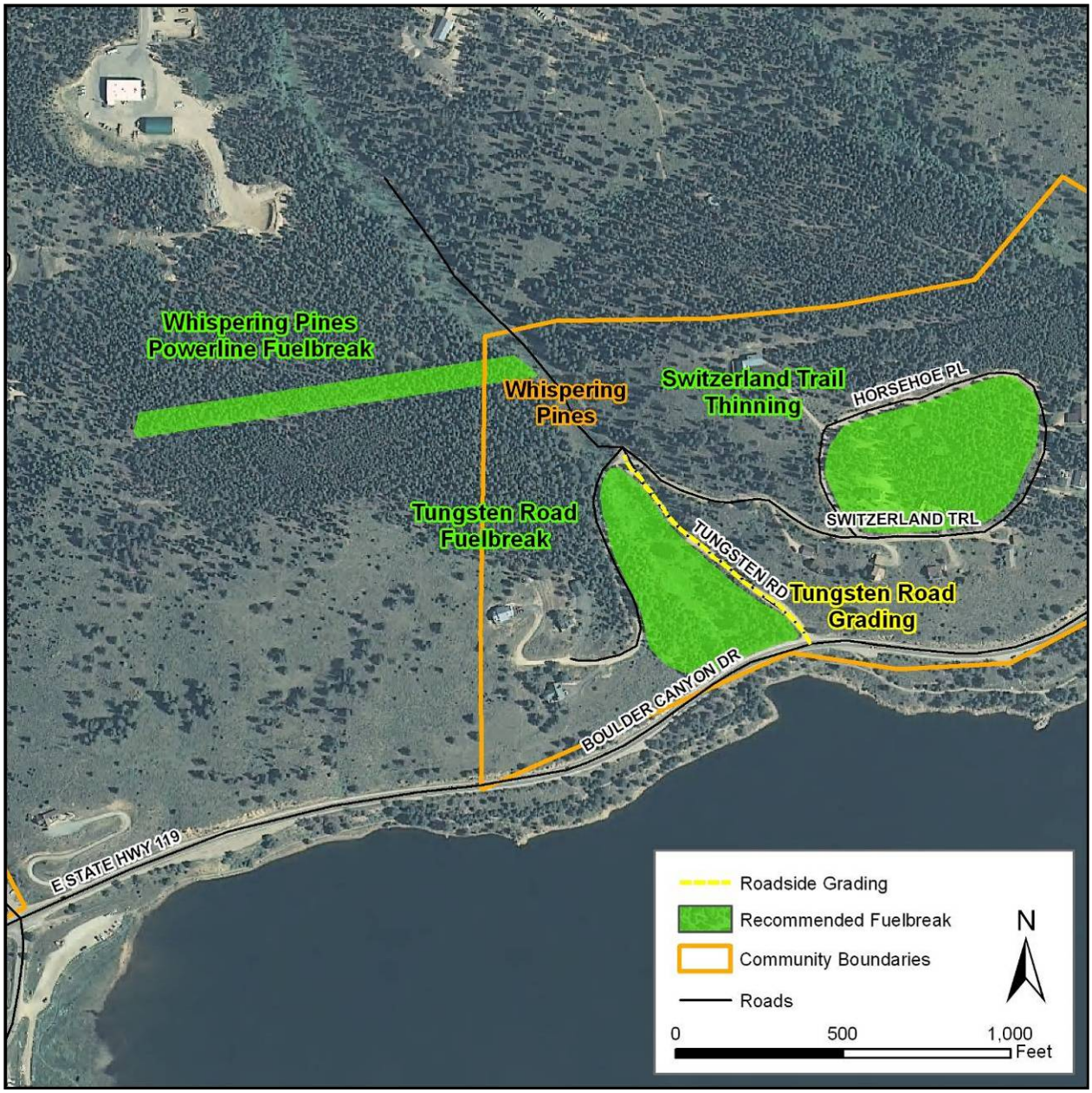


Figure 38. Multiple fuelbreaks and road grading for the Whispering Pines area.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

13. Beaver Creek

Hazard Rating: High

Figure 39. Beaver Creek is mostly grass vegetation with forested areas on hillsides.

Beaver Creek is northwest of downtown Nederland, behind Fire Station No. 1. The topography is generally flat, with steep north-facing slopes along the southern border. Roads within the community are narrow, frequently less than 20 feet across and are dirt. There are two ways in and out of the community, which provides more options for an evacuation during a wildfire. Intersections are missing road signs in multiple locations, and several of the signs that are present are mounted on combustible posts made out of wood. Lot sizes are larger in this community than many of the others within the NFPD, often more than an acre in size. Houses have combustible siding and decks and asphalt shingle roofing. A few homes still have highly flammable shake shingle roofs and wood siding. Little work has been completed towards defensible space. Overhead utilities and propane tanks are found throughout the community. Some structures have individual cisterns, and the majority of the community is within close proximity of fire hydrants within the town of Nederland; however, hydrants are not always consistent in terms of pressure and whether they function properly.

Figure 40. Unmarked intersection in Beaver Creek area.

The north-facing slopes above the community are heavily forested with ponderosa and lodgepole pine, while the community itself has a large grass component. Since Beaver Creek sits in the bottom of drainage, it is fairly wet and not as likely to burn. A backing fire would be most likely, and as a result, extreme fire behavior, including active crown fire, is not predicted. Drought conditions combined with extreme weather could generate long flame lengths in the timber, but it is unlikely to spread into the community. The grass fuels will provide for fast rates of spread but lower flame lengths and less intensity than the forested areas. Fine grass fuels still pose a great threat to structures, especially if there is debris and firewood directly abutting them.

Fuel Reduction Recommendations

- No specific fuel reduction project is recommended for Beaver Creek. This does not mean that there are not projects that could be established, but from the initial assessment, defensible space and home construction is the most beneficial action that the community/planning area can pursue.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

14. Hurricane Hill

Hazard Rating: High

The Hurricane Hill community can be accessed from both Boulder Canyon and Ridge Road. Road names and access can be confusing considering Hurricane Hill is referred to as CR 128S on most maps. The dirt and paved roads have sections with slopes greater than 10%, and they are 20-24 feet wide. There are adequate turnarounds for emergency vehicles, but some sections are not well maintained. Most lots are under an acre, and the homes have asphalt roofs with high fire resistance. As with most of the homes in Nederland, the siding and deck materials are wood, which can easily ignite the main building. Newer structures have defensible space, but older homes typically do not. Houses within the community are built at the top of drainages, in saddles, and on steep slopes.

Combined with inconsistent road signage, non-reflective or absent addressing, navigating the community can be complicated. Utilities are above ground, overhanging the roads, which limits fire apparatus access. Liquid propane gas tanks provide an additional risk when vegetation is not cleared around them. There are no hydrants in the community, only individual home cisterns.

Ponderosa pine is the dominant tree species throughout the community. The surface vegetation is fairly continuous because of the large quantity of grasses. Douglas firs growing from the understory act as ladder fuels to allow fire transition into the tree crowns of the larger, more mature trees. Ignitions from Boulder Canyon are less of a concern because of cliff faces that are void of vegetation capable of moving a fire uphill. The more dense stands of trees are more likely to experience individual torching, while in the open areas, surface fire is unlikely to move into individual tree canopies.

Figure 41. Homes with various amounts of defensible space work done on the property.

Fuels Reduction Recommendations

- Thin forested areas in the drainage between Bonanza and Hurricane Hill. Trees should be high-limbed and slash removed from the drainage. Remove small-diameter and diseased trees first. The goal is to increase crown spacing in the drainage to reduce the risk of active crown fire that would threaten the values-at-risk.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

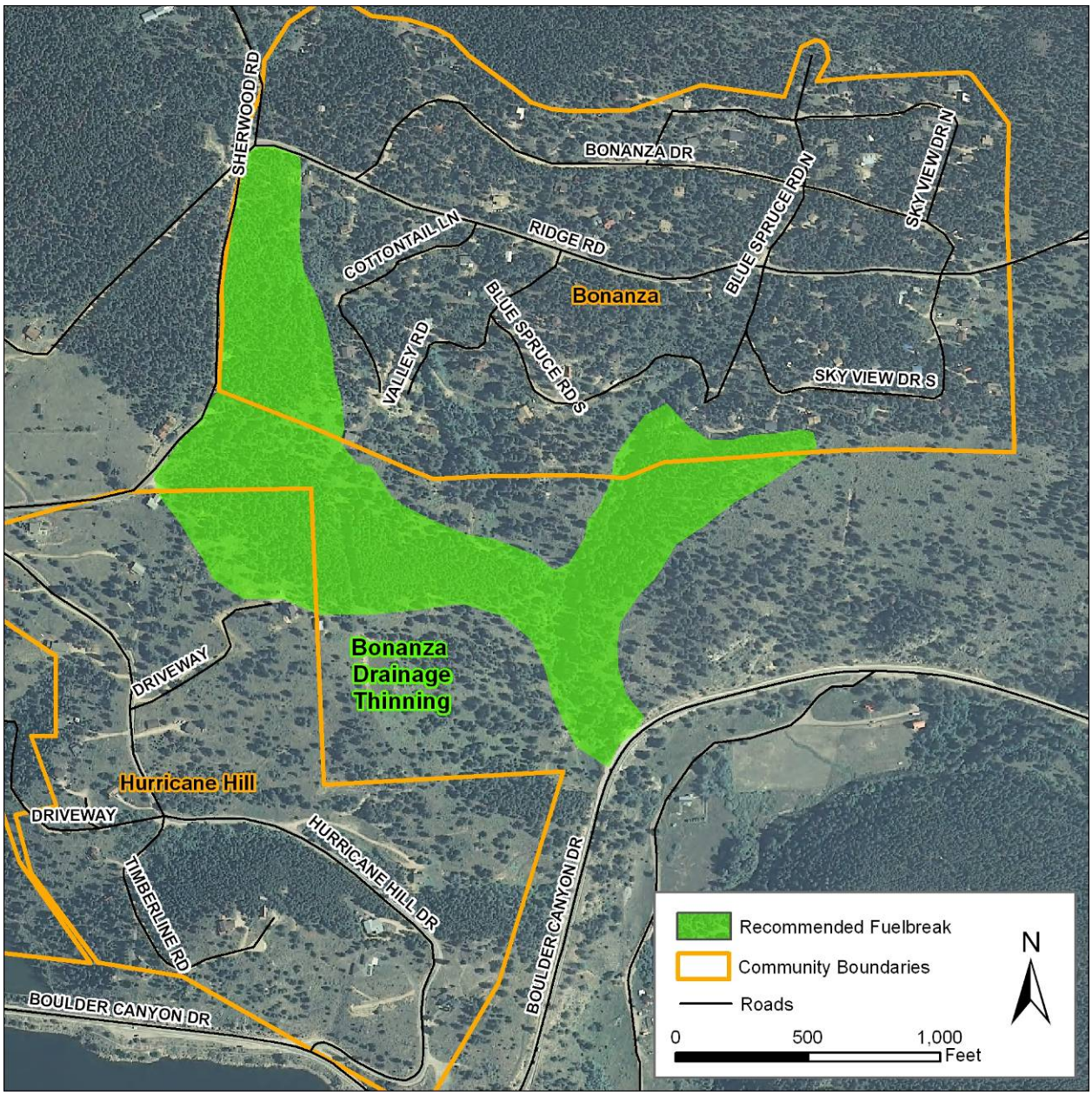


Figure 42. The drainage between Bonanza and Hurricane Hill that needs to be treated to reduce extreme fire behavior.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

15. Indian Peaks/Caribou Ridge

Hazard Rating: High

Figure 43. General home construction and some defensible space done in the Indian Peaks area.

The Indian Peaks/Caribou Ridge community sits at the top of a hill above Sunnyside and directly to the west of the Peak to Peak Highway. County Road 128 N and Sundown Trail are the main roads. Homes within the community are primarily newer construction: siding is primarily combustible, the roofs are asphalt, and some trees have been removed during construction. Some homeowners have worked on additional defensible space for their property, but other residents have not completed any work. The lot sizes are around an acre.

Non-reflective addressing is common, which makes homes difficult to locate at night or in smoky conditions. Some roads are paved and others are well-maintained dirt. Road signs are 4 inches high and reflective at some intersections, but completely absent in others. Liquid propane gas tanks are on properties, so vegetation should be cleared around the tanks. Caribou Ridge has lots that have been cleared but not developed. There are additional lots that could be developed, and any new structures built will have to follow Boulder County codes for buildings in the urban interface.

Because the area to the south of the community is developed, there is not continuous vegetation that would allow for active crown fire to spread into the community. Lodgepole and ponderosa pine are the most common species, and ground vegetation is sparse. It would be difficult for fire to get enough momentum to spread into the community. The most likely scenario would entail a structure fire igniting the surrounding forest. Within the community, if a fire were to get into the tree canopies, there is potential for torching and active crowning in a few areas. The most significant fire behavior would be expected in the vicinity of the loop on Sundown Trail. Boulder County Parks and Open Space has done extensive mitigation work adjacent to the community in the Mud Lake project area, which could help reduce the wildfire risk to the Indian Peaks/Caribou Ridge planning area.

Fuel Reduction Recommendations

- No specific fuel reduction project is recommended for Indian Peaks/Caribou Ridge. This does not mean that there are not projects that could be established, but from the initial assessment, defensible space and home construction is the most beneficial action that the community/planning area can pursue.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

16. North Nederland

Hazard Rating: High

Figure 44. Residential and commercial areas in the North Nederland community/planning area.

The area delineated as North Nederland comprises the more developed area within the NFPD. The Sunny Side subdivision is further to the north, and the bridge delineates its southern boundary. There are both homes and commercial buildings within the area, but some of the overall building characteristics between the two are similar. Lot sizes are typically under an acre, and the homes are some of the oldest construction in the study area. Most of the roofs are asphalt shingle, so they have high fire resistance. Siding is wood, as well are the decks. Other than clearing for the building, defensible space work has not been completed. Utilities to the homes and businesses are run above ground.

Addressing for all structures is generally non-reflective and built using combustible materials. Several roads are paved, but most are well-maintained dirt. Road widths are generally 20-24 feet, which can create access and egress issues, especially during the summer months when there are a significant number of people recreating in the area. Paved roads are well-marked with 4-inch reflective road signs. In contrast, dirt roads are regularly marked with wooden signs that are not visible at night, especially in smoky conditions. Unlike many of the communities, reliable hydrants are present throughout the North Nederland community.

There are not continuous fuels within this community. Ponderosa pine, blue spruce and other conifers have been planted in yards between houses. A house fire could ignite vegetation

surrounding the house and spread easily to the adjacent structure. As a result, home-to-home ignitions are of greater concern than an actual wildland fire. The southwest portion of the North Nederland does have fewer commercial buildings and development, so the forest vegetation is denser. In these areas, longer flame lengths are predicted, as well as more intense fires and more potential for torching and active crown fire.

Fuel Reduction Recommendations

- No specific fuel reduction project is recommended for North Nederland. This does not mean that there are not projects that could be established, but from the initial assessment, defensible space and home construction is the most beneficial action that the community/planning area can pursue.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

General Recommendations

- A second bridge or paved stream crossing across Boulder Creek is important for egress of residents and ingress of fire resources in case of a wildland fire.

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

17. Sunnyside

Hazard Rating: High

Figure 45. Examples of defensible space work in Sunnyside. Additional work is still required on some properties.

The community referred to as Sunnyside sits below Indian Peaks/Caribou Ridge and is bordered by Colorado Highway 72 to the west. The more developed area within town forms the southern boundary. Housing density in this community is higher than Indian Peaks/Caribou Ridge. Houses are older in this community, have combustible siding and asphalt shingle roofing. Areas under decks are open with flammable vegetation and storage. Defensible space cutting has been completed on several properties, and a few residents have completed additional forest health thinning. The majority of the parcels are around an acre in size and others less than 3 acres.

Home addresses may be difficult to read at night or in smoky conditions because they are not reflective. One of the greatest values-at-risk in this area is the elementary school. Evacuation for the school is critical. Depending on fire location, the school may also be used as an evacuation center. Utilities to the structures are above ground, often hanging over the roads. Liquid propane gas tanks are present, so vegetation should be cleared around the tanks. The road network consists of dirt roads throughout. Although well-maintained, navigation within the community can be difficult as a result of steep grades and vague road signage. Additionally, most of the signs are wooden, making them combustible if a fire were to occur in the community. There are multiple ways in and out of Sunnyside, either on Navajo Trail to Colorado Highway 72 or West 5th Street to Forest Road. Road widths are 20-24 feet and provide

adequate turnarounds for fire equipment if driveways are utilized. Unlike many of the communities in the study area, Sunnyside has water available via hydrants.

Ponderosa pines are the dominant tree species. Understory is largely native grasses and shrubs such as common juniper, which is typical of south-facing slopes. Fuel continuity is patchy, with low surface loading and little fuel available to carry fuels into tree canopies. There are multiple ravines and chimneys that have heavier fuels, including regeneration that could funnel fire to structures. Most of the homes sit along the sloped hill. Under moderate weather conditions, torching of individual trees is predicted, but active crown fire is not. Higher wind speeds and higher temperatures may allow for active crowning and long flame lengths.

Fuel Reduction Recommendations

- No specific fuel reduction project is recommended for Sunnyside. This does not mean that there are not projects that could be established, but from the initial assessment, defensible space and home construction is the most beneficial action that the community/planning area can pursue.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the “Fuelbreak Guidelines for Forested Subdivisions & Communities” document included within Appendix A.

General Recommendations

- Depending on the time of year, ensure that there is an evacuation plan in place for the school. Assuming fire is not threatening the school, consider using it as a meeting place for community members or as an incident command post/staging area for fire personnel.

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

18. South Nederland (Old Town)

Hazard Rating: High

Figure 46. Typical home construction, lack of defensible space, and non-reflective road signs.

Middle Boulder Creek forms the north border of this community. South Nederland, commonly referred to as "Old Town," is more developed than other communities within the study area and has some of the oldest structures. Houses are built extremely close to one another, frequently with less than 10 feet between them. The largest concern in the community stems from a combination of dense lots and lack of vegetation clearing; a wildland or structure fire could easily ignite neighboring homes. Roofs are asphalt shingle, which has high fire resistance, though the siding is flammable. No defensible space has been completed on any of the properties. Ground vegetation has typically not been cleared around propane tanks either.

Addresses are difficult to read and sometimes not present. Although this area is considered more developed than many of the other communities in the district, the roads are dirt and less than 20 feet wide. Street signs are inconsistent; some are metal and reflective, but most are wooden. In general, the area is fairly flat. Water supply is available via fire hydrants spaced throughout the community.

There are not continuous fuels within the community. Ponderosa pines, blue spruce and other conifers have been planted in yards between houses. A house fire could ignite vegetation surrounding houses and spread easily to adjacent structures. As a result, home-to-home

ignitions are of greater concern than an actual wildland fire. The northwest portion of the community is less developed and has more forested areas, including a riparian corridor. Fire behavior within the non-riparian stands will likely have longer flame lengths and a higher probability of torching and active crowning.

Fuel Reduction Recommendations

- No specific fuel reduction project is recommended for South Nederland. This does not mean that there are not projects that could be established, but from the initial assessment, defensible space and home construction is the most beneficial action that the community/planning area can pursue.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

General Recommendations

- Adequate defensible space is recommended for all homes. Please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

Timberline Fire Protection District

TFPD is primarily responsible for property in Gilpin County; however, they also respond to the southern border of Boulder County and along parts of Magnolia Road. The Boulder County response area is included in this report because it was not completed with the Gilpin County CWPP. The area is defined as the private property along between Mile Marker 5 to Mile Marker 9 on Magnolia Road, encompassing an estimated 4,000 acres of forests, meadows and wetlands. The land surrounding the area consists of areas owned and administered by the Arapahoe and Roosevelt National Forests, Boulder County Parks and Open Space and Denver Water. Within the area, aspen, ponderosa pine, Doulas fir, lodgepole pine and mixed conifer forests are present. Small meadows and wetland areas are also found. There are approximately 425 private owners, of which an estimated 255 are year-round residents.

Extreme	Very High	Unrated
CR 99/Beaver Creek Road	Lazy Z Pine Glade/Upper CR 68 Porter Ranch/Twin Sisters	Pinecliffe

Table 5. Community hazard ratings within TFPD

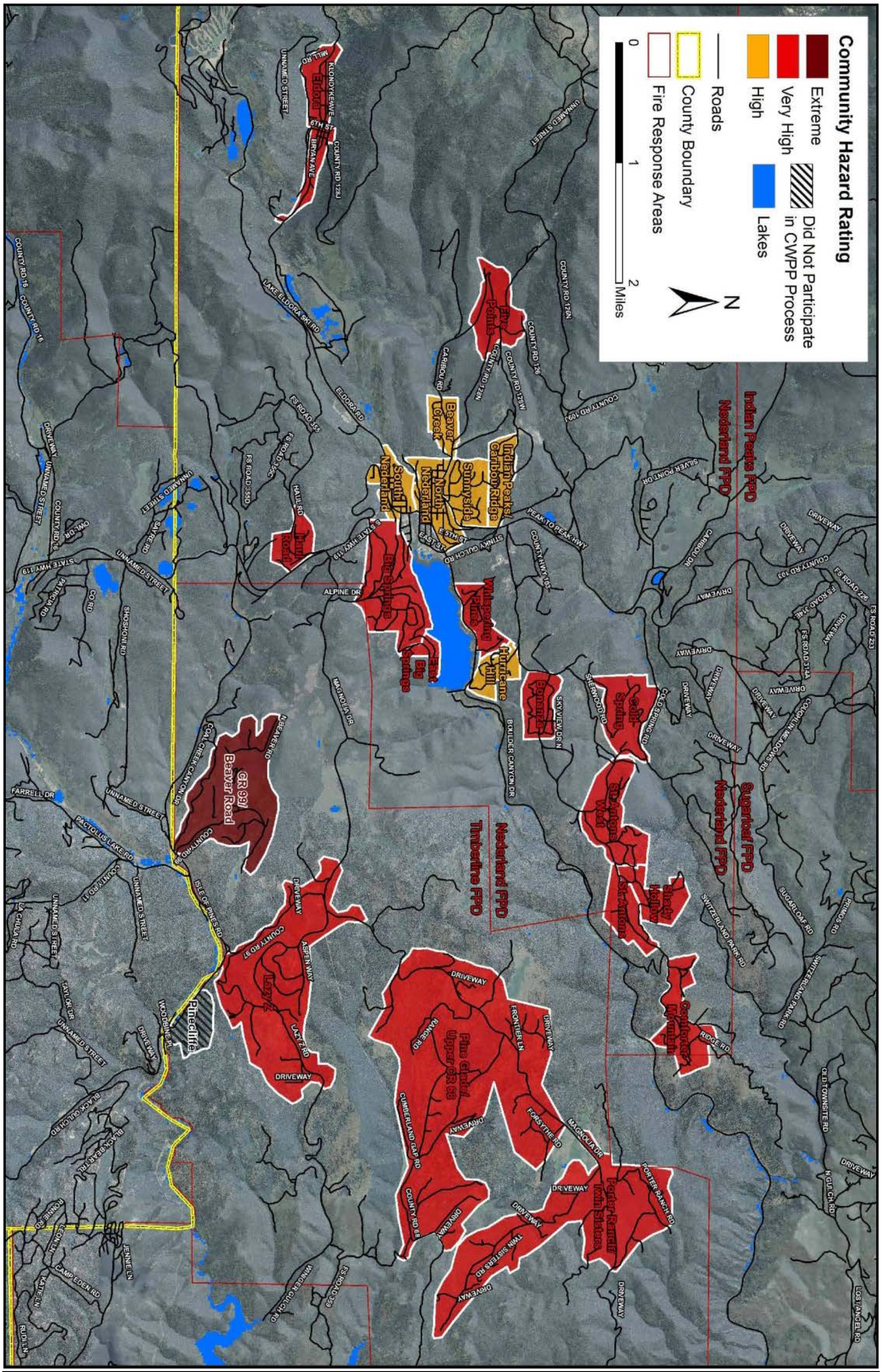


Figure 47. TFPD communities and ratings.

1. North Beaver/County Road 99

Hazard Rating: Extreme

Figure 48. Gates that may limit access and egress if locked.

Figure 49. Home needing defensible space.

The community of North Beaver and County Road 99 lies north of Coal Creek Canyon and due west of the Coal Creek and Peak-to-Peak highway intersection. The main access for the community is County Road 99, which goes through a steep, narrow drainage that runs north and south. The potential for this drainage and others to funnel fire into the community is dangerously extreme. Roads throughout the community are in overall good condition, though grades get steeper further into the community. There is a viable secondary egress route through Reynolds Ranch, where patch cuts have been completed. This route needs work and there is a gate across the entrance. Home siding and deck materials are made of combustible materials on most houses, and many lack any defensible space. Signs and address markers throughout the community are non-reflective and combustible. Like many Magnolia communities, water availability is insufficient. Frequent lightning, adjacent camping areas and potential pile-burning create potential ignition sources.

Homogenous lodgepole pine stands are the dominant fuel type in the community. Mistletoe and mountain pine beetle infestations are visible: pitch tubes and red needles are present. Some residents have done work around their houses, but more mitigation should be done. Work has also been done in the Reynolds Ranch area. Ignitions from Colorado Highway 72 are capable of traveling quickly up the hill to the north. High rates of spread are also likely along the slopes on either side of County Road 99. Longer flame lengths, torching and even active crown fire are also possible on these slopes, especially under more extreme weather conditions. The northern half of the community, extending outside its boundaries would likely experience active crown fire given the right weather conditions.

Fuels Reduction Recommendations

- Residents in the community should work together with neighbors when implementing defensible space. Multiple defensible spaces around homes linked together will act as a larger, more extensive fuelbreak. This should follow along the same vein as previous work that has been done with the Boulder County chipping program.

- An existing road that passes through Reynolds Ranch could connect to Magnolia Road with some improvement. Thinning vegetation and maintaining the road will allow for an additional egress route for residents. Remove regeneration and diseased trees. Consider installing a gate to limit travel during non-emergencies.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the “Fuelbreak Guidelines for Forested Subdivisions & Communities” document included within Appendix A.

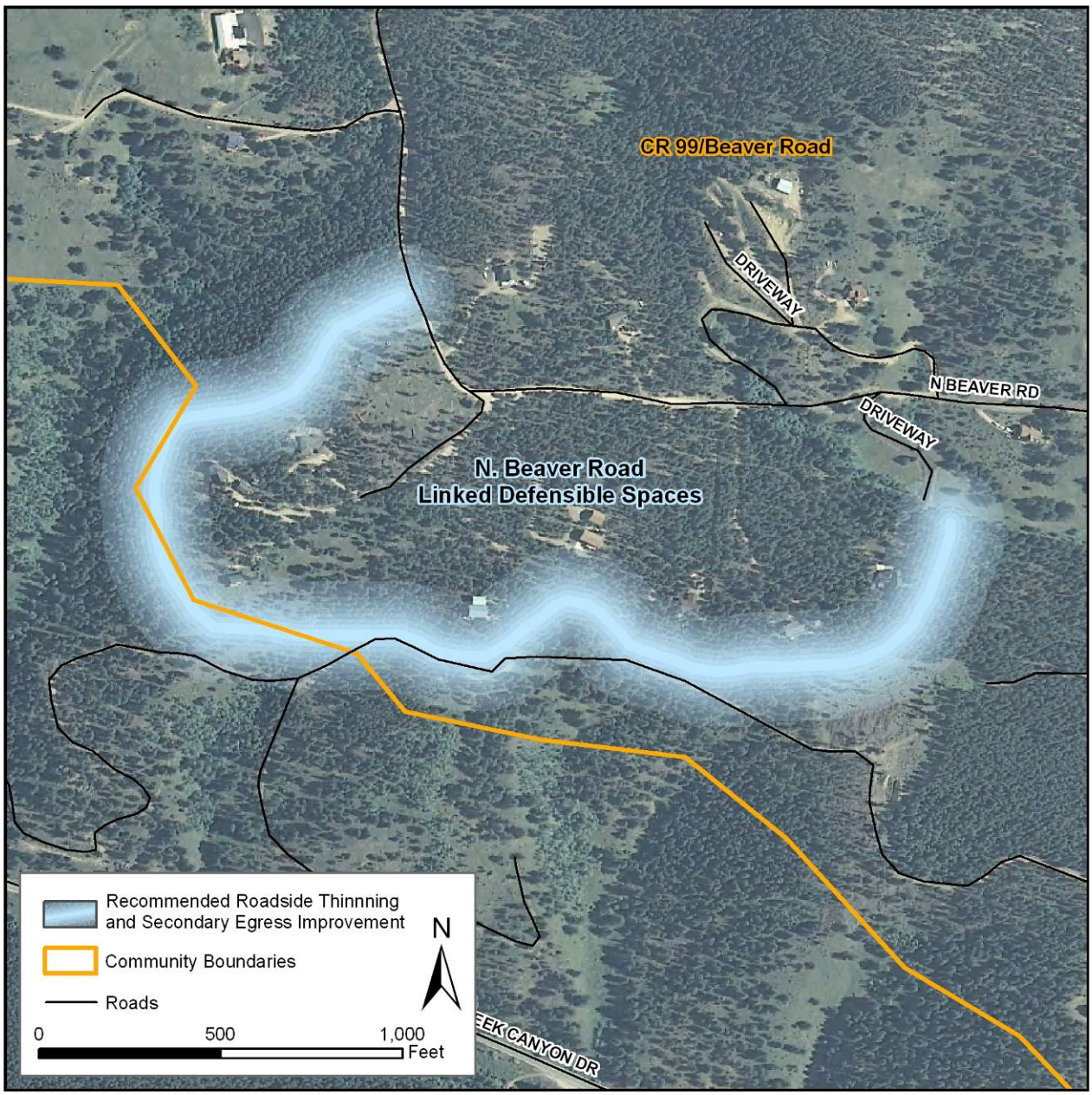


Figure 50. Map of properties where linked defensible space will be effective for reducing wildfire risk.

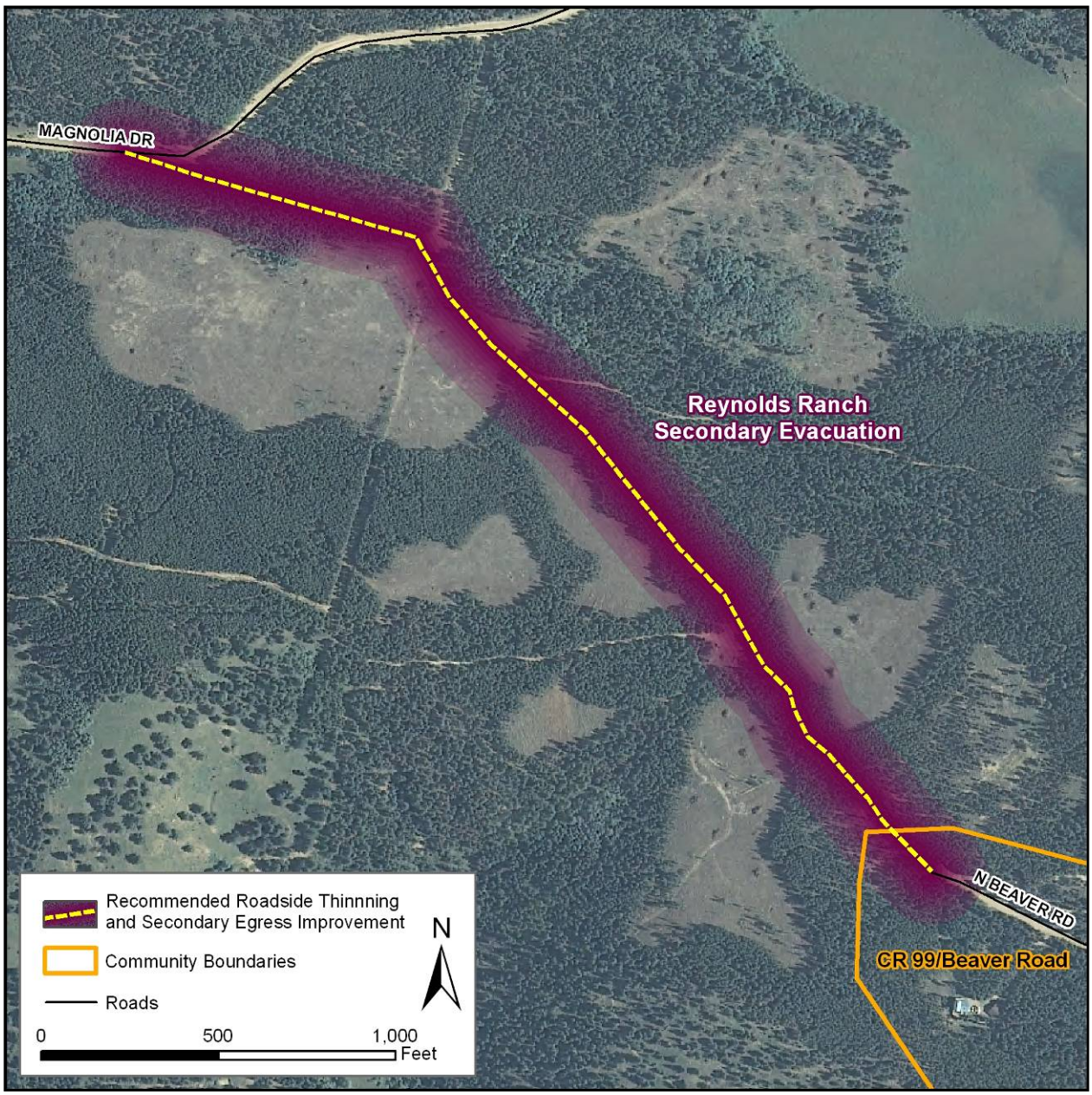


Figure 51. The road through Reynolds ranch that should be improved to be a potential secondary egress.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

- A large-animal evacuation plan should be developed where applicable.

2. Lazy Z

Hazard Rating: Very High

Figure 52. Steep driveway.

Figure 53. Home with partial defensible space.

The Lazy Z community is located between Magnolia Road and Coal Creek Canyon. Despite accessing both major roads, the community has only one way in and out and numerous secondary roads. Steep slopes and ravines are present throughout the community. Roads vary in condition and width, though many are narrow and poorly maintained. There are few adequate turnarounds and pull-offs. Many driveways are extremely steep and narrow and do not have adequate space for staging and turning around vehicles. There are many homes with combustible siding and decks, and certain areas with large buildups of flammable vegetation surrounding houses. There is a buried gas line running through the community that needs to be identified to residents and firefighters in the event of a wildfire. Most homes lack any defensible space.

Figure 54. Home lacking defensible space.

Addresses and signing is inconsistent, sparse and in many areas where it does exist, it is difficult to see. There are individual cisterns present, though overall water availability is limited. As with many communities in the Magnolia area, many residents are not present year-round.

Vegetation varies throughout the community. Dense areas of homogenous lodgepole pine exist, as well as more open areas consisting of ponderosa pine and grasses. Meadows and areas of aspen exist in the community, with many aspen sprouts crowded out by coniferous trees. The center of the community, where roads and houses encircle a steep central point, is especially susceptible to wildfire. Fire behavior under moderate weather conditions is likely to support surface fire with some areas of torching. More extreme weather, with higher wind speeds and temperatures, lower humidity and fuel moisture, will allow for more extreme fire behavior. The most intense fire behavior would be expected along the ridge that begins in the community and extends to the east. This area is likely to exhibit active crown fire and flame lengths exceeding 10 feet.

Fuels Reduction Recommendations

- The existing roadway that connects Lazy Z Road to County Road 97 should be cleared and improved as a secondary egress route.

- Using predicted fire behavior as a guide, consider developing large-scale projects, such as thinning in the center of the community, which has been identified as an area where extreme fire behavior is possible.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

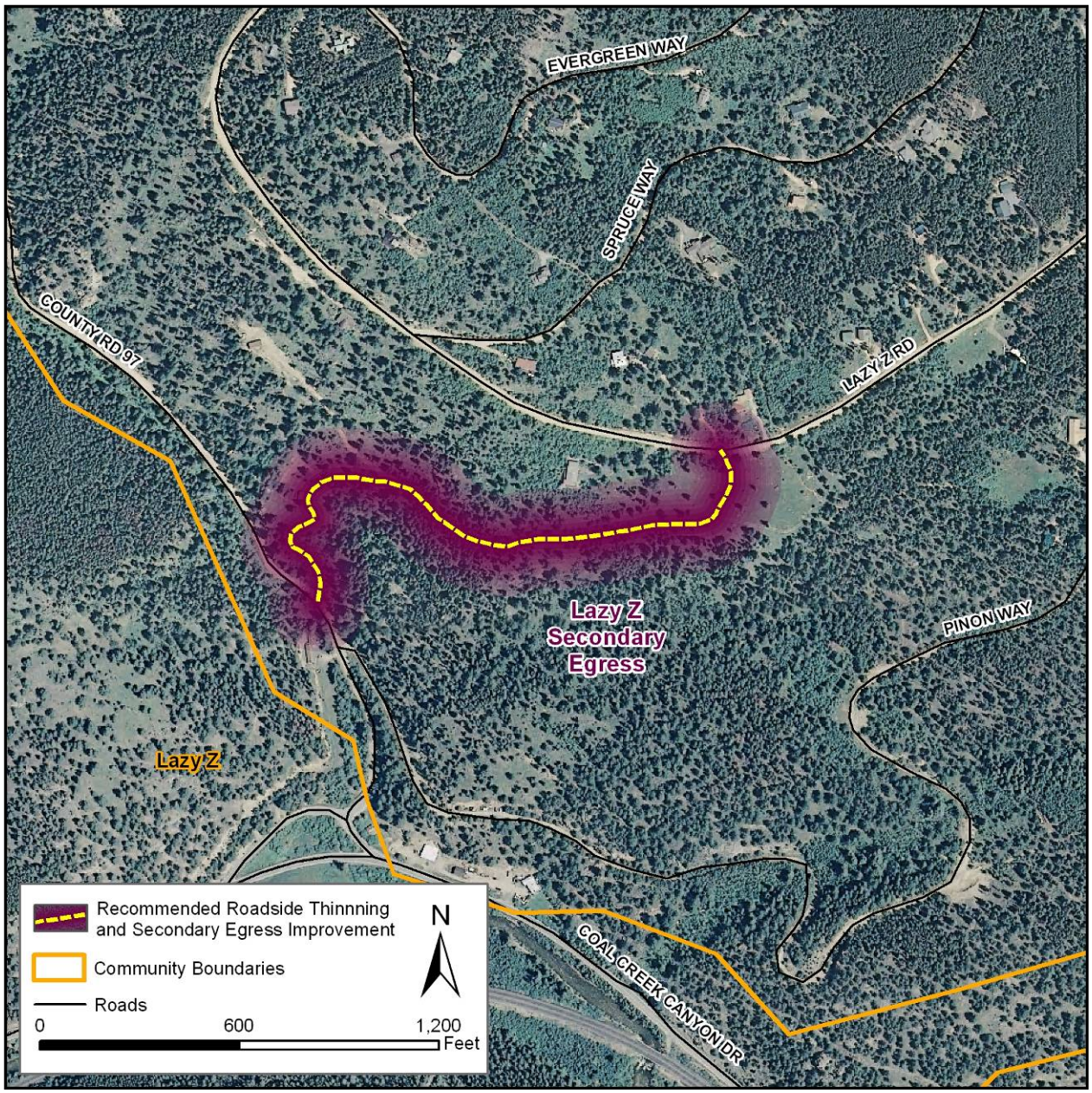


Figure 55. Location of the necessary road improvement to create a secondary egress for the Lazy Z area.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

- A large-animal evacuation plan should be developed where applicable.

3. Pine Glade/Upper County Road 68

Hazard Rating: Very High

Figure 56. Home on left lacks defensible space; house on the right has partial defensible space.

The Pine Glade and Upper County Road 68 community is dominated by drainages running southeast to northwest. These drainages create an environment primed for rapid rates of spread. Homes located in saddles, atop steep slopes and near chimneys further exacerbate the fire risk. Most homes lack any defensible space implementation and have combustible siding and decks. Roofs are typically asphalt shingle.

The community does benefit from relatively wide, maintained roads and multiple egress points, though there are few turnarounds for fire apparatus. Addressing and signing is non-reflective, inconsistent and combustible. Overhead utilities and propane tanks are found throughout. There are nine potential water supplies, including cisterns and ponds, but the volumes are limited and sometimes unknown. Adequate water supply is an important consideration when addressing the fire risk to this community and must be part of any effort to reduce that risk.

Vegetation is dense throughout the community. Forested areas are mixed-conifer composed primarily of lodgepole pine. There are also open, park-like stands of ponderosa pine with a grass understory component. Fuels treatments have begun in the area, and there are large piles of cut fuels near homes that need to be treated. Trees previously cut beneath power lines are already starting to grow back and may need additional treatment. Residents have been proactive in removing mountain pine beetle-infested trees and should continue tree removal until the epidemic has passed. Average weather conditions are most likely to support surface fire with some areas of torching. Rates of spread in the forested areas are not expected to be fast. Under hot and dry weather conditions, higher winds and low fuel moistures, extreme rates of spread are possible in the lighter fuels, as is active crown fire, especially in the area north of the community.

Fuel Reduction Recommendations

- No specific fuel reduction project is recommended for Pine Glade/Upper CR 68. This does not mean that there are not projects that could be established, but from the initial assessment, defensible space and home construction is the most beneficial action that the community/planning area can pursue.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

General Recommendations

- Install additional 20,000-gallon cisterns throughout the community since lack of water supply could significantly reduce the ability to control a wildfire.

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

- A large-animal evacuation plan should be developed where applicable.

4. Porter Ranch / Twin Sisters

Hazard Rating: Very High

Figure 57. Typical homes in Porter Ranch/Twin Sisters area. Homes are lacking defensible space and many have combustible wood siding.

The Porter Ranch and Twin Sisters community is the eastern-most portion of the Magnolia area. The Twin Sisters Road runs through the middle of the southern section of the community, while the northern section consists of a web-like maze of intersecting roads and driveways. Some defensible space work has been done within the community, though in most cases significant vegetation is present adjacent to homes and other structures.

Addressing and signing in the community is very poor, and firefighters could have a difficult time locating and evacuating individual homeowners. Both the northern and southern sections could drastically benefit through the improvement of primary and secondary egress routes, including improvement to the road connecting to County Road 68. Roads and driveways within the community are primarily steep, narrow and unmaintained, creating a significant concern for incoming fire apparatus. Moreover, in many areas there is a lack of pull-offs and turnarounds. Other noteworthy areas of concern include homes with combustible decks and siding and above-ground utilities. Nearby recreation areas and frequent lightning provide potential ignition sources.

The majority of the community is situated on south- and west-facing aspects. The northern section is more heavily vegetated, with ponderosa pine and Douglas fir composing the vegetative mix. The southern section has large aspen stands and meadows and is thus less of a fire risk in certain areas. Despite these aspen stands and meadows, both sections contain areas of thick and abundant fuels. The ponds in the southern section of the community could serve as viable water sources and should be noted in the event of a wildfire. While the northern section may have some individual cisterns, it would greatly benefit from additional water sources. Fire behavior runs indicate a potential for rapid rates of spread and active crown fire in the northern half of the section north of Magnolia Road.

Fuel Reduction Recommendations

- No specific fuel reduction project is recommended for Porter Ranch/Twin Sisters. This does not mean that there are not projects that could be established, but from the initial assessment, defensible space and home construction is the most beneficial action that the community/planning area can pursue.

- When beginning any project, a forester should be consulted to ensure proper guidelines are being followed and that the work will be effective. Thinning guidelines, including crown-spacing recommendations, can be found in the "Fuelbreak Guidelines for Forested Subdivisions & Communities" document included within Appendix A.

General Recommendations

- Adequate defensible space is recommended for all homes. For details, please refer to Appendix A.

- Because of the potential for extreme fire behavior, extended defensible space is recommended for all homes, especially when located in dangerous topography (above ravines and natural chimneys, mid-slope on steep slopes, on ridge tops or summits) with heavy vegetation loads near or below the home.

- Discourage the use of combustible materials for decks, siding and roofs, especially where homes are upslope from heavy vegetation. 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 should be 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 planting flammable ornamentals, such as non-native conifers, within 30 feet of homes. Encourage the use of fire- and drought-tolerant plants for ornamental plantings, especially within 30 feet of homes.

- Thin vegetation along access roads and driveways. This is especially important for narrow driveways and road segments, and for any areas where ravines with heavy fuels are below the access. Focus on removing vegetation in drainages that cross roads.

- Wherever possible, add pullouts for emergency apparatus on driveways and private roads longer than 300 feet. Turnarounds should be constructed at the end of all driveways and dead-end roads.

- Add reflective, non-combustible addressing to all driveways and homes.

- Ensure that all road signs and attachments are made of non-combustible materials.

- A large-animal evacuation plan should be developed where applicable.

5. Pinecliffe

Hazard Rating: Unrated

Pinecliffe, a Forest Agriculture Tax property, has been determined to be a community at risk from wildfire within the TFPD response area but has chosen to not participate in the CWPP process. Although Pinecliff chose not to participate in the CWPP process, we have included these basic recommendations here because of its continuity with the communities that did and the potential for a wildfire to spread to them if it starts within Pinecliff. Although not specific to the community itself, It may be beneficial and a prudent precaution for residents of the CWPP communities to share general information with their neighbors in Pinecliff. It should be noted that extensive forestry work has been done within the community, including defensible space and forest health thinning. Pinecliffe should continue with efforts to decrease risk and promote forest health. There are approximately 20 homes and structures in the area outside of the Ag Tax property, but the recommendation for these homes is defensible space.

General Recommendations

- Although not community-specific, Pinecliff would benefit from following the some or all of the fuels and general recommendations detailed for the communities participating in the CWPP.

AREAS OF SPECIAL INTEREST

Areas of Special Interest (ASIs) are places within the CWPP study area that could be threatened form wildfire and that have a social or economic value that is not based on residential development. Unlike communities, ASIs are not given hazard ratings. Frequent candidates for ASIs include recreation areas such as parks, reservoirs, ski areas and defined open space. Guest ranches, church camps, RV parks and other large-acreage recreational camps that have a significant but temporary population are typically included as an ASI. Also included is some critical infrastructure, such as communication arrays. ASIs are identified separately from communities because of the size and a focus on recreation and infrastructure over residences.

Sometimes there are specific fuels-reduction recommendations that can help mitigate fire risk to ASIs. Frequently, there are no significant recommendations for the ASIs, but they are still identified, as they are values at risk. Damage to these areas as a result of wildfire could impact the surrounding community and areas.

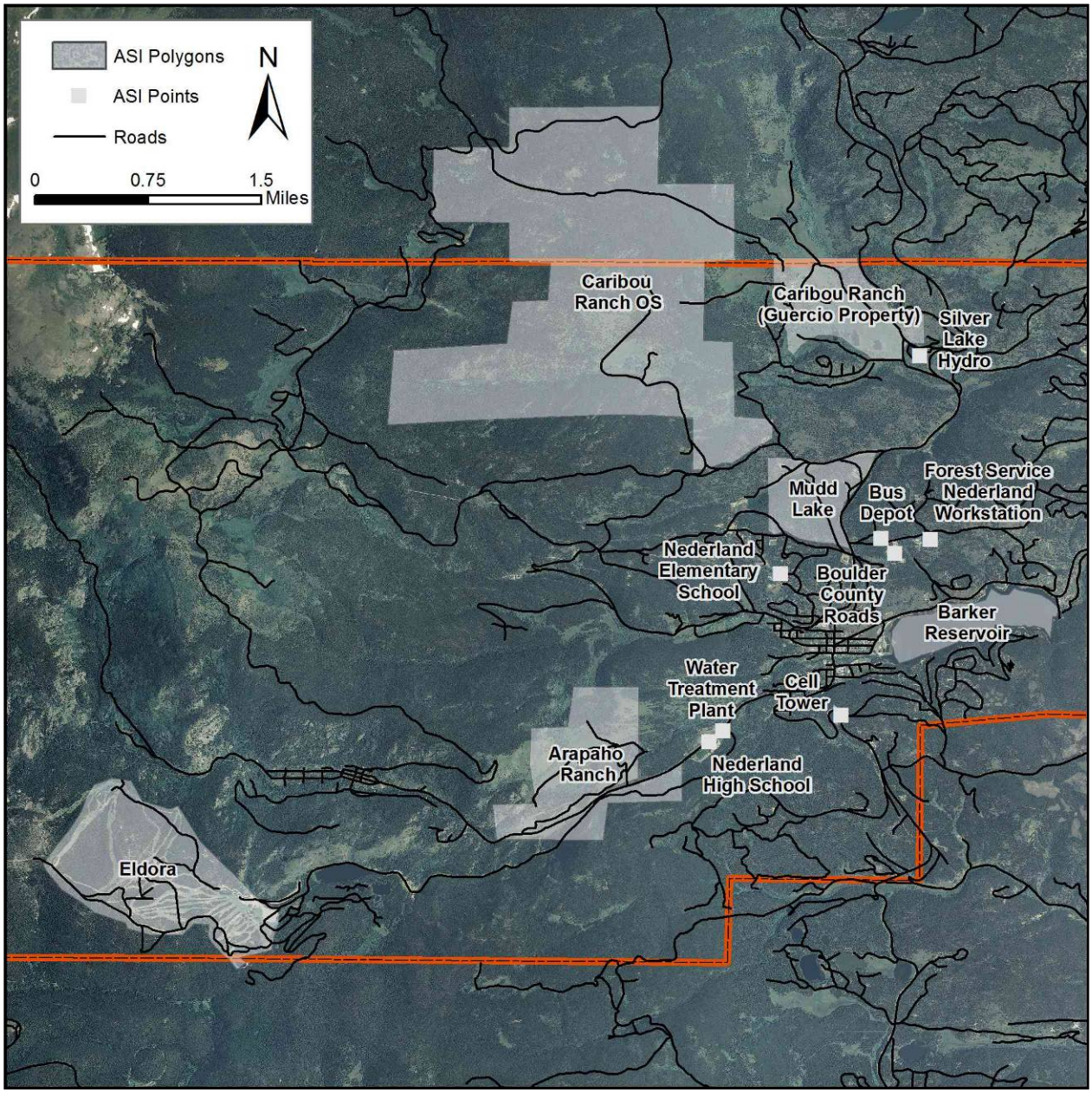


Figure 58. Areas of special interest within the study area.

ARAPAHOE RANCH

This is a privately owned dude ranch located at the junction of Colorado Highway 130 and the Eldora Ski Resort Road. It covers 455 acres and includes many structures from a primary residence to multiple-unit temporary housing. There are a significant number of outbuildings on the property, which is located in a riparian area at the bottom of a steep canyon. There are multiple ponds throughout the ranch. Fuels include grass and shrub in the riparian area with ponderosa, Douglas fir and lodgepole on the borders of the riparian zone. There is potential for impacts on fire behavior from mountain pine beetle mortality.

General Recommendations

- Work with a forester or natural resource specialist to design an ecosystem and fire management plan for the ranch. Consider insect and disease issues, such as the mountain pine beetle outbreak and the potential impact on wildfire behavior.

BARKER RESERVOIR

Barker Reservoir is owned by the City of Boulder, and as such, is discussed in the city's CWPP. Barker Reservoir is the storage for Boulder's municipal water, much of which is then delivered to Betasso Water Treatment Plant. Erosion, disruption of aquatic species, reduced water quality and reservoir capacity, and transport capability due to sedimentation are possible impacts of wildfire. Aside from limiting the total area burned, there is little preventative work that can be done to protect the reservoir.

BOULDER VALLEY SCHOOL DISTRICT BUS DEPOT

This area is heavily thinned to accommodate many school busses, and the structures are steel construction. However, there is still a haz-mat potential from all of the fueling facilities. There are two structures and as many as 30 busses staged at this location.

General Recommendations

- Create and maintain defensible space for all structures on the property.

CARIBOU RANCH - GUERCIO PROPERTY

The Guercio Property was originally 4,000 acres in size and houses several buildings, including a world-famous recording studio. The studio was damaged by fire in 1985 and is no longer in use. Boulder County purchased 2,180 acres of the property to create Caribou Ranch Open Space. Much of the remainder of the property is occupied by Guercio's housing development. For a more in-depth examination of the Ranch, please see its existing Fire Hazard - Structure Risk Analysis.

CARIBOU RANCH OPEN SPACE

A 2,180-acre piece of open space that is owned by Boulder County, Caribou Ranch is one of the five large open space parcels that the county staffs full time. The land and vegetation display a large range of variation, from meadows with shrub and grass to ponderosa and lodgepole stands. The ranch has one full-time ranger assigned to maintain the area and respond to emergencies including law enforcement and wildfire calls. Boulder County also provides countywide fire-suppression capabilities with a focus on county open space properties. Fuels-reduction projects are in planning stages for this area through Boulder County Open Space resource management plans.

COUNTY ROADS

The Boulder County Transportation Department has a workstation along Ridge Road. This facility is a two-story building that equips, stores and repairs five snowplows and other road maintenance equipment. There is the potential of a hazardous materials emergency because of the fueling facilities. The Boulder County Sheriff's Office also maintains a small wildland firefighting supply cache at the site.

General Recommendations

- Create and maintain defensible space for all structures on the property.

ELDORA SKI RESORT

Eldora Mountain Resort is a ski area that includes 680 acres of private and U.S. Forest Service land. The primary concerns in this area of special interest include the infrastructure to support a mountain-wide snowmaking operation, as well as buildings ranging from large lodes and warming huts to small lift operator huts. The mountain has six primary chairlifts and six secondary lifts. The ski area is predominantly covered by lodgepole pine and has been impacted by mountain pine beetle. The USFS and resort continue to work on removing dead trees. A single access road runs from Nederland High School to the resort, and there is a minor road network throughout the ski area.

General Recommendations

- While an unconventional use, it has been shown that snowmaking equipment can be used for fire suppression. Consider looking into ways to convert the equipment to be ready in case of a wildfire.

- Create and maintain defensible space for all structures on the property.

MUD LAKE OPEN SPACE

Mud Lake is a 200-acre piece of open space adjacent to the larger Caribou Ranch. Mud Lake is also owned and maintained by Boulder County. There is a 5-acre piece of land within the property that is held by the Wild Bear Center for Nature Discovery. The Mud Lake property was thinned for forest health and for fire mitigation between 2005 and 2007. There is currently a forestry project taking place on the Wild Bear property to complete the fuels reduction work. Once this project is complete, the entire property will have been treated to some degree.

NEDERLAND MIDDLE-SENIOR HIGH SCHOOL & WATER TREATMENT PLANT

Figure 59. Nederland Middle-Senior High School

Nederland Middle-Senior High School is home to grades 6-12. Approximately 340 students attend the school. The school has a densely forested north-facing slope behind it where mountain bikers and hikers enjoy recreating. Recently the number of dead and dying trees due to beetle kill has increased greatly. As seen at other schools in Colorado, students smoking in the forested areas behind the school are a potential ignition source. Because of the risk of ignition and the fact that the school could potentially be used as an evacuation center or incident command, it has been identified as an ASI. While it is most likely that a fire in the area would occur while students are on summer break, there is still a need to complete mitigation work on the school property.

The Town of Nederland raw water treatment plant abuts the eastern edge of the Nederland Middle Senior High School baseball field. It has been identified as the most significant critical infrastructure in the Nederland area. This parcel is surrounded by USFS land to the east and south. A significant patch of beetle-kill lodgepole pine is in close proximity to the treatment plant at the property's boundary to the west. The USFS is planning a fuels-reduction project in the West Magnolia area in the near future.

General Recommendations

- Work with the CSFS or certified forester to develop a mitigation plan for the forested hillside behind the school. Work on ways to integrate forest ecology into the school's academic program to teach students about forest stewardship and ecosystem processes.

- Educate students about the dangers of wildfire and keep the school apprised of current wildfire risk.

- Town of Nederland should work collaboratively with USFS and BVSD to establish a fuel-break in this region to protect both the water treatment plant and the high school.

SILVER LAKE HYDRO

Lakewood reservoir and the Silver Lake hydro-electric project are located just off the Peak to Peak Highway. The water in the reservoir is part of the City of Boulder Watershed. It comes out of the greater watershed and is piped to the Betasso Mountain Water Treatment Facility. The

lake is a critical piece of infrastructure for the water supply to Boulder. Apart from the lake and hydro plant, the site also contains a single-family residence, which is occupied year round.

U.S. FOREST SERVICE WORK STATION

The Arapahoe-Roosevelt National Forest has a work center for the south zone of the forest off of Ridge Road. There are work facilities and housing facilities on site. The USFS maintains three Type VI engines and two Initial attack crews from this site during the fire season. During the summer, as many as 40 people can be housed on the site. The Colorado Department of Transportation also has a work station that shares the access off of Ridge Road with the Forest Service. The CDOT facilities are similar to the facilities for the County transportation department.

General Recommendations

- Create and maintain defensible space for all structures on the property.

CONCLUSIONS AND NEXT STEPS

The NFPD Wildfire Protection Plan is a comprehensive analysis of wildfire-related hazards and risks in the wildland-urban interface (WUI) areas in Boulder County, Colorado. This document follows the standards for CWPPs that have been established by the Healthy Forest Restoration Act, which was established in 2003.

The results of the analysis were used to determine a variety of fuel-reduction projects throughout the study area. While these are recommendations made by Anchor Point Group LLC, the stakeholders can also use these results to guide in decision-making for additional fuel-reduction projects. Recommendations focus on reducing the threat of wildfire to values within the study area. Additional recommendations are presented throughout the document and include public education, home and street addressing, as well as water source availability. Since much of the report is technical, detailed discussions of certain elements are contained in appendices, which are included after the main CWPP document.

Local agreements and existing plans were examined in order to create a coordinated fire management effort between all parties involved. Public land management agencies, private landowners and residents' concerns and comments were used to generate this document. The NFPD CWPP is a multi-year guiding document that will facilitate the implementation of future mitigation efforts. The CWPP is a living document, meaning it changes and evolves through time. Consequently, it should be revisited at least annually to assess the relevance and progress on the given recommendations. There is no official way to amend or adapt a CWPP, but any changes must be collaborative and include stakeholder representation.

ESTABLISH A FIRE WISE COUNCIL

Perhaps the most important next step is to establish some sort of fire-safe council or fire mitigation group. This effort is imperative to ensure that the CWPP is continuously revisited, modified as necessary, updated and utilized to its fullest capacity. Following the adoption of the CWPP, the stakeholder group should reconvene with the purpose of assembling a group of involved community members to be responsible for implementing the projects in the document. Ideally, a representative for every community/planning area should be on the council. Indian Peaks Forest Alliance could potentially take on the responsibilities of such a group, as it is already organized and comprises individuals actively involved in forest management in the area.

Once the group has been formalized, it should focus on one goal in the first year. This may include creating and distributing a newsletter, setting-up an additional public meeting(s) to gain community support, picking a single fuel-mitigation project to complete as an example, or producing an annual work plan. The initial year goal set by the group must be achievable to generate momentum. Successfully completing this initial task will serve to motivate the fire-safe group and residents alike.

FUNDING SOURCES

Often the biggest hurdle to overcome when trying to implement a CWPP or wildfire mitigation project is funding. By having an official CWPP, a multitude of funding sources becomes available to complete the work outlined in the plan. Federal, national, state and county funds are available to begin treatments. The list below is not all-inclusive, but it provides many of the most commonly available sources. From these sites, links to more funding sources can be accessed. The WEBSITE RESOURCES INCLUDING GRANT RESOURCES section of this document on page 131 has a more complete list.

http://www.firewise.org/usa/grant_funding_sources.htm

http://csfs.colostate.edu/pages/funding.html

http://csfs.colostate.edu/pdfs/Landowner-Assistance-Programs-rev112610.pdf

http://rockymountainwildlandfire.info/grants.htm

\http://www.anchorpointgroup.com/resources.html

PROJECTS TO IMPLEMENT

The table below is a list of potential fire-mitigation projects identified by Anchor Point Group. Further details for each of the projects can be found within the community/planning areas of the main report. A map of each of the projects is also included. The recommendations are not a prescription for the area, and any project to be undertaken should be done in conjunction with a trained forester. The projects detailed in the CWPP are not the only projects that are viable within the planning areas; they are the most achievable for communities. Landscape-scale projects are excellent options as well but often require multiple communities working with federal, state and county government. As support and community involvement grows through these smaller projects, the larger treatments become more obtainable. Additional projects at all scales should be considered by the fire-safe council, especially as Nederland begins to complete the initial projects identified in the CWPP.

# on Figure Below	Treatment Name	Acres	Priority Rating (1-4; 1=high)	Potential Treatment Methods
1	Big Springs drainage thinning	10.7	1	Hand-felling (b/c of access and slope)
2	Bonanza drainage thinning	35.7	1	Hand-felling (b/c of access and slope)
3	Continuation of Forest Service patch cuts	14.8	2	Mechanical (feller buncher/harvester)
4	Shady Hollow linked defensible spaces	15.6	3	Hand-felling only (due to hazards)
5	Five Points roadside thinning	45.6	4	Mechanical (feller buncher/harvester) or hand-felling
6	Colorado Highway 119 roadside thinning	113.3	1	Mechanical (feller buncher/harvester) or hand-felling
7	Lazy Z secondary egress	14.6	3	Mechanical (feller buncher/harvester) or hand-felling
8	North Beaver Road linked defensible spaces	27.4	2	Hand-felling only (due to hazards)
9	Reynolds Ranch secondary evacuation	23.5	2	Mechanical (feller buncher/harvester) or hand-felling
10	Ridge Road roadside thinning	21.3	1	Mechanical (feller buncher/harvester) or hand-felling
11	St. Antons linked defensible spaces	78.3	2	Hand-felling only (due to hazards)
12	St. Antons power line fuelbreak	7.1	2	Mechanical (feller buncher/harvester), hand felling,

				mastication
13	Cougar Run linked defensible spaces	12.7	3	Hand-felling only (due to hazards)
14	Summer Road roadside thinning	24.7	2	Mechanical (feller buncher/harvester) or hand-felling
15	Switzerland trail thinning	5.0	3	Hand-felling only (due to hazards)
16 & 17	Tungsten Road fuelbreak and roadside thinning	3.7	3	Hand-felling (b/c of access and slope)
18	Whispering Pines power line fuelbreak	2.0	3	Mechanical (feller buncher/harvester), hand felling, mastication
Total Acres: 456				

Table 6. Table of proposed projects, approximate acreages and potential methods that could be used to implement these projects.

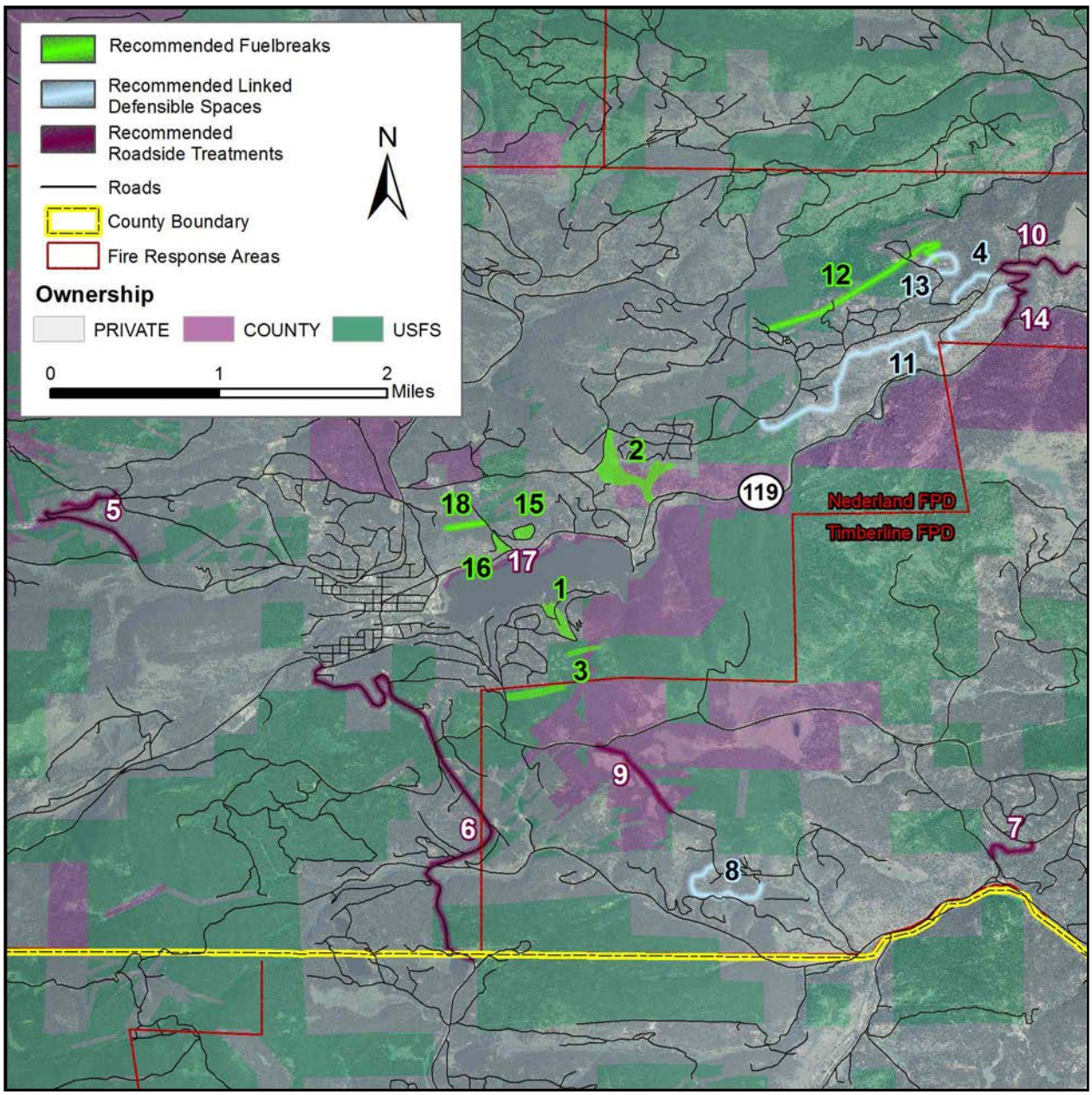


Figure 60. All of the recommended fuels treatments overlaid on ownership.

Landscape Scale Projects

Recent changes in federal policies and funding opportunities have shifted the focus from small-scale projects to larger, landscape scale projects. In addition to wildfire mitigation, these projects are valuable as forest restoration opportunities. The projects outlined below were determined to be valuable to Nederland from a fire and forest health perspective. Before undertaking any of the landscape scale projects identified in this CWPP, the CSFS, USFS, community members, and any private landowners impacted should convene to discuss the correct way to implement these projects. A certified forester should write a detailed prescription to ensure that the goals of all interested parties are addressed and the work is completed in an ecologically sound manner. The total number of acres suggested for landscape-scale treatment is 1302 acres. In all, a total of 1758 acres are being recommended for some sort of fuels treatment.

Name	Acres	Priority Rating (1-4; 1=high)
Big Springs fuelbreak	367	2
County Road 126 Fuelbreak	152	2
Natural riparian area fuelbreak	221	2
Nederland HS fuelbreak	86	1
Peak to Peak Highway treatment	209	1
Ridge Road fuelbreak	164	2
West First Street thinning	103	2
Total Acres: 1,302		

Table 7. Landscape scale treatments, acreages and priority ratings

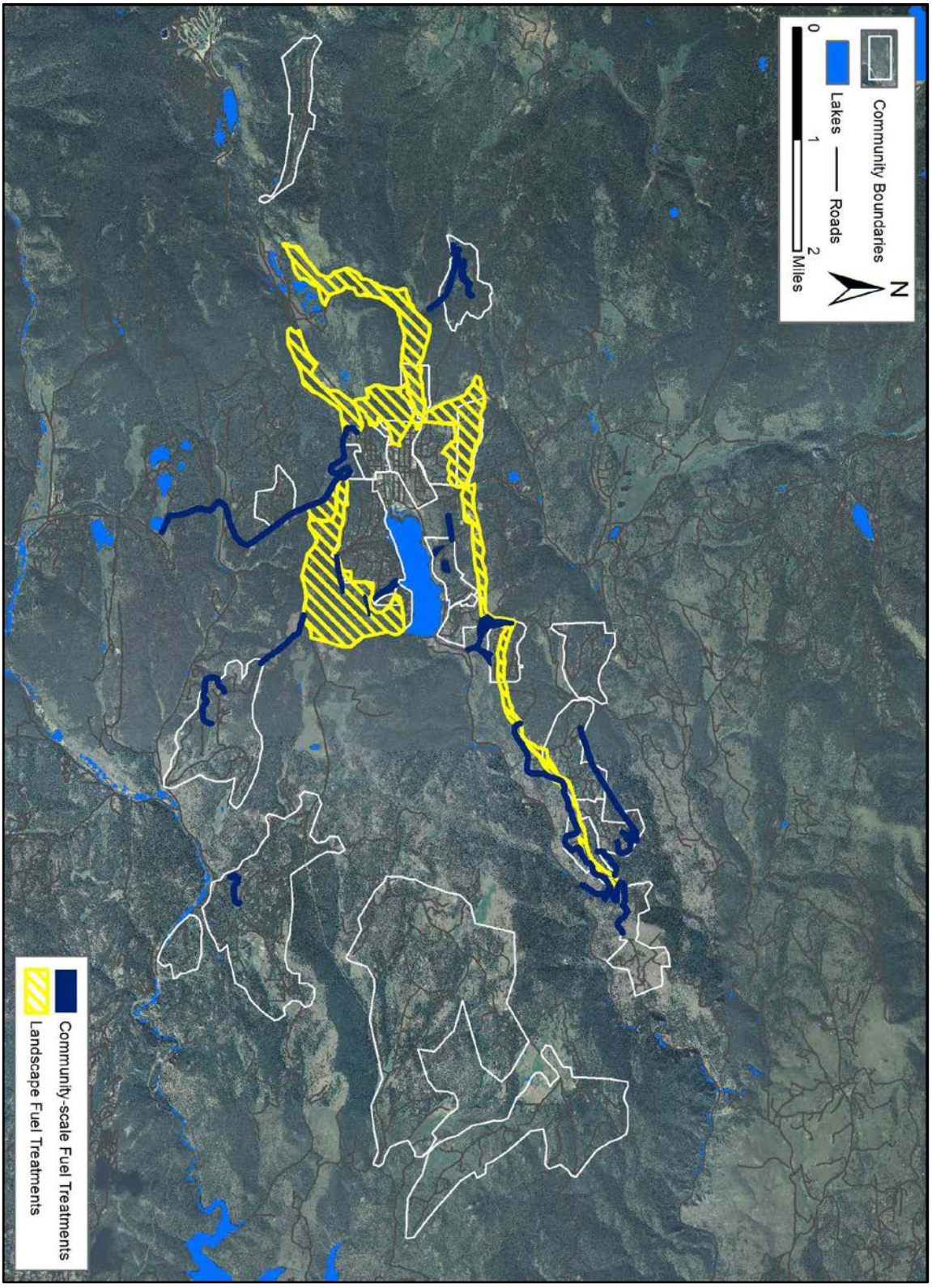


Figure 61. Landscape-scale and community-scale projects for the study area.

Big Springs Fuelbreak

Thin the area south of the Big Springs and East Big Springs communities in order to slow or potentially stop a fire spreading north into the two communities, as well inhibit fire spread from the communities into the wildlands. There are a number of existing patch cuts in this area that should be tied in together, and additional patch cuts should be created in order to break up the canopy and create new age classes. Stand-level selection thinning should be utilized to reduce crown bulk density and increase crown spacing in areas where patch cuts might not be viable or desirable. These treatments should connect to adjacent roads to increase effectiveness, including Magnolia Road and Colorado Highway 119. Concentrate most thinning as close to the communities as possible or desirable and in areas affected by insects and disease. **Acres: 367**

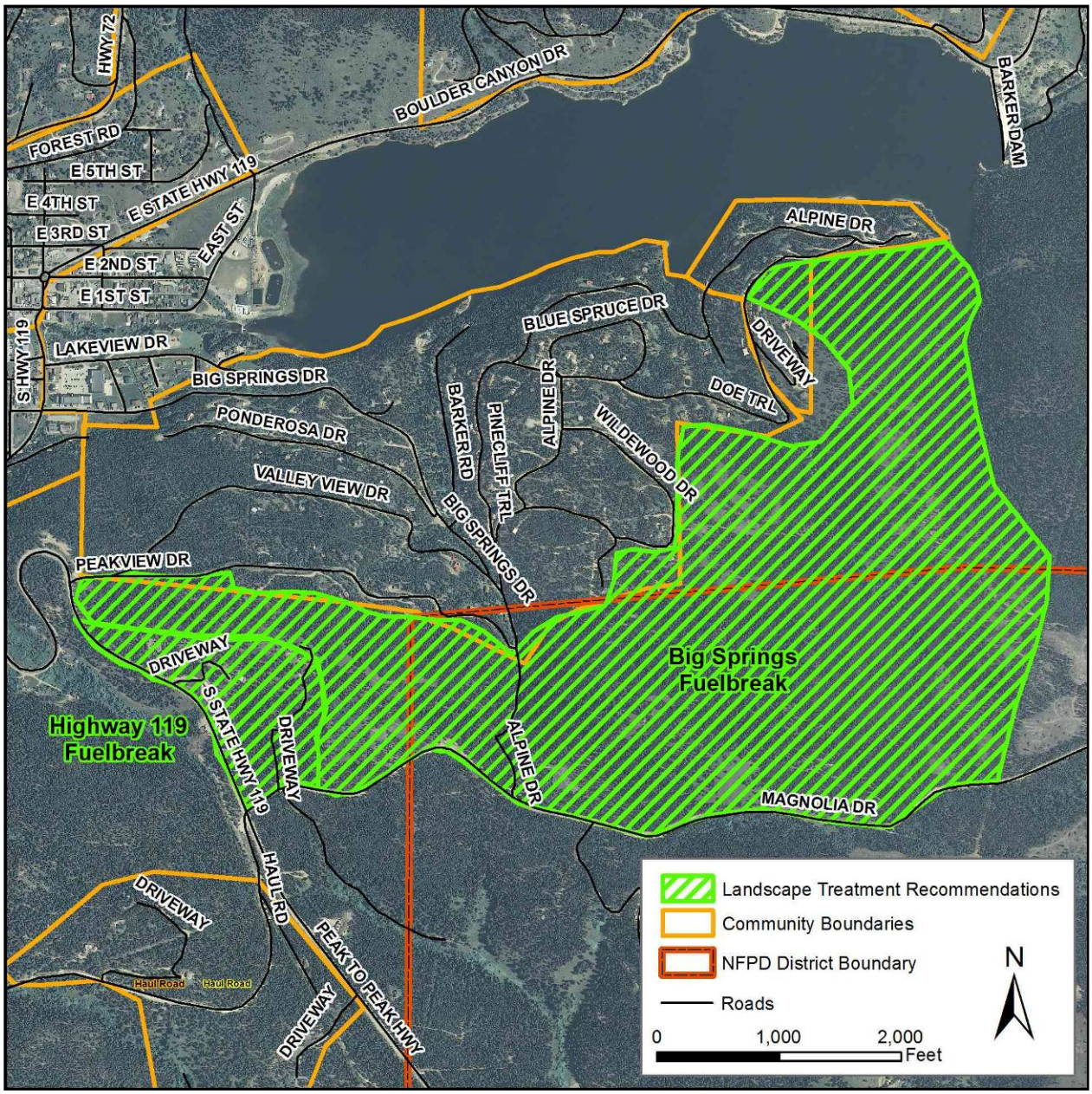


Figure 62. Landscape-scale project surround the Big Springs and East Big Springs communities.

CR 126 Fuelbreak
Utilize selection thinning and small patch cuts to reduce crown continuity. Connect these thinning treatments with extended defensible space around structures in order to increase efficacy. Thinning should be concentrated in areas closest to roads in order to aid ingress and egress of residents and fire personnel, as well as provide for the greatest canopy separation. Target trees affected by insects and disease for removal. Multiple stage cuts may be needed in order to prevent wind throw. **Acres: 152**

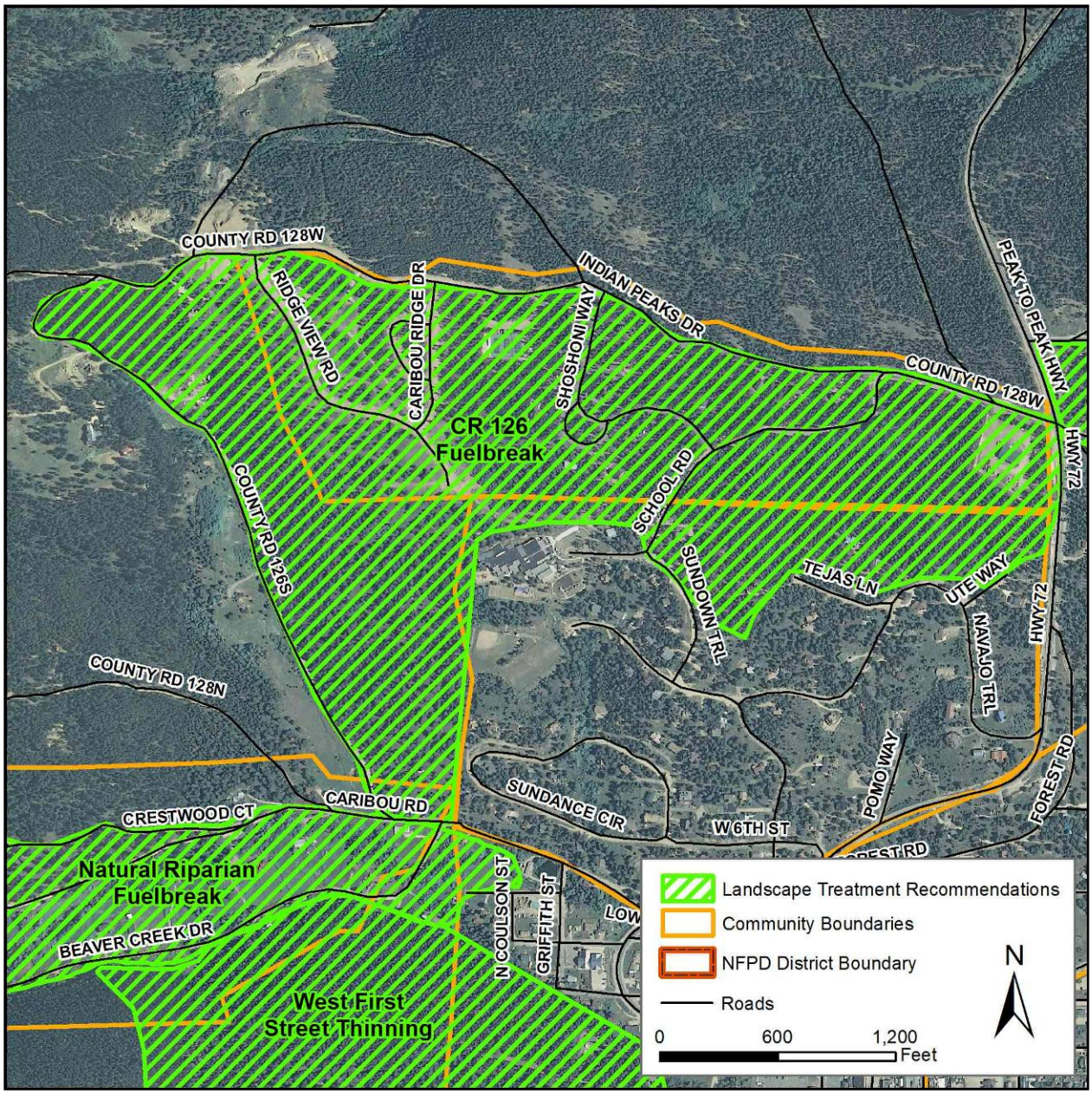


Figure 63. Landscape fuelbreak within and to the west of Indian Peaks/Caribou Ridge community.

Natural Riparian Fuelbreak
Thin conifer trees within and adjacent to the designated area in order to create a natural fuelbreak that will slow or potentially stop a fire spreading east into the area surrounding Nederland. Utilize patch cuts in order to break up crown continuity, especially in areas south of Caribou Road. Concentrate heavier thinning along the road area in order to aid ingress and egress of residents and fire personnel. Selection thinning may be utilized north of Caribou Road and should be tied into extended defensible space in the eastern part of the proposed fuelbreak.
Acres: 221

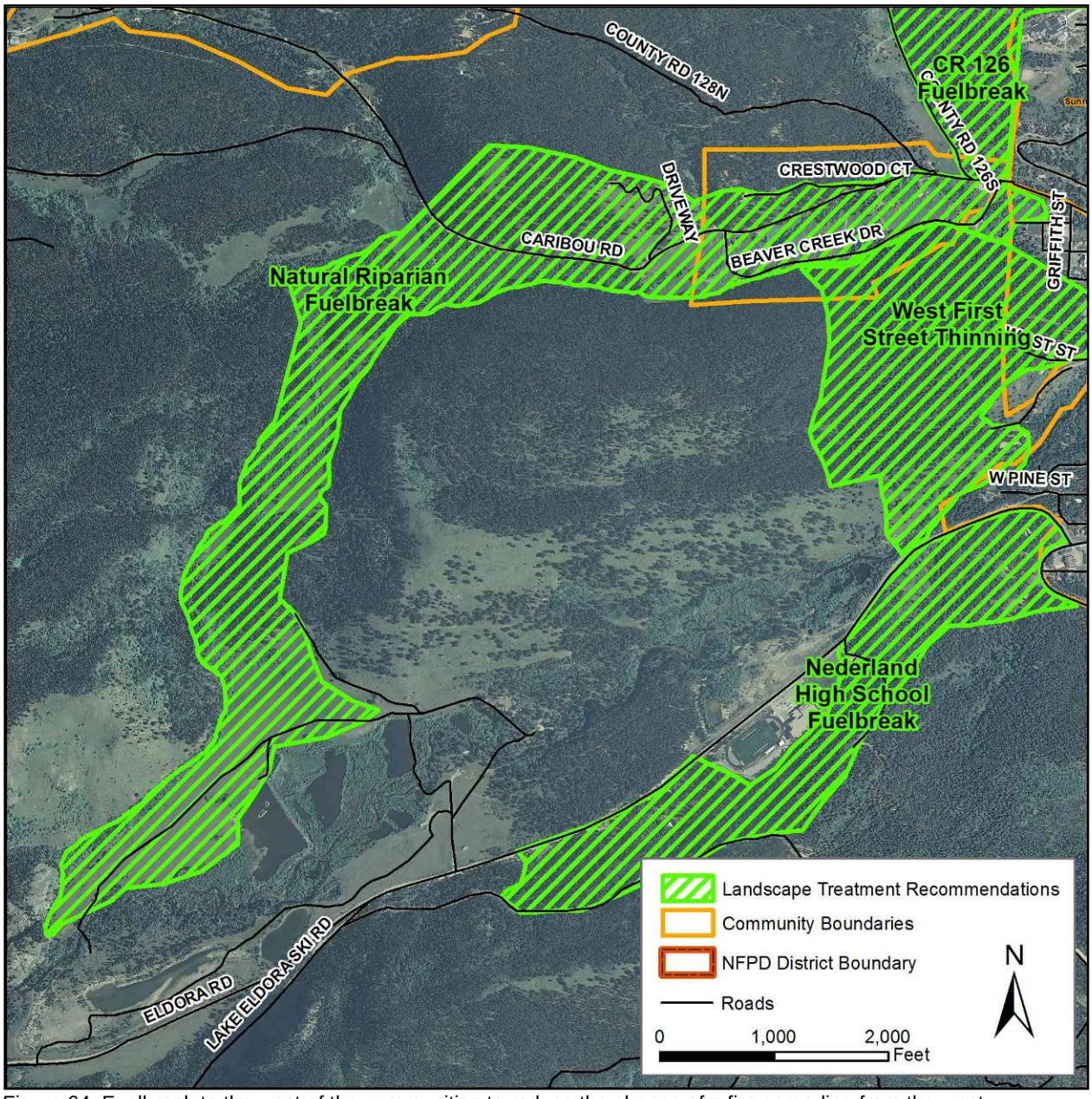


Figure 64. Fuelbreak to the west of the communities to reduce the chance of a fire spreading from the west.

Nederland High School
Thin the hillside surrounding Nederland High School. This will reduce the likelihood of a wildfire impacting the high school itself, as well as create a large fuelbreak that ties Haul Road into Colorado Highway 130. Implement extended defensible space around the high school structures and conduct selection thinning and small patch cuts beyond up to Haul Road. Focus should initially be on the removal of beetle-killed trees, as they pose a threat to students and recreationalists in the area. Multiple stage cuts may be needed in order to prevent wind throw.
Acres: 86

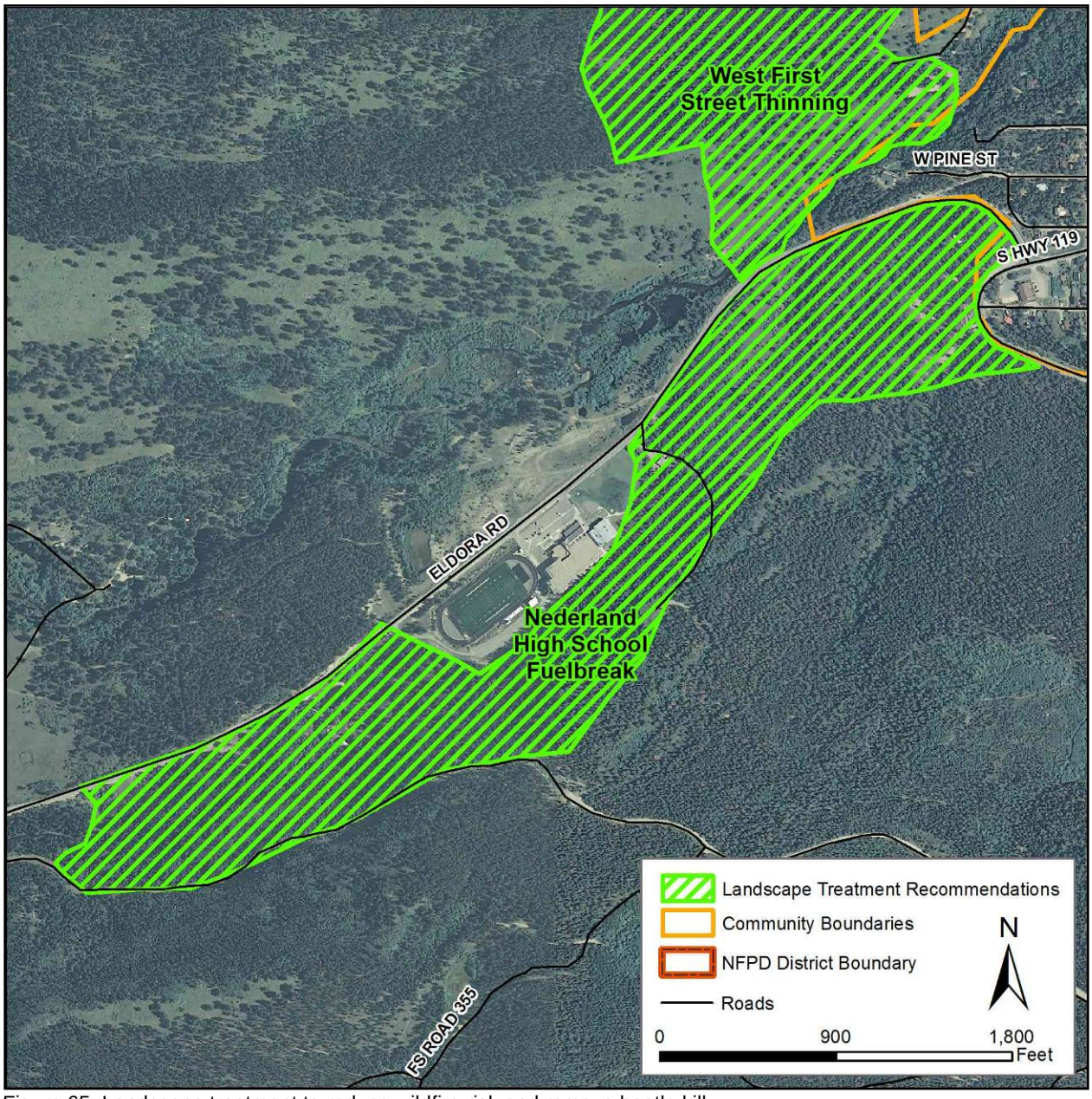


Figure 65. Landscape treatment to reduce wildfire risk and remove beetle kill.

Peak to Peak Highway
Thin along both sides of the Peak-to-Peak Highway from County Road 126 to Kelly Dahl Campground. Thin up to 200 feet or more from the roadside along the entirety of the highway area, where possible. Utilize selection thinning and small patch cuts in order to reduce crown continuity. Concentrate heavier thinning near the road and then feather the treatment moving back from the highway. Tie this work into existing and planned treatments along the highway corridor. Target trees affected by insects and disease for removal. Multiple stage cuts may be needed in order to prevent wind throw. **Acres: 209**

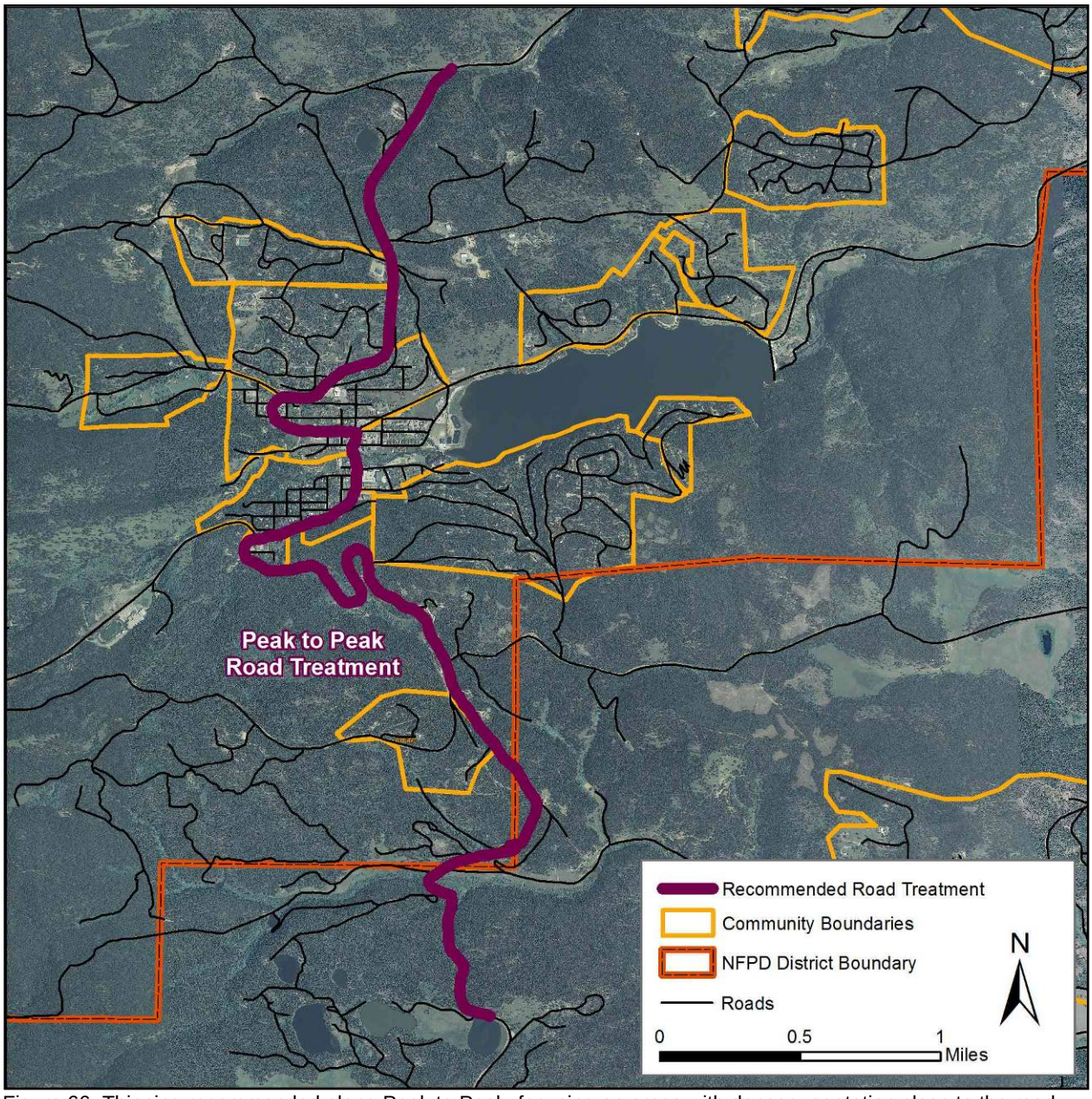


Figure 66. Thinning recommended along Peak to Peak, focusing on areas with denser vegetation close to the road.

Ridge Road
Thin below Ridge Road from Colorado Highway 119 to Summer Road. Thin up to 500 feet below the roadway area, tying into existing and planned extended defensible space areas. The fuelbreak will aid in the ingress and egress of residents and fire personnel, as well as slow or potentially stop a fire moving uphill from Colorado Highway 119, which is a potential ignition source due to motor vehicle accidents, overheated vehicles and discarded cigarettes. Utilize selection thinning to target trees for removal. Target trees affected by insects and disease for priority removal. **Acres: 164**

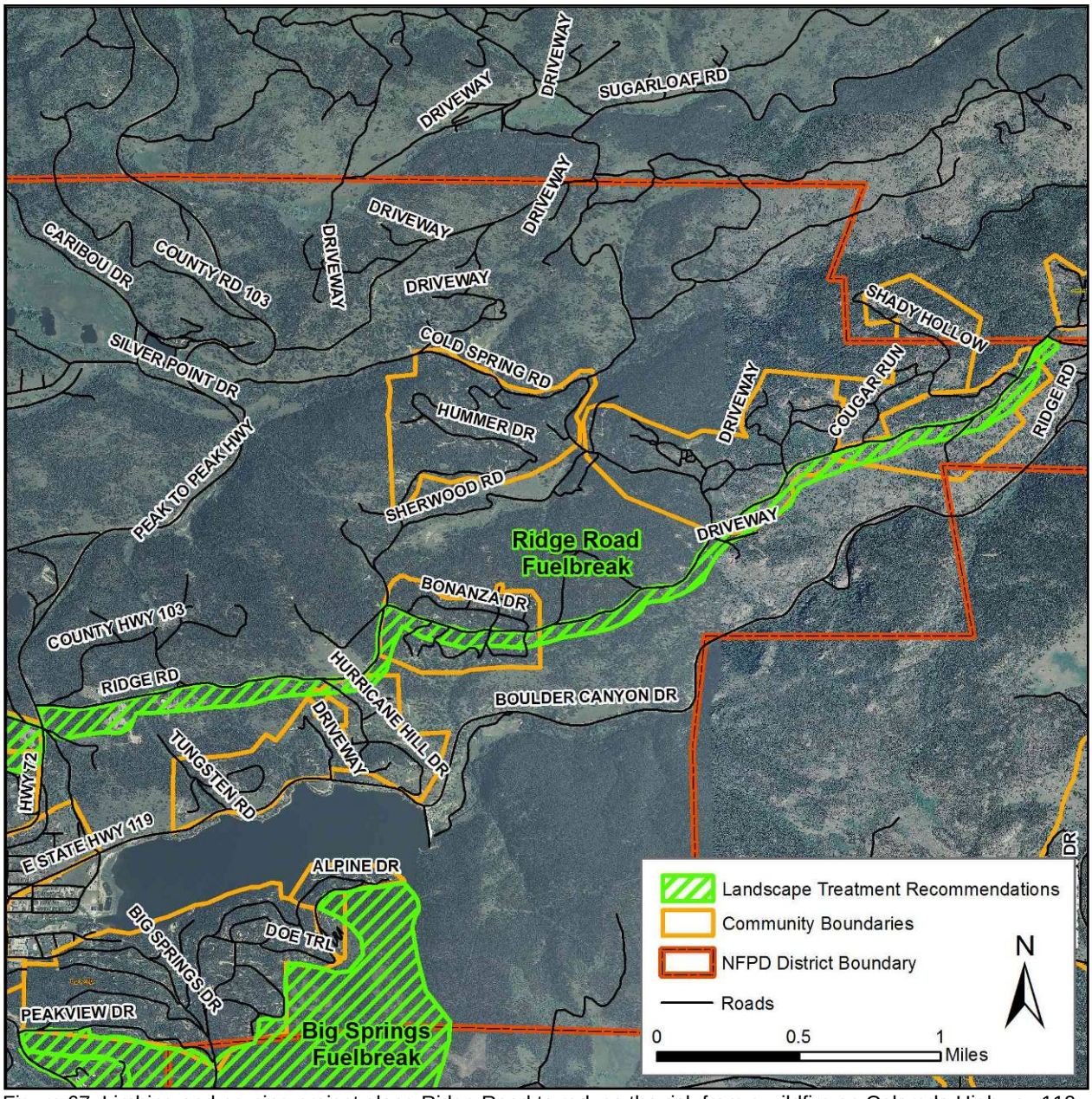


Figure 67. Limbing and pruning project along Ridge Road to reduce the risk from a wildfire on Colorado Highway 119.

West First Street
Utilize selection thinning and patch cuts to reduce crown bulk density and break up the canopy in the heavily forested area west of Nederland. This will act to slow or potentially stop a fire spreading east into the Nederland area. Concentrate thinning in the northern and eastern areas of the fuelbreak, as they are closest to homes. This work should be tied into existing and planned defensible space areas, as well as into meadows and roads. **Acres: 103**

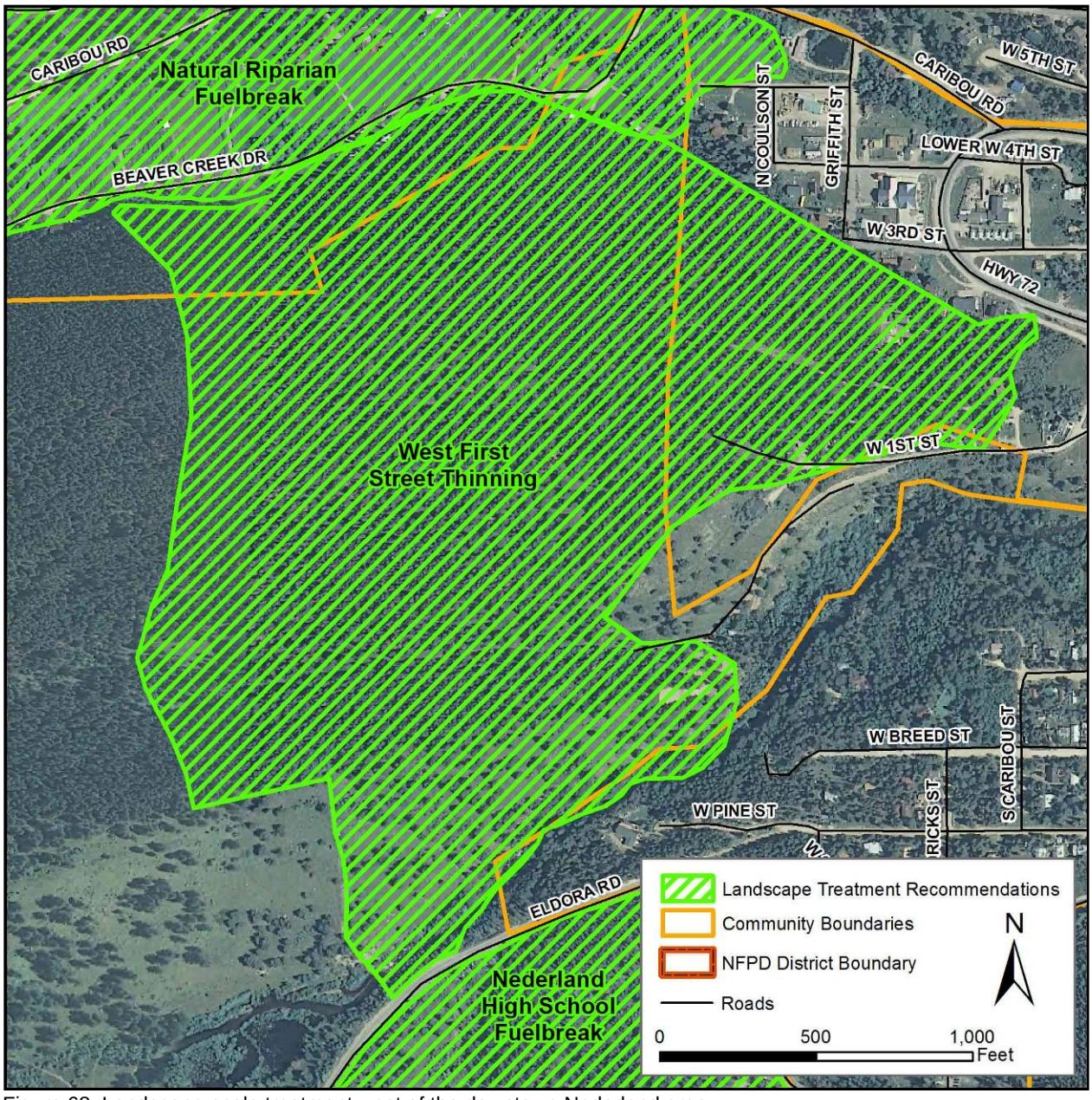


Figure 68. Landscape-scale treatment west of the downtown Nederland area.

To facilitate implementation, each action item, such as fuel modification, public education, etc. can be populated into the provided worksheet on the next page to organize information on key issues, develop ideas for implementation, coordinate and partner organizations, generate a timeline, and plan goals addressed.

Action Item Worksheet

Proposed Action Item Identification:
(Each action item includes a list of the key issues that the activity will address. Action items should be fact-based and tie directly to issues or needs identified through the planning process.)
Proposed Action Title:
(*Utilize the appropriate recommendation name or title in the CWPP.*)
Rationale for Proposed Action Item:
(*Utilize any justification or report language in the CWPP.*)
Ideas for Implementation (Optional):
(Each action item includes ideas for implementation and potential resources. This information offers a transition from theory to practice. The ideas for implementation serve as a starting point for this plan. This component is dynamic in nature, as some ideas may not be feasible and new ideas may be added during the plan maintenance process. Report graphics can add value to this section.)

Coordinating Organization:	
Internal Partners:	**External Partners:**
(*Internal partners are members of the CWPP advisory committee and may be able to assist in the implementation of action items by providing relevant resources to the coordinating organization.)*	(*External partner organizations can assist the coordinating organization in implementing the action items in various ways. Partners may include local, regional, state or federal agencies, as well as local and regional public and private sector entities.)*

Timeline:		**If available, estimated cost:**
Short Term (0-2 years)	Long Term (2-4 or more years)	
(Action items or activities that may be implemented with existing resources and authorities within one to two years.)	(*Action items or activities that may require new or additional resources and/or authorities, and may take from one to five years to implement.)*	

GLOSSARY

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

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

10-hour time lag fuels: Twigs and small stems; 1/4 inch to 1 inch in diameter

100-hour time lag fuels: Branches; 1 to 3 inches in diameter

1,000-hour time lag 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).

Backfire: An intentionally ignited wildland fire that is intended to interact with the main fire or its convection column.

Burn Out: A fire set inside a control line meant to consume fuel between the edge of the fire and the control line

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 a 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 1/4-inch in diameter, such as grass, leaves, draped pine needles, fern, tree moss and some kinds of slash that, when dry, ignite readily and are consumed rapidly.

Fire Behavior Fuel Model: A complete set of [fuel] inputs for the mathematical fire spread model.

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 (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.

Shaded Fuelbreak: 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. The stand is thinned, and remaining trees are pruned to remove ladder fuels. Brush, heavy ground fuels, snags and dead trees are disposed of and an open, park-like appearance is established.

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.

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 the surface litter, debris and small vegetation on the ground.

Time lag: Time needed under specified conditions for a fuel particle to lose about 60% 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, or Community Assessment): A 140-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. Also is sometimes referred to as Urban Wildland Interface, or UWI.

RECOMMENDED READING

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

At Home in the Woods – Lessons Learned in the Wildland/Urban Interface, FEMA, 2004.
Bachmann, A., and Allgower, B., *A Consistent Wildland Fire Risk Terminology is Needed!,* Fire Management Today (61, 4), USDA Forest Services, Washington, DC, Fall 2001.

Dennis, F.C., *Fuelbreak Guidelines for Forested Subdivisions,* Colorado State Forest Service, Colorado State University, 1983.

Developing a Cooperative Approach to Wildfire Protection, National Wildland-Urban Interface Fire Protection Program.

Development Strategies in the Wildland/Urban Interface, International Association of Fire Chiefs and Western Fire Chiefs Association, Billings, Montana, July 1991.

Firefighter Safety in the Wildland/Urban Interface – A Video Series (VHS Video - 60 Minutes.), National Wildland/Urban Interface Fire Program, 2003.

Fires that Changed the Fire Service – Wildlands (VHS Video – 84 Minutes.), American Heat, March 2000.

FireSmart – Protecting Your Community from Wildfire, Partners in Protection, Edmonton, Alberta, Canada, May 1999.

Hirsch, K.G., Pinedo, M.M., and Greelee, J.M., *An International Collection of Wildland-Urban Interface Resource Materials*, Information Report NOR-X-344, Canadian Forest Service – Northwest Region – Northern Forestry Centre, 1996.

Home Improvement: A Firewise Approach (VHS Video – 15 Minutes.), 2003.

Introducing Firewise Communities Workshops (VHS Video– 6 Minutes.), Firewise Communities, Quincy, MA.

Mangan, R. J., *Improving Firefighter Safety in the Wildland-Urban Intermix*, FE02P16 – USDA Forest Service Technology and Development Program, Missoula, Montana, Feb. 2000.
National Wildland/Urban Interface Fire Protection Program Building a Fire wise Home (VHS Video – 20 Minutes.), Hearst-Argyle Television Productions, Needham, MA, Nov. 1997.
Langowski, P., Fire and Fuels Analysis to Support Project Planning, Nov. 2003.

Preparing a Community Wildfire Protection Plan – a Handbook for Wildland-Urban Interface Communities, Sponsored by: Communities Committee, National Association of Counties, National Association of State Foresters, Society of American Foresters, Western Governors' Association, March 2004.

Queen, Phillip L., *Fighting Fire in the Wildland/Urban Interface*, Fire Publications, Inc., Bellflower, California, 1993.

Quincy, M.A., *Wildfire! Preventing Home Ignitions!* (VHS Video – 19 Mins.), Firewise Communities

Slaughter, R. (ed.), California's I-ZONE – Urban/Wildland Fire Prevention & Mitigation, Sacramento, California, Jan. 1996.
Standard for Protection of Life and Property from Wildfire, NFPA 1144(02) (Formerly *NFPA 299*) National Fire Protection Association, Quincy, MA, 2002.

Southwest Community Wildfire Protection Plan Guide, Southwest Strategy, 2004.

Urban-Wildland Interface Code™, International Fire Code Institute, Whittier, California, Jan. 2000.

White, C., Dry Hydrant Manual – A Guide for Developing Alternative Water Sources for Rural Fire Protection, Developed for Summit County, Colorado.

Wildland/Urban Interface Fire Hazard Assessment Methodology, Developed by National Wildland/Urban Interface Fire Protection Program. Wildland/Urban Interface Fire Policy Action Report, Western Governors' Association, Feb. 1996.

WEBSITE RESOURCES INCLUDING GRANT RESOURCES

Colorado State Forest Service website for general forest health information, defensible space recommendations, contact information for local foresters and grant funding opportunities.
http://csfs.colostate.edu

Department of Homeland Security website for granting opportunities for Staffing for Adequate Fire and Emergency Services (SAFER) grants and provides other useful information.
www.firegrantsupport.com

Firewise, multi-agency organization designed to increase homeowner, community leader, developer and others education on the wildland urban interface and the actions they can take to reduce fire risk to protect lives, property and ecosystems.
http://firewise.org/

FRAMES – Fire Research and Management Exchange System,
www.frames.gov/tools/

Environmental Protection Agency.
http://cfpub.epa.gov/fedfund

ESRI Grant Assistance program for GIS users.
www.esri.com/grants

The Fire Safe Council.
www.FireSafeCouncil.org

Grant opportunities search website.
www.grants.gov

NFPA 1710 summary.
www.iaff.org/academy/content/online/modules/1710/summary.htm

National Association of State Foresters listing of grant sources and appropriations.
www/stateforesters.org/S&PF/FY_2002.html

National database of state and local wildfire hazard mitigation programs,
www.wildfireprograms.com, January 2005.

Nederland Fire Protection District.
www.nfpd.org/

Pre-disaster mitigation program.
www.cfda.gov/public/viewprog.asp?progid=1606

RAMS - (Risk Assessment and Mitigation Strategies), U.S. Department of Interior, Bureau of Land Management, National Interagency Fire Center, wildland fire management information.
www.nifc.blm.gov/nsdu/fire_planning/rams

Rural fire assistance and other state forestry grants.
www.azsf.az.gov/grant_information

Standard for Protection of Life and Property from Wildfire, NFPA 1144.
www.normas.com/NFPA/PAGES/NFPA-1144(02).html

Standard for Protection of Life and Property from Wildfire, NFPA 299.
http://webstore.ansi.org/ansidocstore/product.asp?sku=29997PDF

Stewardship and landowner assistance—financial assistance programs.
www.na.fs.fed.us/spfo/stewardship/financial.htm

U.S. Fire Administration—Assistance to Firefighters grant program.
www.usfa.fema.gove/dhtml/inside-usfa/grants.cfm

SOLUTIONS AND MITIGATION

The local land management, stakeholders and fire management agencies (ideally with the input of a citizen's advisory council) must determine priority actions. The following areas have been identified for the study area, and recommendations are provided for each. These sections are NOT ranked by priority, but specific recommendations have been given priority rankings in this appendix.

GENERAL RECOMMENDATIONS

A combination of adequate access, ignition-resistant construction and fuels management will help create a safer environment for emergency service personnel and residents, and it will provide better protection to structures in the event of 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 individual communities, several general measures can be taken to improve fire safety. Actions taken in reference to cutting, pruning or thinning should be done by a certified arborist or forester. The following recommendations should be noted and practiced by anyone living in the WUI:

- Stay aware of the current fire danger in the area.
- Clean your roof and gutters at least twice a year.
- Stack firewood uphill or on a side contour at least 30 feet away from structures.
- Do not store combustibles or firewood under decks.
- Maintain and clean spark arresters on chimneys.
- Place liquid propane gas (LPG) tanks at least 30 feet away from any structure. Clear all vegetation and anything flammable within 10 feet of the tank.
- When possible, maintain an irrigated greenbelt or xeric landscape around the home.
- Mow native grasses at least two or three times per year. Use holidays like Memorial Day, July 4th and Labor Day to remember to complete this task.
- Connect, and have available, a minimum of 50 feet of garden hose. This should include a nozzle that can reach all parts of the house.
- Roof and gutters should be cleared of pine needles, branches and other flammable material. Remove branches overhanging the roof and chimney.
- Fire extinguishers are checked and in working condition.
- Hand tools such as shovels and rakes are easily accessible.
- Post reflective house numbers so that they are clearly visible from the main road. Reflective numbers should also be visible on the structure itself.
- Driveways are easily accessible. Trees and vegetation along driveways should be thinned as necessary to maintain a minimum of 15 feet of vertical and horizontal clearance for emergency vehicle access. This includes removing ladder fuels, which are low-lying branches that allow a fire to climb from the ground into tree canopies at least 8 feet above the ground.
- Remove diseased, stressed, dead or dying vegetation on your property.
- Maintain your defensible space constantly. See below for details on defensible space guidelines.

HOME MITIGATION

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

Communities in the study area were rated for hazard – that is, the likelihood and severity of fire outcomes (fire effects) that result in damage to people, property and/or the environment. The community-level assessment identified 16 of the communities in the study area to be at extreme or very high hazard and 6 of the 23 communities were rated at high hazard. Construction type, condition, age, the fuel loading of the structure/contents, and building position are contributing factors in making homes more susceptible to ignition. Community hazard ratings are also influenced by factors related to the likelihood of rapid fire growth and spread due to fast-burning or flashy fuel components and other topographic features contributing to channeling winds and promotion of intense fire behavior. It is important to remember that these communities are rated relative to what is customary for interface in the Rocky Mountains and may bear little resemblance to similarly rated communities in other areas, such as California chaparral or southern hardwood forests.

Nederland's communities are typical of many interface communities in the West where homes are primarily found in clusters of development often with relatively unbroken forest vegetation separating them. Even homes that do not fall within a community boundary will most likely have hazard levels similar to homes within nearby evaluated communities. Parcel-level hazard surveys of these individual properties may be desired.

DEFENSIBLE SPACE

Construction type, condition, age, fuel loading of the area and building position are contributing factors in making homes more susceptible to ignition under even moderate burning conditions.

Outside of the individual homes within the planning units, historical sites and ranches exist. The following defensible space and home construction guidelines apply to all structures that could be threatened by wildfire, whether or not they are part of a defined community.

Because of the fire ecology of the vegetation and topography, an aggressive program of evaluating and implementing defensible space for all homes, combined with adequate home construction, will do more to limit fire-related property damage than any other single recommendation in this report.

To improve life-safety and preserve property, every home in the study area should have compliant, effective defensible space. This is especially important for homes with wood roofs and homes located 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 Firewise or improve existing home mitigation efforts. Defensible space needs to be maintained throughout the year. Because of differences in vegetation, topography and construction materials, it is suggested that a trained individual be consulted before embarking on a defensible space project.

The check list on the first page includes a starting point for simple steps that can be taken by individual homeowners that will greatly reduce the risk posed by wildfire to their home, as well as better accommodate any kind of emergency response to the residence.

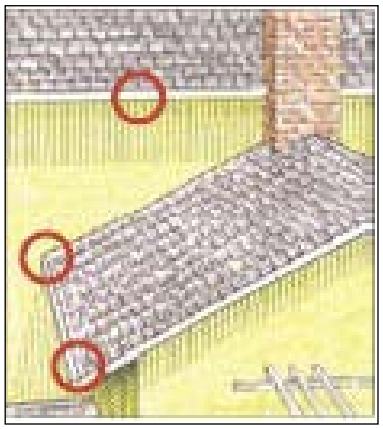


Figure 1. Clean out gutters

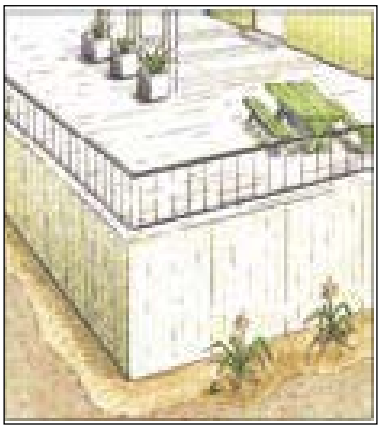


Figure 2. Enclose decks

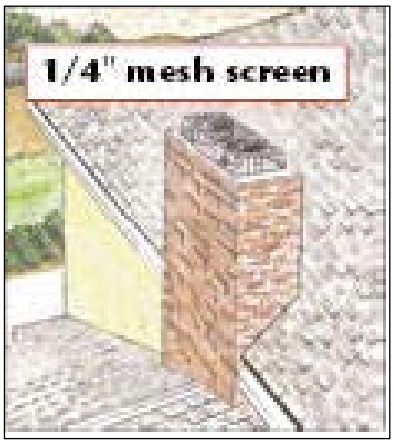


Figure 3. Screen chimneys

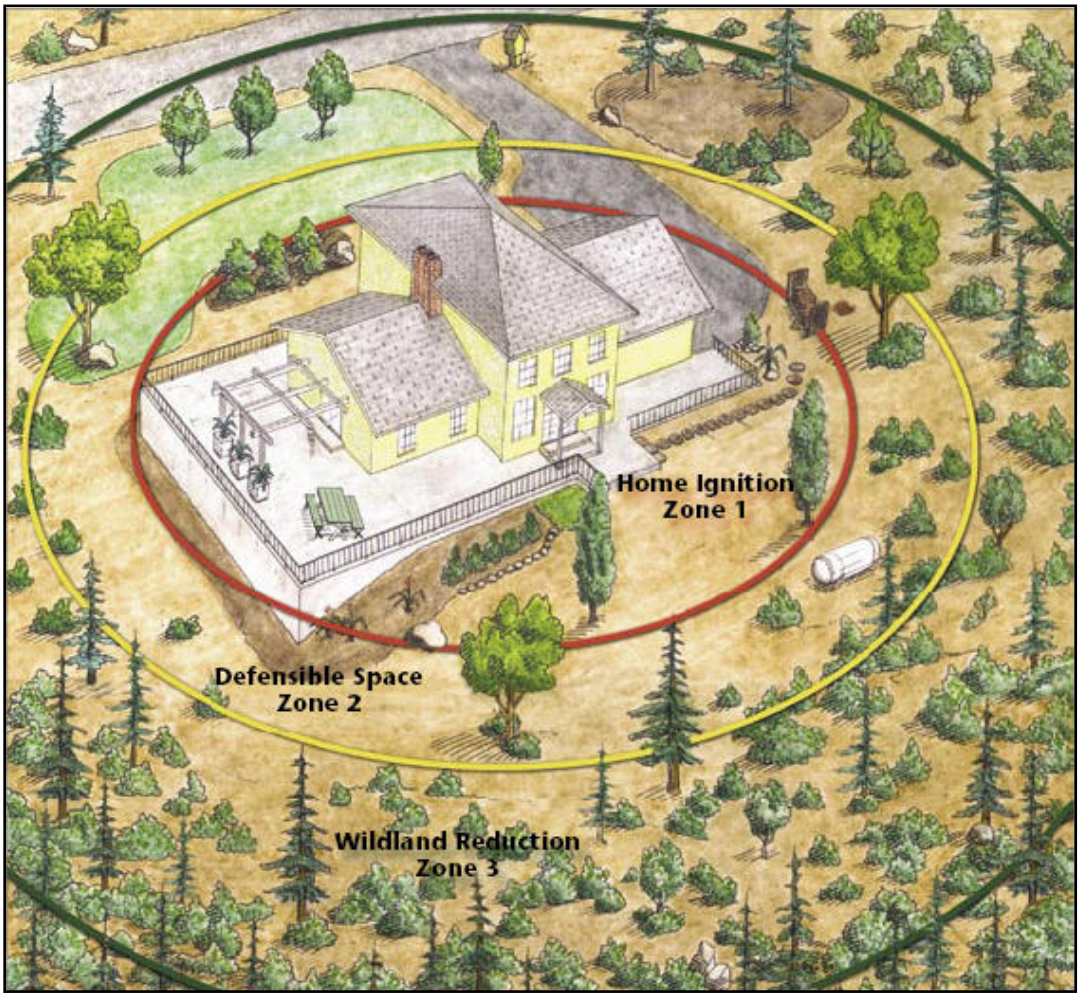


Figure 4. Defensible space zones around the homesite.

The following information is taken directly from the Colorado State Forest Service guidelines on defensible space, also found at: http://csfs.colostate.edu/pdfs/06302.pdf.

Zone 1 is the area of maximum modification and treatment. It consists of an area of 15 feet around the structure in which all flammable vegetation is removed. The 15 feet is measured from the outside edge of the home's eaves and any attached structures, such as decks.

Zone 2 is an area of fuel reduction. It is a transitional area between Zones 1 and 3. The size of Zone 2 depends on the slope of the ground where the structure is built. Typically, the defensible space should extend at least 75 to 125 feet from the structure. See Figure 2 for the appropriate distance for your home's defensible space. Within this zone, the continuity and arrangement of vegetation is modified. Remove stressed, diseased, dead or dying trees and shrubs. Thin and prune the remaining larger trees and shrubs. Be sure to extend thinning along either side of your driveway all the way to your main access road. These actions help eliminate the continuous fuel surrounding a structure while enhancing homesite safety and the aesthetics of the property.

Zone 3 is an area of traditional forest management and is of no particular size. It extends from the edge of your defensible space to your property boundaries.

Prescriptions

Zone 1

The size of Zone 1 is 15 feet measured from the edges of the structure. Within this zone, several specific treatments are recommended. Plant nothing within 3 to 5 feet of the structure, particularly if the building is sided with wood, logs or other flammable materials. Decorative rock, for example, creates an attractive, easily maintained, nonflammable ground cover.

If the house has noncombustible siding, widely spaced foundation plantings of low-growing shrubs or other “fire wise” plants are acceptable. Do not plant directly beneath windows or next to foundation vents. Be sure there are no areas of continuous grass adjacent to plantings in this area. Frequently prune and maintain plants in this zone to ensure vigorous growth and a low-growth habit. Remove dead branches, stems and leaves. Do not store firewood or other combustible materials in this area. Enclose or screen decks with metal screening. Extend the gravel coverage under the decks. Do not use areas under decks for storage.

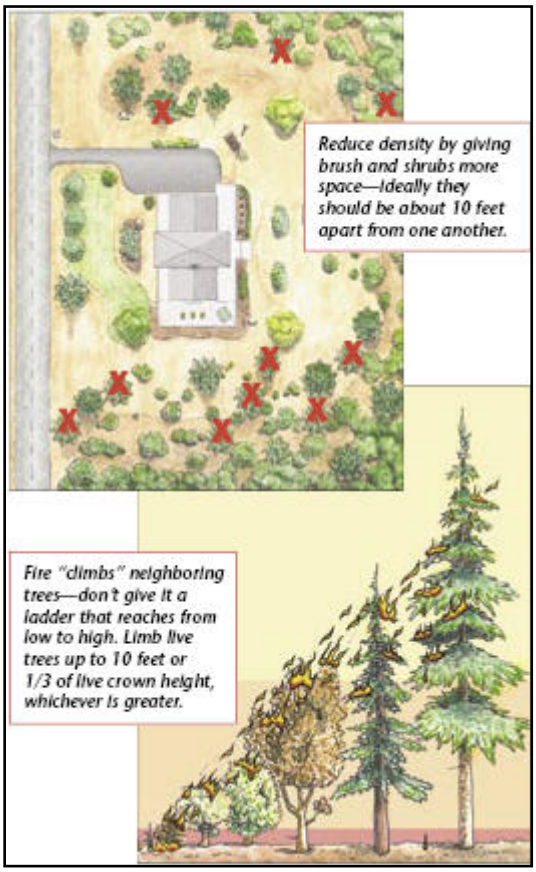


Figure 5. Examples of decreasing vegetation density and example of ladder fuels promoting crown fire.

Ideally, remove all trees from Zone 1 to reduce fire hazards. If you do keep a tree, consider it part of the structure and extend the distance of the entire defensible space accordingly. Isolate the tree from any other surrounding trees. Prune it to at least 10 feet above the ground. Remove any branches that interfere with the roof or are within 10 feet of the chimney. Remove all “ladder fuels” from beneath the tree. Ladder fuels are vegetation with vertical continuity that allows fire to burn from ground level up into the branches and crowns of trees. Ladder fuels are potentially very hazardous but are easy to mitigate. No ladder fuels can be allowed under tree canopies. In all other areas, prune all branches of shrubs or trees up to a height of 10 feet above ground (or half the height, whichever is the least).

Zone 2

Zone 2 is an area of fuel reduction designed to reduce the intensity of any fire approaching your home. Follow these recommended management steps.

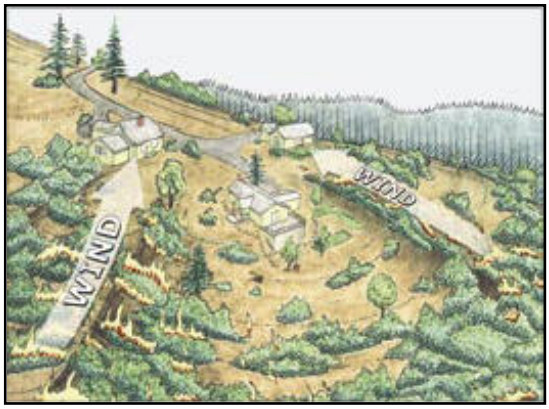


Figure 6. Wind and slope should be taken into consideration when working on defensible space.

Thin trees and large shrubs so there is at least 10 feet between crowns. Crown separation is measured from the furthest branch of one tree to the nearest branch on the next tree. On steep slopes, allow more space between tree crowns. (See Table 1 for minimum recommended spacing for trees on steep slopes.) Remove all ladder fuels from under these remaining trees. Carefully prune trees to a height of at least 10 feet.

Small clumps of two to three trees may be occasionally left in Zone 2. Leave more space between the crowns of these clumps and surrounding trees.
Because Zone 2 forms an aesthetic buffer and provides a transition between zones, it is necessary to blend the requirements for Zones 1 and 3. Thin the portions of Zone 3 adjacent to Zone 2 more heavily than the outer portions.

Isolated shrubs may remain, provided they are not under tree crowns. Prune and maintain these plants periodically to maintain vigorous growth. Remove dead stems from trees and shrubs annually. Where shrubs are the primary fuel in Zone 2, refer to the Special Recommendations section of this fact sheet.

Limit the number of dead trees (snags) retained in this area. Wildlife needs only one or two snags per acre. Be sure any snags left for wildlife cannot fall onto the house or block access roads or driveways.

Mow grasses (or remove them with a weed trimmer) as needed through the growing season to keep them low, a maximum of 6 to 8 inches. This is extremely critical in the fall when grasses dry out and cure or in the spring after the snow is gone but before the plants green up.
Stack firewood and woodpiles uphill or on the same elevation as the structure but at least 30 feet away. Clear and keep away flammable vegetation within 10 feet of these woodpiles. Do not stack wood against your house or on or under your deck, even in winter. Many homes have burned from a woodpile that ignited as the fire passed. Wildfires can burn at almost any time in Colorado.

Locate propane tanks at least 30 feet from any structures, preferably on the same elevation as the house. You don't want the LP container below your house — if it ignites, the fire would tend to burn uphill. On the other hand, if the tank is above your house and it develops a leak, LP gas will flow downhill into your home. Clear and keep away flammable vegetation within 10 feet of these tanks. Do not screen propane tanks with shrubs or vegetation.

Dispose of slash (limbs, branches and other woody debris) from your trees and shrubs through chipping or by piling and burning. Two sites are available seasonally in Nederland and near Allenspark. Contact your local CSFS office or county sheriff's office for information about burning slash piles. If neither of these alternatives is possible, lop and scatter slash by cutting it into very

small pieces and distributing it over the ground. Avoid heavy accumulations of slash. Lay it close to the ground to speed decomposition. If desired, no more than two or three small, widely spaced brush piles may be left for wildlife purposes. Locate these towards the outer portions of your defensible space.

Zone 3

This zone is of no specified size. It extends from the edge of your defensible space to your property lines. A gradual transition into this zone from defensible space standards to other management objectives you may have is suggested. Typical management objectives for areas surrounding homesites or subdivisions are: provide optimum recreational opportunities; enhance aesthetics; maintain tree health and vigor; provide barriers for wind, noise, dust and visual intrusions; support limited production of firewood, fence posts and other forest commodities; or grow Christmas trees or trees for transplanting.

Specific requirements will be dictated by your objectives for your land and the kinds of trees present. Issues with mountain pine beetle and other insect and diseases should be addressed in this zone. Forest management in Zone 3 is an opportunity for you to increase the health and growth rate of the forest in this zone. Keep in mind that root competition for available moisture limits tree growth and ultimately the health of the forest.

A high-canopy forest reduces the chance of a surface fire climbing into the tops of the trees and might be a priority for you if this zone slopes steeply. The healthiest forest is one that has multiple ages, sizes and species of trees where adequate growing room is maintained over time. Remember to consider the hazards of ladder fuels. Multiple sizes and ages of trees might increase the fire hazard from Zone 3 into Zone 2, particularly on steep slopes.

A greater number of wildlife trees can remain in Zone 3. Make sure that dead trees pose no threat to power lines or fire access roads.

While pruning generally is not necessary in Zone 3, it may be a good idea from the standpoint of personal safety to prune trees along trails and fire access roads. Or, if you prefer the aesthetics of a well-manicured forest, you might prune the entire area. In any case, pruning helps reduce ladder fuels within the tree stand, thus enhancing wildfire safety.

% slope	Tree Crown Spacing	Brush and Shrub Clump Spacing
0 -10 %	10´	2 1/2 x shrub height
11 - 20%	15´	3 x shrub height
21 - 40%	20´	4 x shrub height
> 40%	30´	6 x shrub height

Table 1. Guidelines for vegetation thinning based on percent slope.

Mowing is not necessary in Zone 3. Any approved method of slash treatment is acceptable for this zone, including piling and burning, hauling material to a safe disposal site, chipping or lop-and-scatter.

An International Society of Arboriculture Certified Arborist or Certified Forester should be consulted before pruning or removing trees. Specific tree care information can be found at: www.isa-arbor.com.

Home Construction

"When considering improvements to reduce wildfire vulnerability, the key is to consider the home in relation to its immediate surroundings. The home's vulnerability is determined by the exposure of its external materials and design to flames and firebrands during extreme wildfires. The higher the fire intensities near the home, the greater the need for nonflammable construction materials and a resistant building design." – Jack Cohen, USDA Forest Service

General Home Construction Considerations

- Enclose under decks so firebrands do not fly under and collect.
- Use glass skylights; plastic will melt and allow embers into the home.
- Enclose eaves and soffits.
- Use non-flammable fencing if attached to the house, such as metal.
- Cover openings with 1/8-inch metal screen to block fire brands and embers from collecting under the home or deck.
- The roof is the most important element of the home. Use rated roofing material.

Guide to Landscaping

- Create a cinder block wall around the perimeter of your yard and use grass and slate to break up the landscape.
- The use of pavers and rock make for a pleasing effect and creates a fuel break.
- Use groupings of potted plants that include succulents and other drought resistant vegetation.
- Use faux brick and stone finishes and high-moisture content annuals and perennials.
- Use grass and driveways as fuel breaks from the house.

Building Materials

Use rated roofing material. Roofing material with a Class A, B or C rating is fire resistant and will help keep the flame from spreading. Examples include:

- Composition shingle
- Metal
- Clay
- Cement tile

Use fire-resistant building materials on exterior walls. Examples include:

- Cement
- Plaster
- Stucco
- Masonry (concrete, stone, brick or block)

While vinyl is difficult to ignite, it can fall away or melt when exposed to extreme heat.
Use double-paned or tempered glass. Double-pane glass can help reduce the risk of fracture or collapse during an extreme wildfire. Tempered glass is the most effective. For skylights, glass is a better choice than plastic or fiberglass.

Enclose eaves, fascias, soffits and vents. "Box in" eaves, fascias, soffits and vents, or enclose them with metal screens. Vent openings should be covered with 1/8-inch metal screen.

Protect overhangs and other attachments. Remove all vegetation and other fuels from around overhangs and other attachments (room additions, bay windows, decks, porches, carports and fences). Box in the undersides of overhangs, decks and balconies with noncombustible or fire-resistant materials. Fences constructed of flammable materials such as wood should not be attached directly to the house.

Anything attached to the house (decks, porches, fences and outbuildings) should be considered part of the house. These act as fuel bridges, particularly if constructed from flammable materials.

1. If a wood fence is attached to the house, separate the fence from the house with a masonry or metal barrier.
2. Decks and elevated porches should be kept free of combustible materials and debris.
3. Elevated wooden decks should not be located at the top of a hill. Consider a terrace.

Recommendations

- *Priority level* ***High.*** High winds in the area are known to cause power lines to blow down. Downed lines pose a significant threat of ignition, and as a result, should be buried when possible. Work towards funding opportunities that will help with the costs associated with this task.
- *Priority level* ***High***. Conduct a parcel-level wildfire hazard analysis for all the homes in the study area, especially those with an extreme or very high rating. Completing this process will facilitate the following important fire management practices:
    - Establish a baseline hazard assessment for individual homes in these communities
    - Educate the community through the presentation of the parcel-level Hazard-Risk Analysis at neighborhood public meetings
    - Identify defensible space needs and other effective mitigation techniques
    - Identify and facilitate "cross-boundary" projects
    - Make community achievement of national Firewise status a priority
    - Maintain a pre-attack/operational plan for the study area. The pre-attack plan assists fire agencies in developing strategies and tactics that will mitigate damage when incidents do occur
- *Priority level* ***High***. Ask homeowners associations and other neighborhood groups to promote the development of defensible space and Firewise plantings. Eliminate any covenants or deed restrictions that require or endorse the use of flammable building materials such as shake roofs. Specific publications that address these issues can be found at: www.firewise.org.

ROAD SIGNS, HOME ADDRESSES, AND EVACUATION

Some of the communities within the study area have missing or inadequate street signs (non-reflective, combustible). For many homes, the only address marker is a homemade sign. These vary widely in type and location, and some cannot easily be identified as address markers. Many are not reflective and some are mounted in such a way that determining which home they belong to is difficult or impossible (Figure 7 and Figure 8).

While residents may consider non-reflective wooden address signage to be decorative, such signage is an impediment to quick and effective response. Proper reflective signage is a critical operational need (Figure 9 and Figure 10). 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 for out-of-district responders who do not have the opportunity to train on access issues specific to the response area. The value of the time saved, especially at night and in difficult conditions, cannot be overstated: it can make the difference between lives saved and lost.

Figure 7. Combustible and difficult to read road sign.

Figure 8. Combustible and non-reflective road signs.

Figure 10. Non-reflective and combustible home address marker with numbers placed backwards.

Figure 9. Confusing and inconsistent home address markers.

Recommendations

- Every intersection and street name change should have adequate, reflective signage. A program of replacing worn or difficult to read street signs should be developed. Include specifications and input from Boulder County officials, developers, HOAs and the Nederland Fire Protection District.
- Grouped 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.
- Lot markers should be replaced with address markers as soon as a 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 Colo. Highway 119”
- Develop a public education campaign to advise property owners of the importance of proper street addressing and how to properly address their property.
- *Priority level **High**.* In order to reduce potential conflicts between evacuating residents and incoming responders, it is desirable to have nearby evacuation centers and staging areas for fire resources. This is especially important in communities with single access and a high population density. Evacuation centers should include heated buildings with facilities large enough to handle the population. Schools and churches are usually ideal for this purpose. Fire staging areas should contain large safety zones, a good view in the direction of the fire, easy access and turnarounds for large apparatus, a significant fuel break between the fire and the escape route, topography conducive to radio communications and access to water. Golf courses and large irrigated meadows may make good safety zones for firefighting forces. Local responders are encouraged to pre-plan the use of potential staging areas with property owners.
- *Priority level **High**.* Identify and pre-plan primary escape routes for all WUI communities. Emergency management personnel should be included in the development of preplans for resident evacuation. Re-evaluate and update these plans as necessary.
- *Priority level **High**.* Educate residents on the proper escape routes and evacuation centers to use in the event of an evacuation. This also applies to animal rescue.
- *Priority level **High**.* Ensure the existing reverse 911 system includes wildfire notifications.
- *Priority level **Moderate**.* Perform response drills to determine the timing and effectiveness of escape routes and fire resource staging areas.

PUBLIC EDUCATION

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 fire department efforts at risk reduction.

Provide communities and homeowners fire prevention educational materials through personal contact. Fire prevention and wildfire hazard mitigation education should be an ongoing effort.

Priority Level ***High:*** Implement fire prevention, fire preparedness and defensible space and hazard-reduction recommendations for each community.

Priority Level ***High*****:** Obtain "Smokey Bear" signs for use along entrances to communities to inform the public of the current fire danger and to promote fire prevention. Ensure that fire danger messages are kept up to date with Daily Fire Danger broadcasts to maintain credibility and effectiveness.

- Create an evacuation plan that is presented and distributed to residents
- Hold multiple meetings per year to educate residents on wildfire risk, defensible space and evacuation
- Use these websites for a list of public education materials and for general homeowner education:
    - http://csfs.colostate.edu/pages/wf-protection.html
    - http://www.Safeco.com/Safeco/about/giving/firefree.org
    - http://www.fs.fed.us/fire/links/links_prevention.html
    - http://www.or.blm.gov/nwfire/docs/Livingwithfire.pdf
    - http://www.firewise.org
    - http://www.SouthwestColoradoFires.org
    - http://www.blm.gov/nifc/st/en/prog/fire.1.html
- Provide residents with the findings of this study including:
    - Levels of risk and hazard
    - Values of fuels-reduction programs
    - Consequences of inaction for the entire community
- Create a Firewise Council or similar WUI citizen advisory committee to promote the message of shared responsibility. Too often, advice from government agencies can be construed as self-serving. Consequently, residents may resist acting on this information. The Firewise Council should consist of local residents, and its primary goals should be:
    - Bringing the concerns of residents to the prioritization of mitigation actions
    - Selecting demonstration sites
    - Assisting with grant applications and awards
- Make use of regional and local media to promote wildfire public education messages in the fire district.
- Maintain current wildfire educational presentations explaining the concepts of defensible space and wildfire hazard mitigation. The information in this report should be incorporated into that presentation for the education of homeowners district-wide. This could be done through informational gatherings sponsored by the fire department,

homeowners associations or neighborhood groups, and at events such as local festivals, school activities, times of extreme fire danger and other times of heightened awareness concerning wildfire. It is far easier to bring the information to residents than to bring residents to the information, making this an especially powerful resource.

LOCAL PREPAREDNESS AND FIRE FIGHTING CAPABILITIES

In addition to the overview of the local fire departments' capabilities discussed in the main CWPP, this section provides additional, more detailed information regarding response times and additional recommendations to consider.

Proximity

Distances to the nearest fire stations were calculated in ArcGIS and take into account the road distance to a given area, rather than merely the "flight distance." Figure 11 shows the driving distances from the communities to the nearest fire station. Note that while the stations are well equipped and have personnel with training, it is possible that a fire could spread into a community before firefighting equipment arrives. The stations are not staffed at all times, and resources may be busy with other emergencies when a fire occurs. For this reason, defensible space is the most important first line of defense.

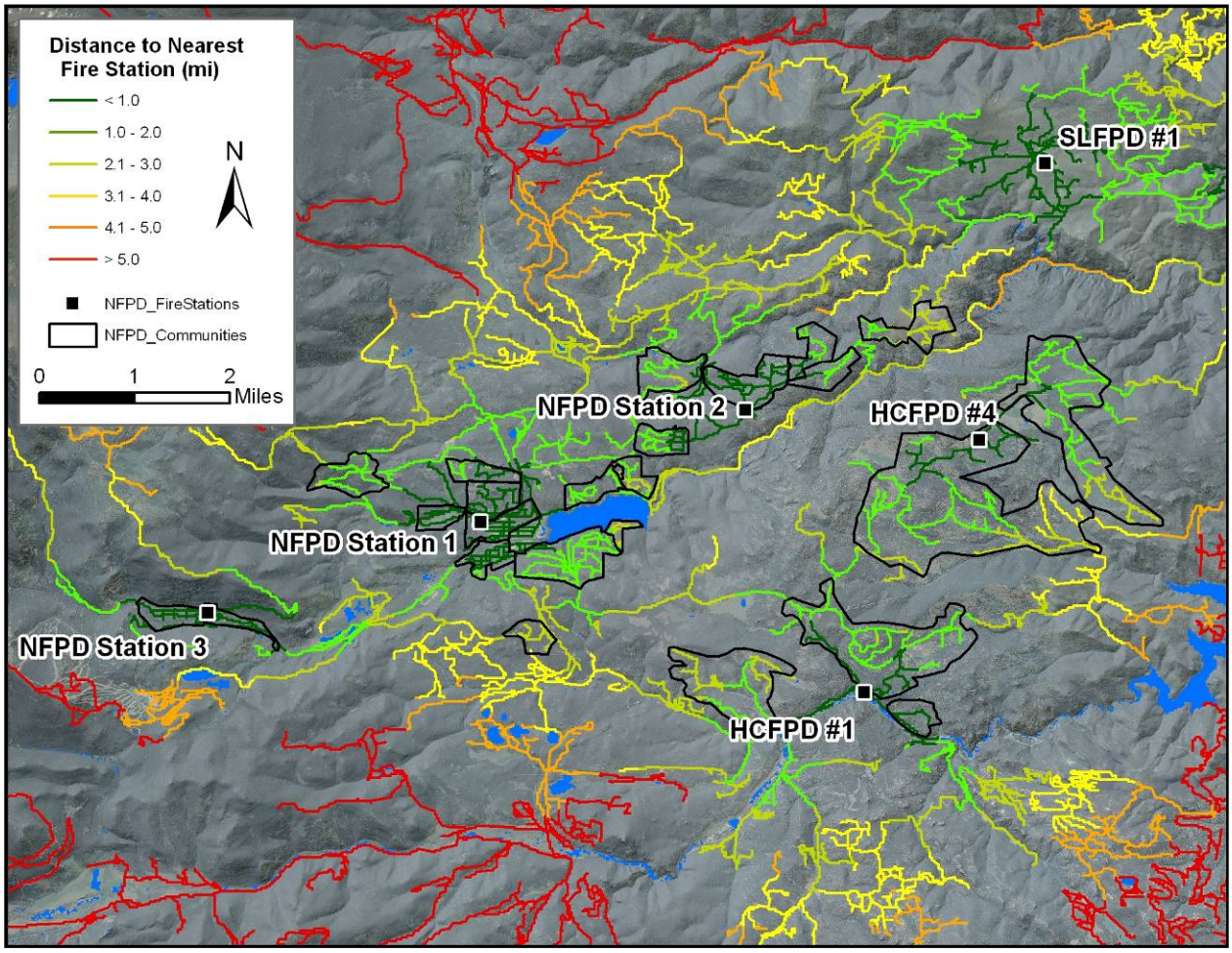


Figure 11. Proximity (driving distance) to nearest fire stations.

The distance analysis calculates *drivable distance, not drive time*. However, the distance is an important factor in rating community hazards. Response times will vary greatly over the same distance because of road conditions, curvature of roads and evacuation traffic. Most fire service leaders agree that response time is composed of a number of distinct elements: call processing time (the time it takes for dispatchers to ascertain the location and nature of the emergency and initiate the appropriate response); turnout or staffing time (the time it takes for personnel to respond to the dispatch, board apparatus and begin traveling to the scene); and travel time (the actual time it takes to travel from the station to the scene). Not only does this graphic display the drivable distance, it assumes the station is actually staffed. As an example, while there are stations throughout the study area, the personnel are volunteers and do not inhabit the stations 24 hours a day.

WATER SUPPLY

Water is a critical fire-suppression issue in the study area, as it is in many communities in Colorado. While cities in the county have an adequate hydrant network, most of the communities identified in the CWPP do not, with the exception of North and South Nederland.

Flow rates are not adequate in all areas for large-scale suppression activities and hydrants are not tested annually.

Recommendations

- *Priority Level* ***High:*** Areas with no water or inadequate water supply should be evaluated to improve existing hydrants, establish a stored water supply or use firefighting resources.
- *Priority Level* ***Moderate:*** Map existing hydrants, water sources and their volume. Make this information available for emergency personnel in and out of the district.
- *Priority Level* ***Moderate:*** Make sure cisterns are well marked with their capacity and are kept clear of vegetation.
- *Priority Level* ***Moderate:*** Conduct annual testing for fire hydrant function and capacity.
- *Priority Level* ***Moderate:*** NFPD and TFPD trainings should focus frequently on drafting operations throughout the spring and summer to ensure apparatus can be filled with water in the event of a wildfire.

FUELBREAK GUIDELINES

The document below is the CSFS publication on fuelbreaks.

COLLABORATION: COMMUNITIES/AGENCIES/STAKEHOLDERS

CWPP development is defined by HFRA as a collaborative process that involves local government, local fire authorities, state forest management agencies and relevant federal land management agencies, as well as a broad range of other interested stakeholders.

The initial step involves organizing an operating group to serve as the core decision-making team. At a minimum, HFRA requires the stakeholders group to comprise representatives from local government, local fire authorities and the state forest management agency (for Colorado, this is the Colorado State Forest Service, or CSFS). Together, these entities form the decision-making team responsible for the development of the CWPP and must mutually agree on the plan's final contents, as outlined in HFRA. The NFPD and TFPD stakeholders are listed in the table below.

Name	Organization
Rick Dirr	Nederland Fire Protection District
Jake Vassar Galen Koepke John Carder Randy Ralphs Dave Hitchcock Greg Ching Dave Thompson Dorothy Whalen	Timberline Fire Protection District
Allen Owen Bob Bundy	Colorado State Forest Service
Jim Webster Scott Golden Ryan Ludlow	Boulder County
Mark Martin	U.S. Forest Service
Barry Bennett Rick Dirr Marca Hagenstad Lex Ivey Ryan Ludlow Keith Nowicki Mikki Osterloo	Indian Peaks Forest Alliance
Mark Guercio	Caribou Ranch

STRATEGIC PLANNING

Several stakeholder meetings were held during the development of the CWPP. The initial stakeholder "kickoff" meeting, held April 12, 2010, at the Nederland Fire Station No. 1, brought together CWPP "Core Team" members. Included were County officials, local fire agencies, CSFS, local land management agencies, local environmental associations and other prominent

stakeholders. A second stakeholder meeting for TFPD was held on June 8, 2010, at the TFPD Station No. 4. Five individuals attended this meeting. Discussion focused on the scope of the project, desired outcomes and agency participation. The meeting covered introductions, methodology, stakeholder goals, project management, mapping data and a regional map review. The group delineated and defined the county's community and neighborhood zones that would be targeted for assessment. The attendees at this meeting are listed in the table above.

COMMUNITY OUTREACH

The success of any CWPP is dependent upon community involvement for both strategic input and long-term ownership and implementation. A plan that accurately reflects the community's interests, concerns and priorities will have greater legitimacy and long-term success. The outreach strategy this CWPP employed was a multi-tiered approach that engaged public agencies, interested parties and local organizations in order to raise public awareness and generate public input.

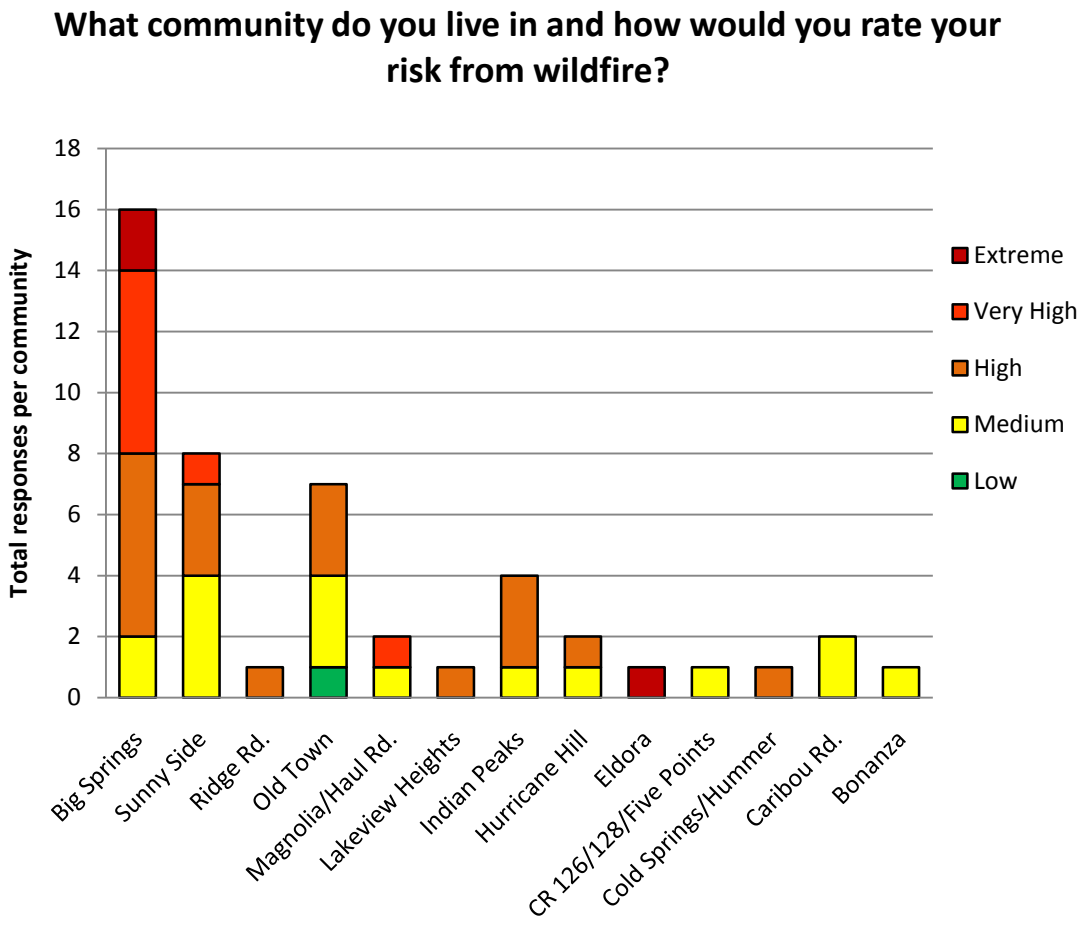
In addition to the stakeholder meeting, a public meeting, advertised via flyers around town and in the Nederland Mountain Ear newspaper was held to generate direct feedback from county residents on the CWPP development process, community assessment results and specific community mitigation recommendations. The meeting was held on Nov. 13, 2010, at the Nederland Community Center. Approximately 10 people attended.

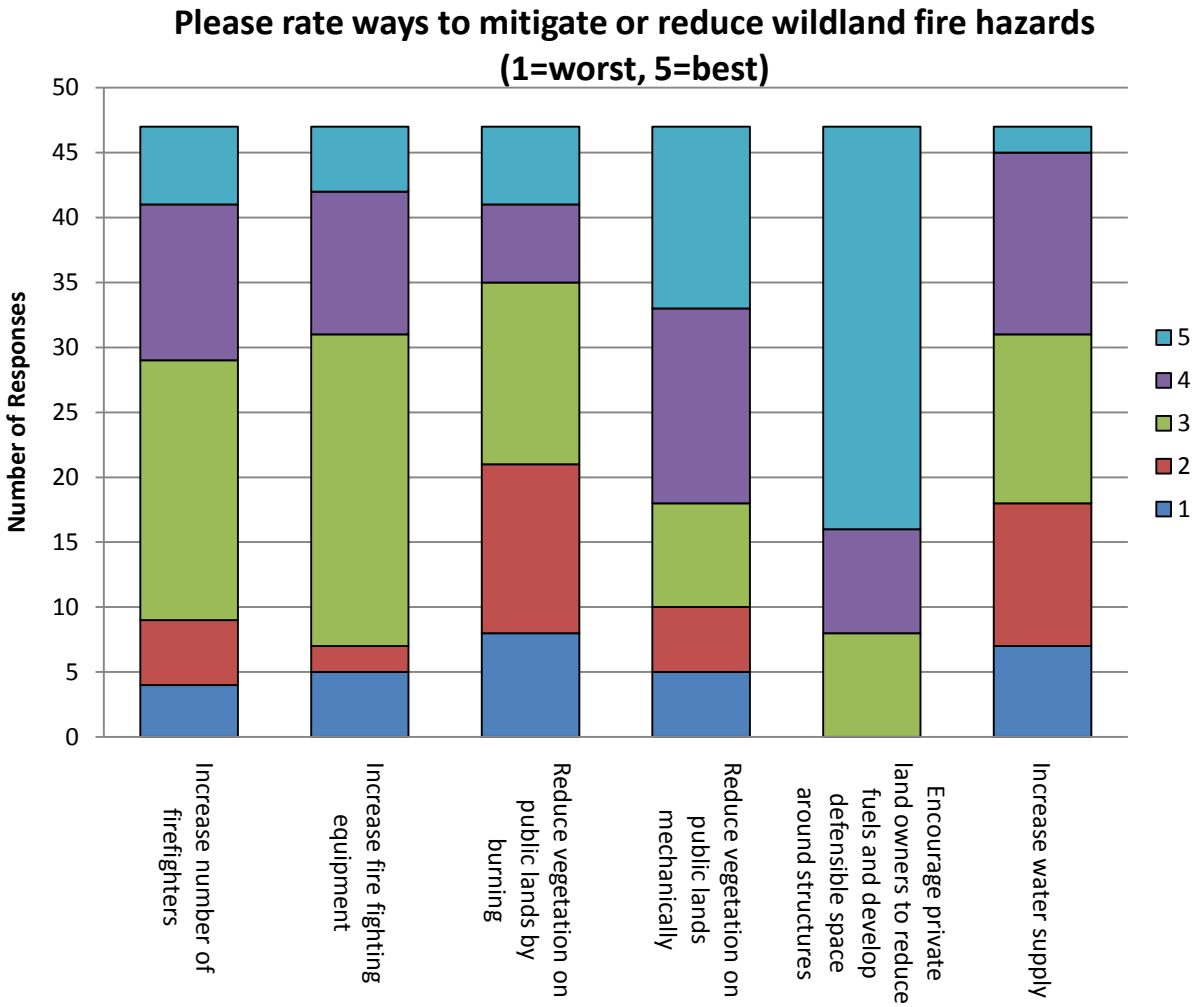
Throughout the CWPP development process, a unique web-based communication tool was provided to all CWPP stakeholders. This tool allowed communication between project team members and stakeholders. Access to the website was provided to the general public upon the release of the draft report to facilitate submission of public feedback to the project team.

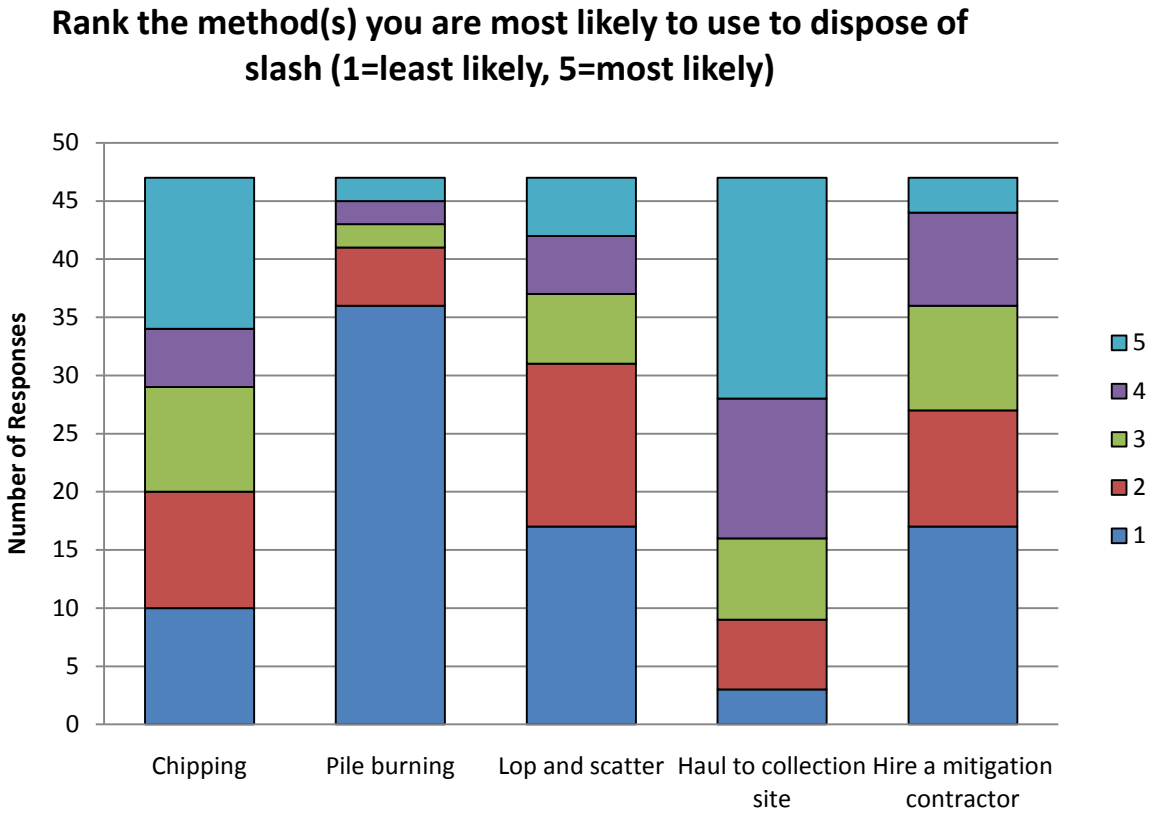
A county-wide resident survey was provided through the Town of Nederland website. This on-line resource was made available to the public and was launched in January 2009 and remains available. Forty-seven people completed the survey. Results were analyzed and are included graphically below.

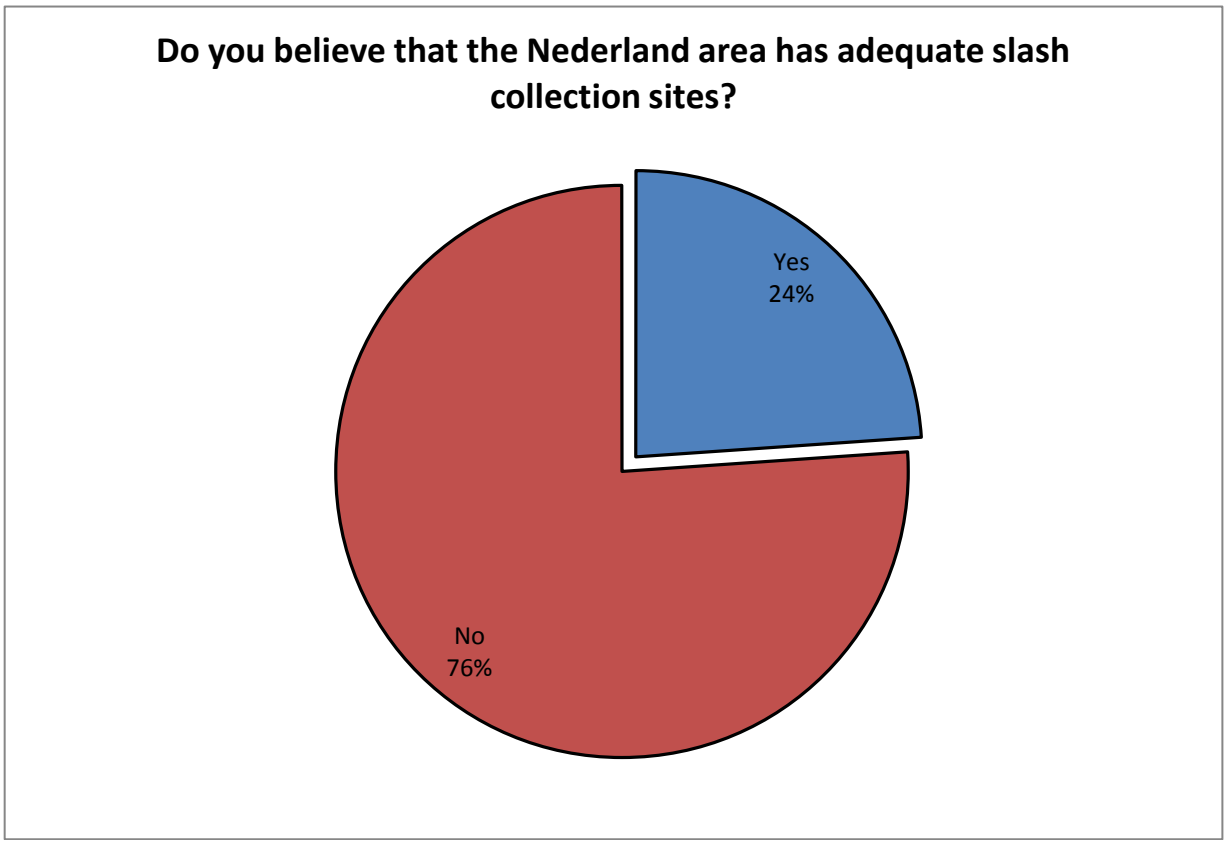
General themes that were determined by the survey and meetings include:

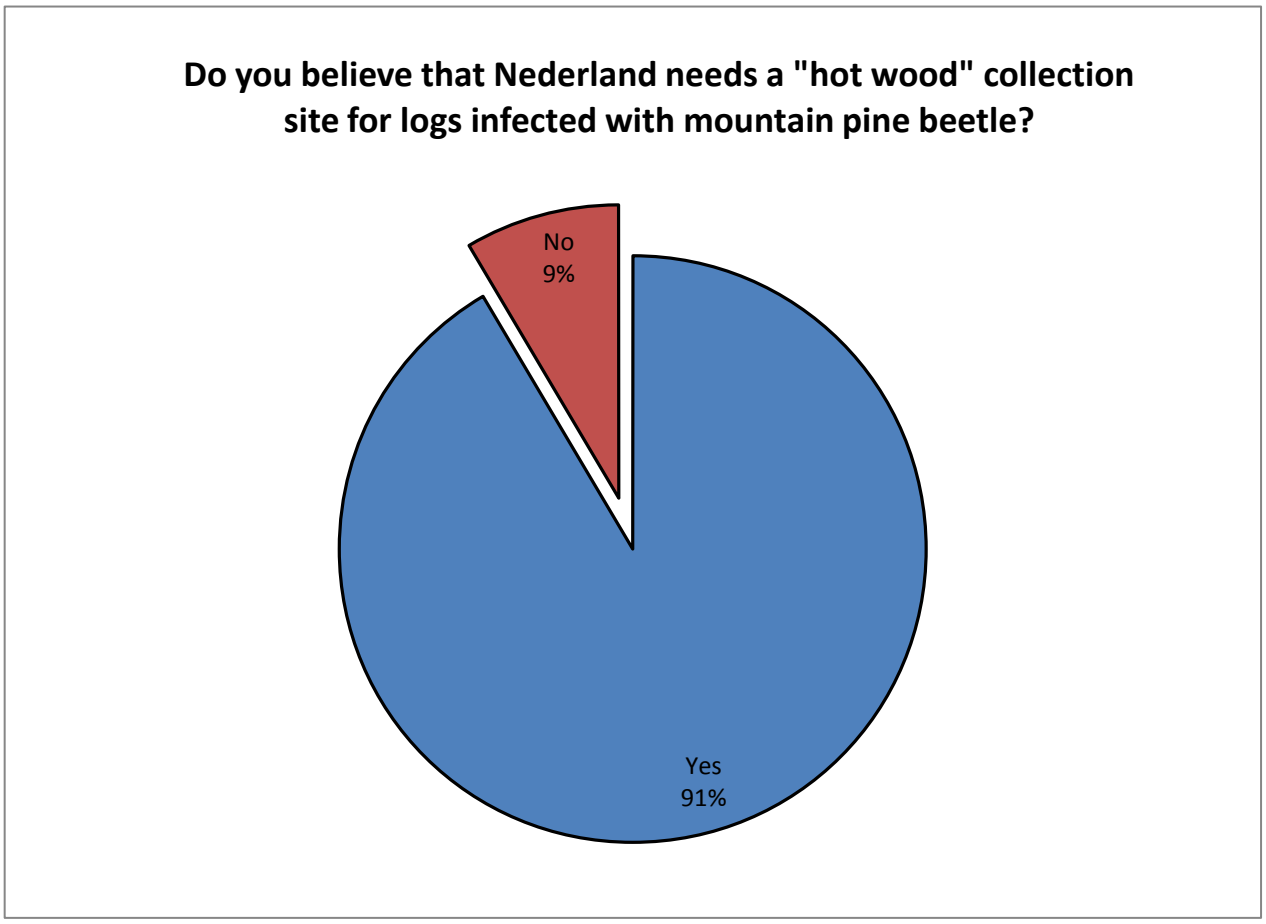
- Individual responsibility for reducing fuels and creating defensible space is thought to be the most effective way to reduce wildfire risk.
- Community members do not think that the Nederland area has an adequate slash disposal site.
- Individuals conducting pile burning are believed to increase the wildfire risk in the area.
- Email and websites are the best ways to educate the community about wildfire.

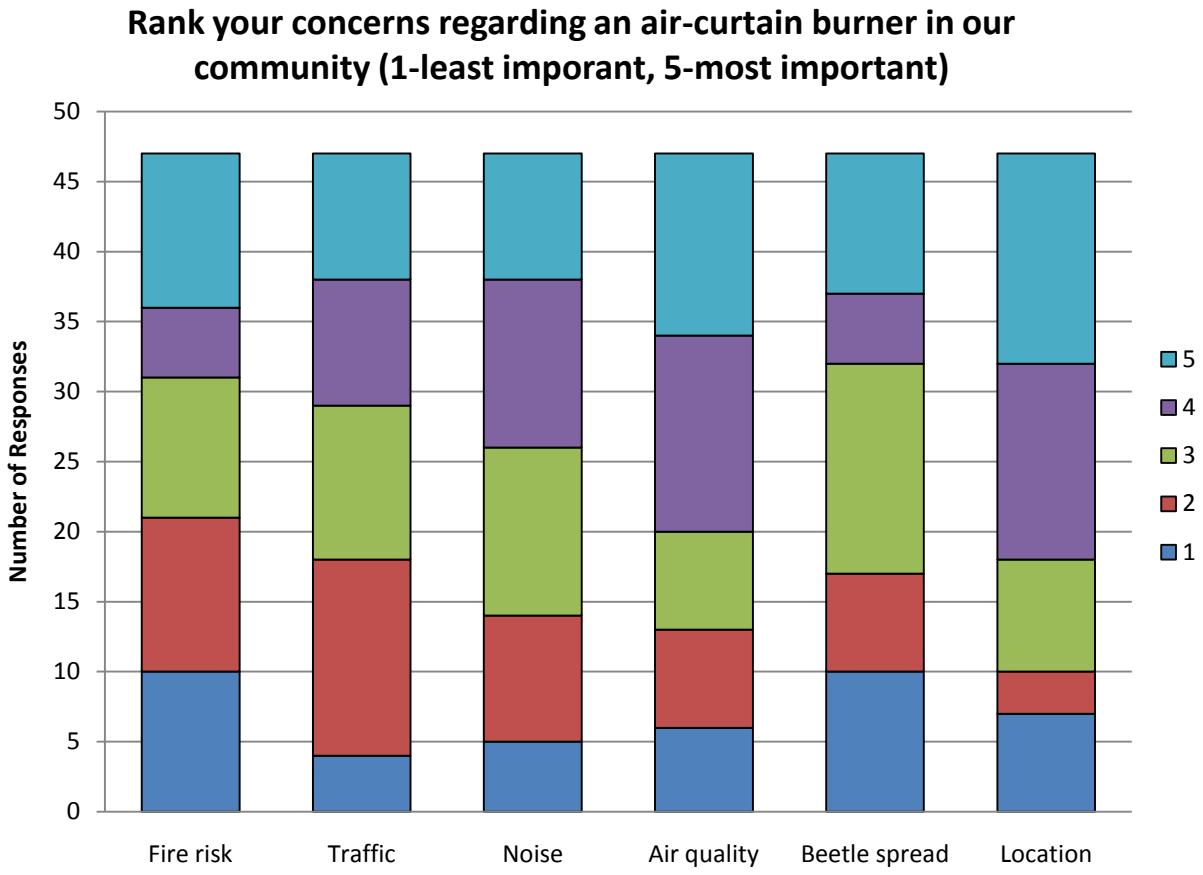

What community do you live in and how would you rate your risk from wildfire?
Total responses per community
18
16
14
12
10
8
6
4
2
0
Extreme
Very High
High
Medium
Low
Big Springs
Sunny Side
Ridge Rd.
Old Town
Magnolia/Haul Rd.
Lakeview Heights
Indian Peaks
Hurricane Hill
Eldora
CR 126/128/Five Points
Cold Springs/Hummer
Caribou Rd.
Bonanza

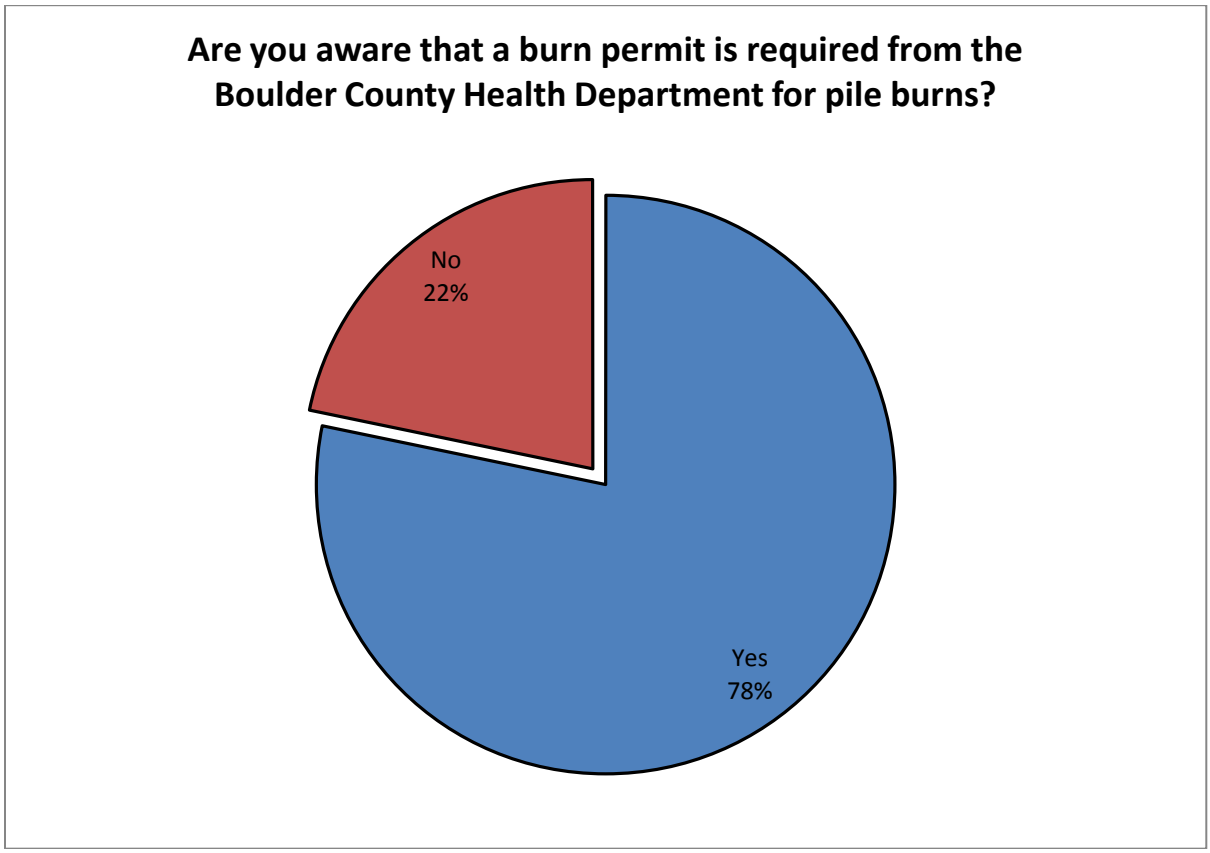

Please rate ways to mitigate or reduce wildland fire hazards
(1=worst, 5=best)
Number of Responses
50
45
40
35
30
25
20
15
10
5
0
Increase number of firefighters
Increase fire fighting equipment
Reduce vegetation on public lands by burning
Reduce vegetation on public lands mechanically
Encourage private land owners to reduce fuels and develop defensible space around structures
Increase water supply
5
4
3
2
1

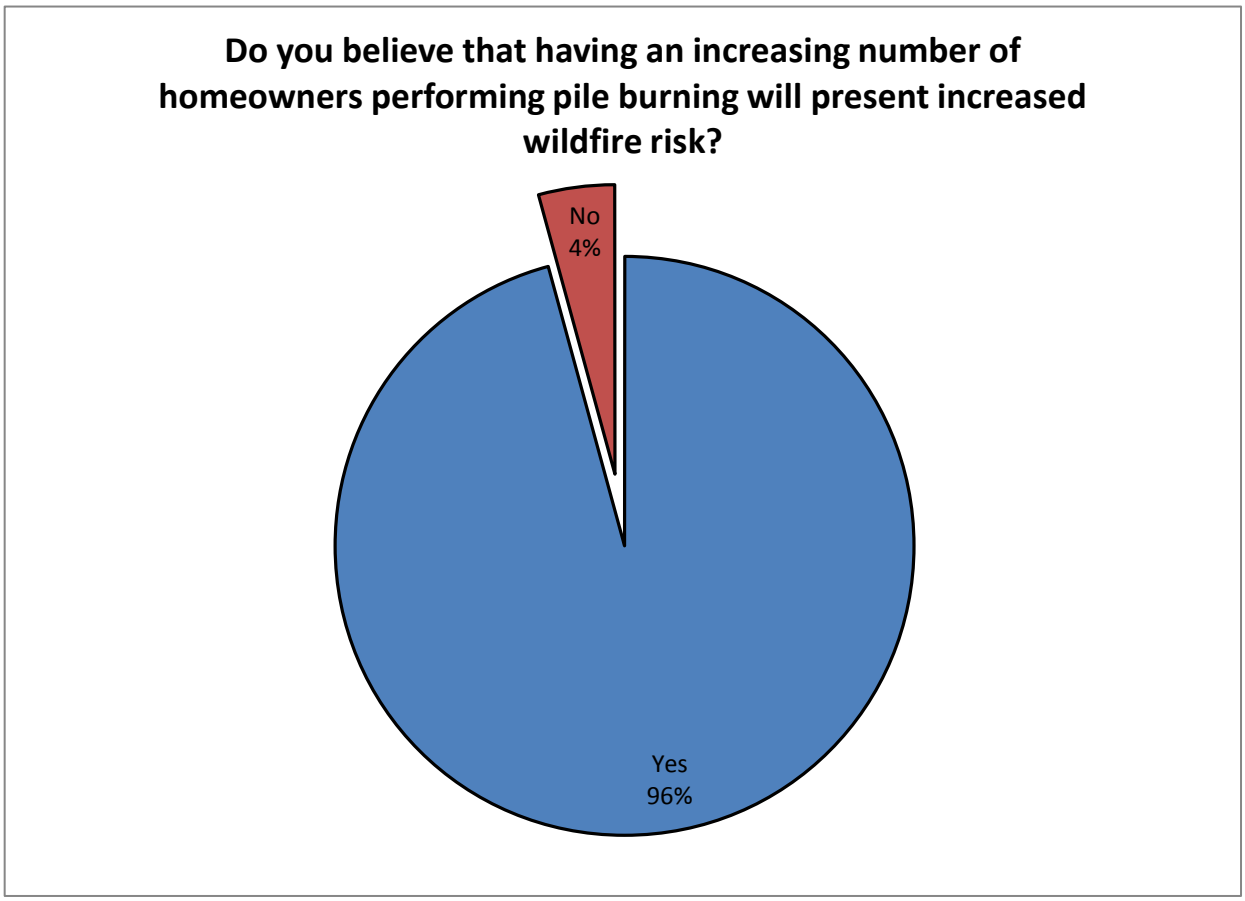

Rank the method(s) you are most likely to use to dispose of slash (1=least likely, 5=most likely)
Number of Responses
50
45
40
35
30
25
20
15
10
5
0
Chipping
Pile burning
Lop and scatter
Haul to collection site
Hire a mitigation contractor
5
4
3
2
1

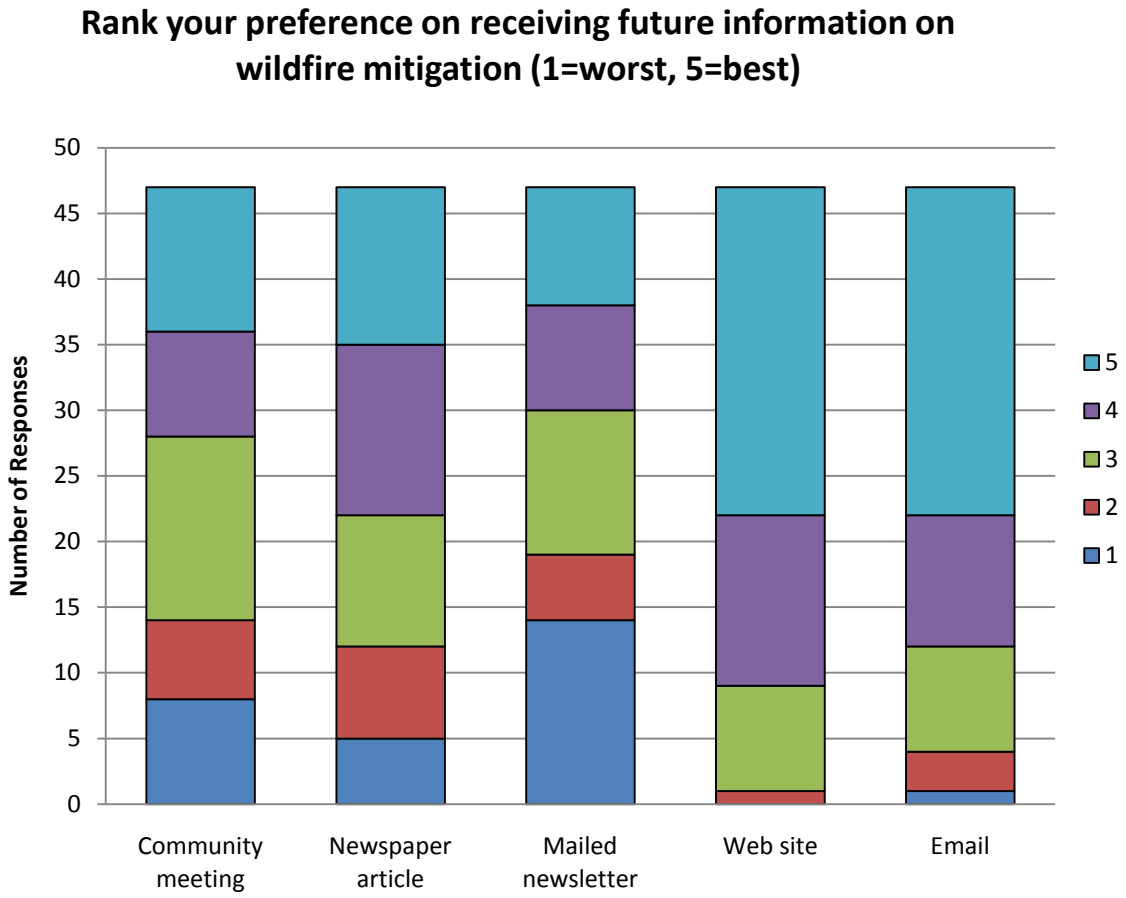

Do you believe that the Nederland area has adequate slash collection sites?
Yes
24%
No
76%

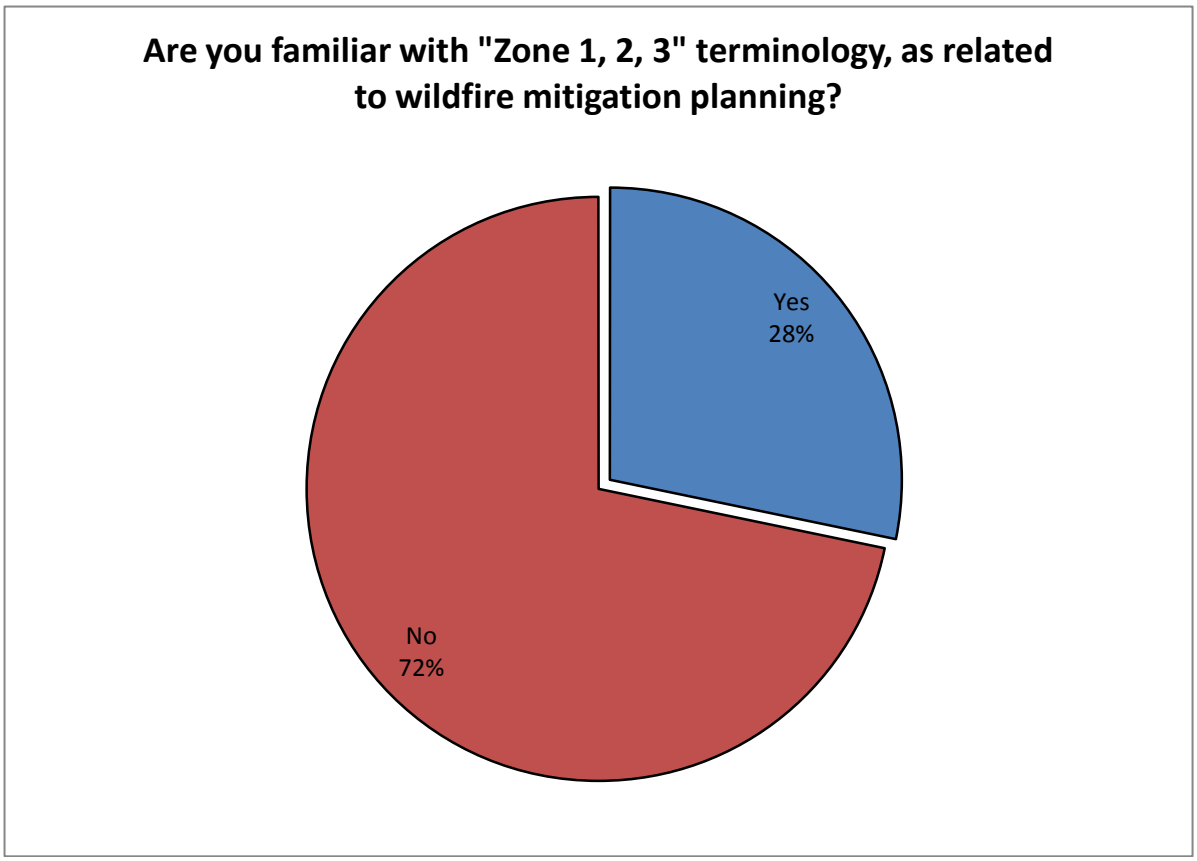

Do you believe that Nederland needs a "hot wood" collection site for logs infected with mountain pine beetle?
No
9%
Yes
91%

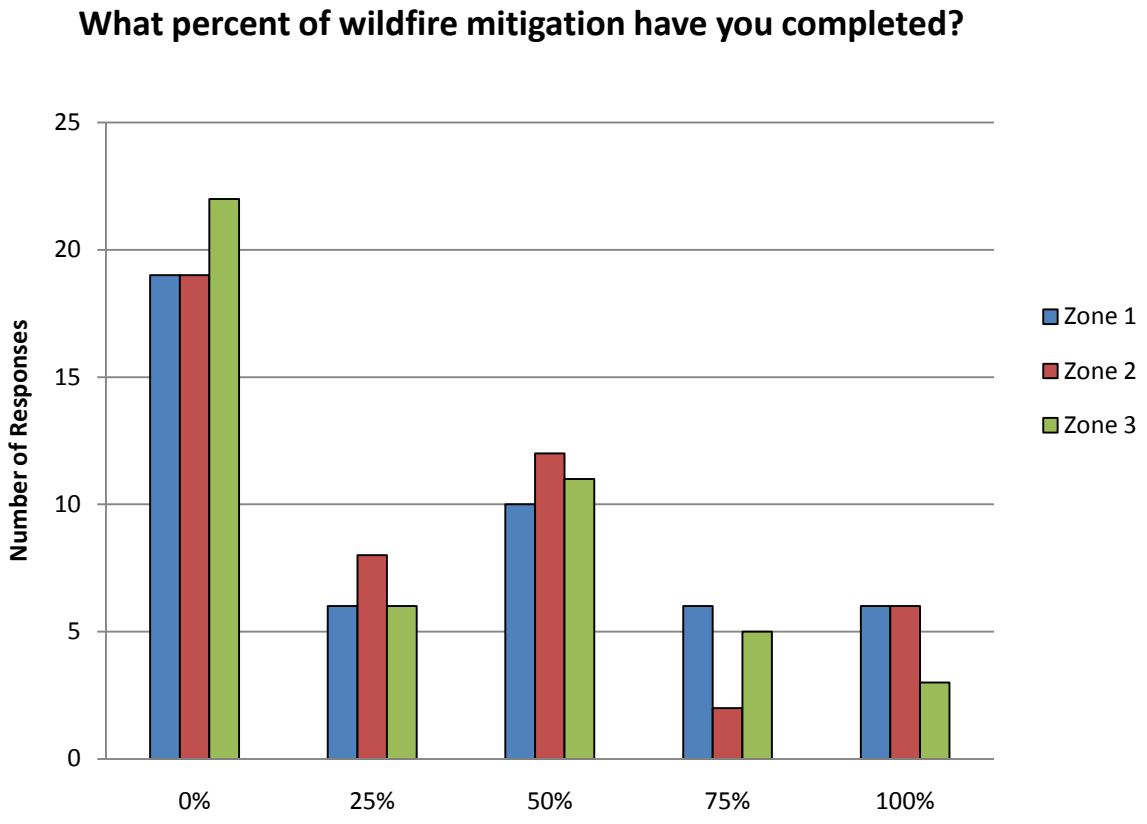

Rank your concerns regarding an air-curtain burner in our community (1-least imporant, 5-most important)
Number of Responses
50
45
40
35
30
25
20
15
10
5
0
Fire risk
Traffic
Noise
Air quality
Beetle spread
Location
5
4
3
2
1


Are you aware that a burn permit is required from the Boulder County Health Department for pile burns?
No
22%
Yes
78%


Do you believe that having an increasing number of homeowners performing pile burning will present increased wildfire risk?
No
4%
Yes
96%


Rank your preference on receiving future information on wildfire mitigation (1=worst, 5=best)
Number of Responses
50
45
40
35
30
25
20
15
10
5
0
Community meeting
Newspaper article
Mailed newsletter
Web site
Email
5
4
3
2
1


Are you familiar with "Zone 1, 2, 3" terminology, as related to wildfire mitigation planning?
Yes
28%
No
72%


What percent of wildfire mitigation have you completed?
Number of Responses
25
20
15
10
5
0
0%
25%
50%
75%
100%
Zone 1
Zone 2
Zone 3

FIRE BEHAVIOR TECHNICAL REFERENCE

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.

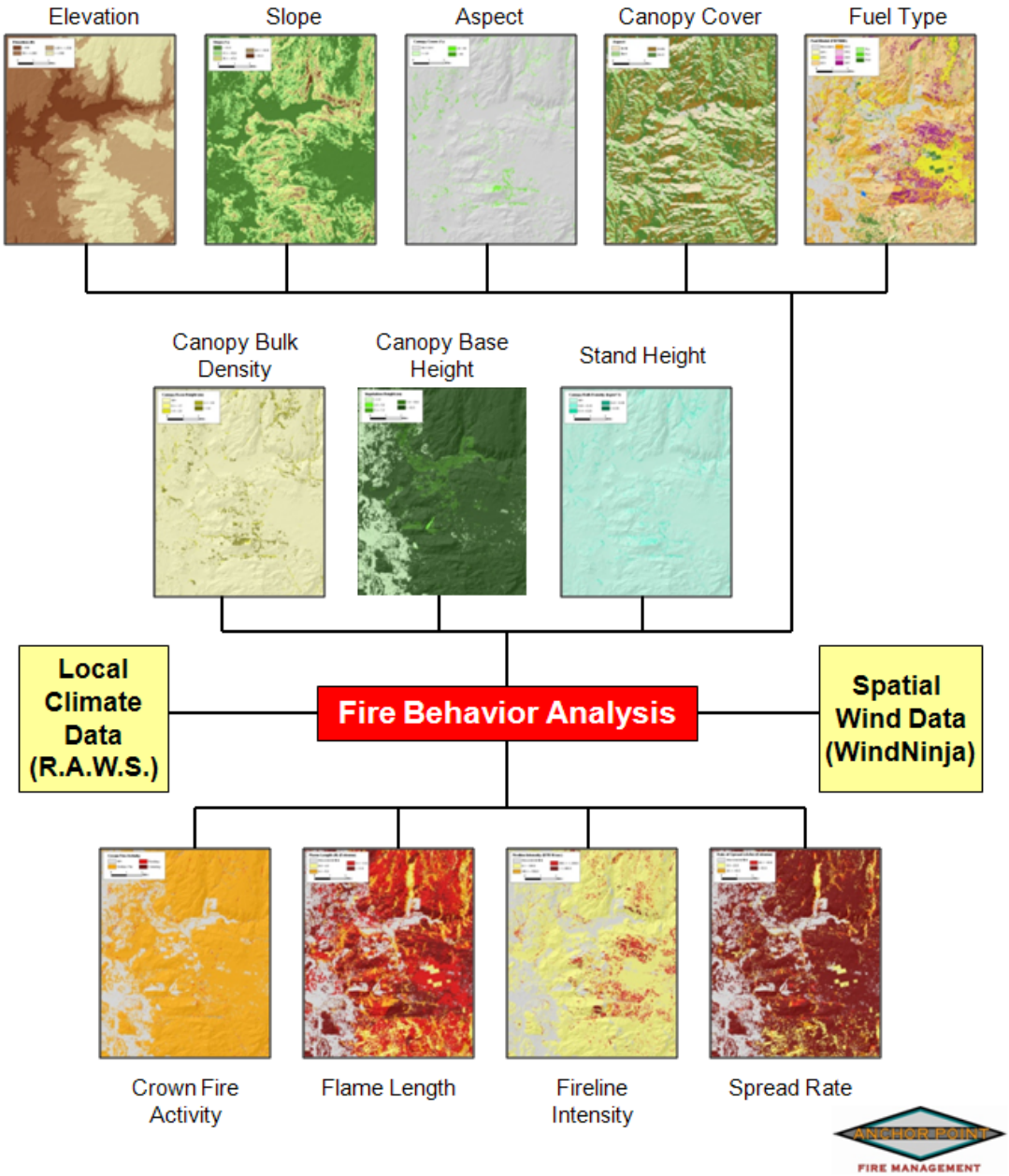


Figure 1. Flow chart for fire behavior modeling process

The fire behavior potential analysis graphically reports the probable range of spread rate, flame length and crown fire potential for the analysis area based on 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, which combines surface-fire predictions with the potential for crown-fire development.[1]

MODELING LIMITATIONS AND DISCUSSION

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 30-meter x 30-meter cell. These calculations may be conservative (under-predict) compared to observed fire behavior.

Weather conditions are extremely variable and all possible combinations cannot be 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 Energy Release Component (ERC) values should also be calculated and distributed during the fire season to be used as a guideline for fire behavior potential.

Anchor Point's fire behavior modeling process for surface fire draws heavily from the BEHAVE fire behavior prediction and fuel modeling system.[2] BEHAVE is a nationally recognized set of calculations used to estimate a surface fire's intensity and rate of spread given certain topographical, fuels and weather conditions.

The BEHAVE modeling system has been used for a variety of applications, including predictions of current fires, prescribed fire planning, fuel hazard assessment, initial attack dispatch and fire-prevention planning and training. Predictions of wildland surface fire behavior are made for a single point in time and space, given 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 behavior is not modeled for the time after the flaming front of the fire has passed)
- Fire is free burning (uncontrolled by suppression efforts)
- Behavior is heavily weighted towards the fine fuels (grasses and small-diameter wood)
- Fuels are continuous and uniform
- Fires are considered to be surface fires (crown fire activity is modeled separately)

BEHAVE makes calculations at a single point. In order to make calculations for an entire landscape (important for pre-planning the effects of a wildfire at the community, district or

[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).

[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).

county scale), fire behavior is modeled using FlamMap, which models surface-fire predictions and the potential for crown-fire development.[3]

Assumptions of FlamMap:

- Each calculation in a given area is independent of calculations in any other area. Fire is not modeled dynamically across the landscape but statically as a series of individual calculations.
- Weather inputs such as wind and fuel moistures do not change over time
- Fire behavior modeling calculations are performed in a series of uniform squares (or "pixels") across the landscape. These pixels determine the level of detail and nothing smaller than a pixel (30 meters x 30 meters in this case) is included in the modeling.

Crown-fire activity, rate of spread, flame length and fireline intensity are derived from the fire behavior predictions. A limitation of FlamMap is that crown fire is not calculated for shrub models. The best method of determining the probability of crown fire in shrubs is to look at the flame length outputs and assume that if the flame length is greater than half the height of the plant, it will likely torch and/or crown. The following maps graphically display the outputs of FlamMap for both moderate and high weather conditions.

The outputs of the fire behavior models can be conceptually overlaid with the Community Wildfire Hazard Ratings (WHR) or other layers, such as recommendations, which are useful for prioritizing mitigation actions. The map below shows the recommendations overlaid on the fireline intensity. This allows for a general evaluation of the effects of the predicted fire behavior in areas of high hazard. However, one should remember that the minimum mapping unit used for fire behavior modeling is 1 acre; therefore, fine-scale fire behavior and effects are not considered in the model.

[3] Van Wagner, C.E. 1977. Conditions for the start and spread of a crown fire. Canadian Journal of Forest Research. 7: 23-24.

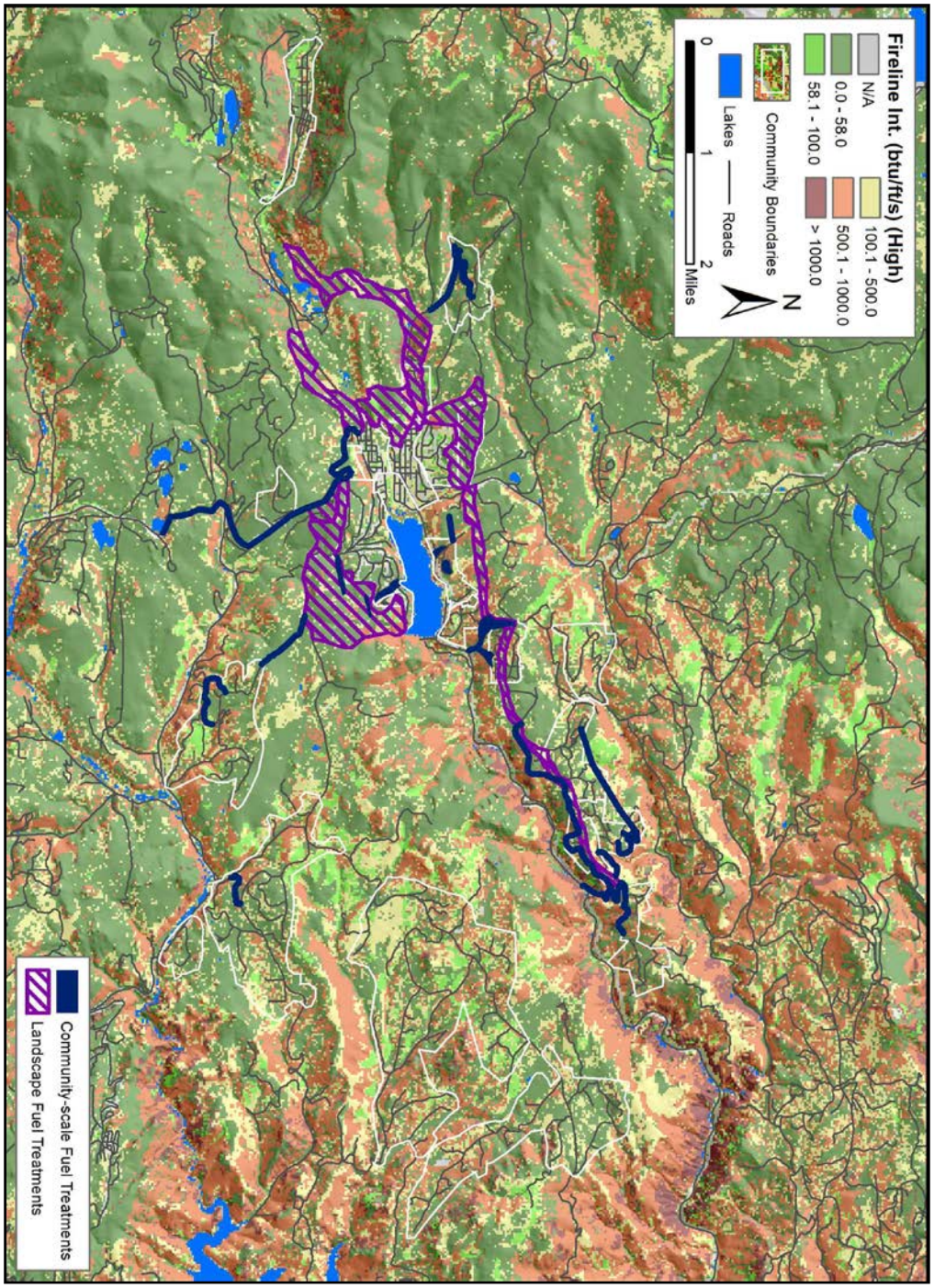


Figure 2. Recommended community and landscape-scale fuel treatments overlaid on predicted fireline intensity.

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.

FlamMap
Anchor Point used FlamMap to evaluate the potential fire conditions in the fire behavior study area. The study area encompasses 39,040 acres (61 square miles).

The study area is broken down into grid cells 30 meters x 30 meters, for each of which fire behavior is predicted based on input fuel, weather and topographic information. For the FlamMap run, data from the Landfire v 1.10 were used for surface fuels, aspect, slope, elevation and canopy closure, canopy base height (CBH) and canopy bulk density (CBD).[4]

The final set of input data for the FlamMap model consist of reference weather and fuel moisture information summarized from a Remote Automated Weather Station (RAWS) site. See the section below for details on RAWS information.

REFERENCE WEATHER USED IN THE FIRE BEHAVIOR POTENTIAL EVALUATION

As stated above,climate and fuel moisture inputs for FlamMap were created by using data collected from a RAWS. The Pickle Gulch RAWS was used to capture the climate for the project area because of its location and elevation. Although it is some distance from the study area, it has the longest weather data set of any of the RAWS in the area.

Latitude (dd.ddddd)	**39.84472º N**
Longitude (dd.ddddd)	**105.51639º W**
Elevation (feet)	**9295**

Table 1. Pickle Gulch RAWS (051901) information.

Weather observations for a 14-year period (1995-2009) were used. The moderate condition class (16th to 89th percentile, sorted by ERC) was calculated for each variable (1-hour, 10-hour, and 100-hour fuel moisture and 20-foot wind speed) using Fire Family Plus. This weather condition class most closely represents an average fire season day.

A second set of weather conditions was calculated to capture a high fire day (in terms of fuel moistures and wind speed). Values in the data set that were in the 90th percentile (sorted by ERC) or greater class were used to calculate the high condition class.

Pre-conditiong of fuel moistures was calculated for both weather scenarios. The models calculate separate dead fuel moistures for each landscape cell based on the topography and shading from forest canopy cover and clouds, as well as the recorded weather (precipitation, high and low temperatures, and high and low relative humidity values) for the previous seven days. The dead fuel moistures that have been calculated by the start date and time of the analysis are used to determine the outputs in fire behavior models.

[4] www.landfire.gov/

The following values, derived from Fire Family Plus, were used as climate/fuel moisture inputs in FlamMap:

Moderate Weather Conditions	
Variable	**Value**
20-foot wind speed upslope	6 mph *
Herbaceous fuel moisture **	90%
Woody fuel moisture **	120%
1-hr fuel moisture	7%
10-hr fuel moisture	8%
100-hr fuel moisture	11%

High Weather Conditions	
Variable	**Value**
20-foot wind speed upslope	30 mph *
Herbaceous fuel moisture **	60%
Woody fuel moisture **	90%
1-hr fuel moisture	4%
10-hr fuel moisture	5%
100-hr fuel moisture	7%

Table 2. Input wind and fuel moisture parameters used for fire behavior models.

*** Winds blowing uphill.**
**** Live fuel moistures are not calculated accurately from RAWS, so a standard moderate and high-fuel moisture set was used for live woody fuel moisture and live herbaceous fuel moisture. For standard values, see Scott and Burgen pg. 18 (2005).**[5]

Upslope winds

Upslope winds were used instead of directional winds because aligning slope and wind will give the worst case results. Directional winds would favor one aspect over another and would show lower fire behavior on the leeward aspects. This is only the case under the given wind direction and would not account for other possible wind directions.

Dead Fuel Moisture

Dead fuel moisture responds solely to ambient environmental conditions and is critical in determining fire potential. Dead fuel moistures are classed by timelag. A fuel's timelag is proportional to its diameter and is loosely defined as the time it takes a fuel particle to reach two-thirds of its way to equilibrium with its local environment. Dead fuels in the National Fire Danger Rating System (NFDRS) fall into four classes: 1-hour, 10-hour, 100-hour, and 1,000-hour.[6]

Live Fuel Moisture

Live fuel moisture is the amount of water in a fuel, expressed as a percent of the oven-dry weight of that fuel. Fuel moisture between 300% and 30% is considered live. Anything below 30% is considered dead fuel. Fuel moistures can exceed 100% because the living cells can expand beyond their normal size to hold more water when available.

[5] Scott, J.H. and R. Burgan. 2005. *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*, United States Department of Agriculture Forest Service, RMRS-GTR-153.

[6] U.S. National Fire Danger Rating System Overview: INT-GTR-367 - FIRES: Fire Information Retrieval and Evaluation System - a Program for Fire Danger Rating Analysis

FUEL MODELS AND FIRE BEHAVIOR

In the context of fire behavior modeling, "fuel models" are a set of numbers that describe fuels in terms that the fire behavior modeling equations can use directly. 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 is described below. Unless otherwise noted, fuel model descriptions are taken from Scott and Burgan's *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*, a national standard guide to fuel modeling.[7] **For specific information about the fuel models' effects on the landscape, see the main report.**

In *Standard Fire Behavior Fuel Models*, Scott and Burgan describe 40 fuel models in the following six groups: Non-Burnable (NB), Grass (GR), Grass/Shrub (GS), Shrub (SH), Timber Understory (TU) and Timber Litter (TL). The study area is represented primarily by the following fuel models (FM):

Grass Fuel Models	Shrub Fuel Models	Timber Fuel Models	Non-Burnable
FM102 (GR2) *	FM141 (SH1) *	FM161 (TU1)	NB1 (91) Urban/Developed *
FM121 (GS1) *	FM142 (SH2) *	FM165 (TU5)	NB2 (92) Snow/Ice
FM122 (GS2)		FM181 (TL1) *	NB3 (93) Agricultural *
		FM183 (TL3)	NB8 (98) Open Water *
		FM188 (TL8)	NB9 (99) Bare Ground

Table 3. Fuel models found in the study area.

* Some fuel models may exist but not in quantities (less than 5% on the landscape) sufficient to significantly influence fire behavior across the landscape.

[7] Scott, J.H. and R. Burgan. 2005. *Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model*, United States Department of Agriculture Forest Service, RMRS-GTR-153.

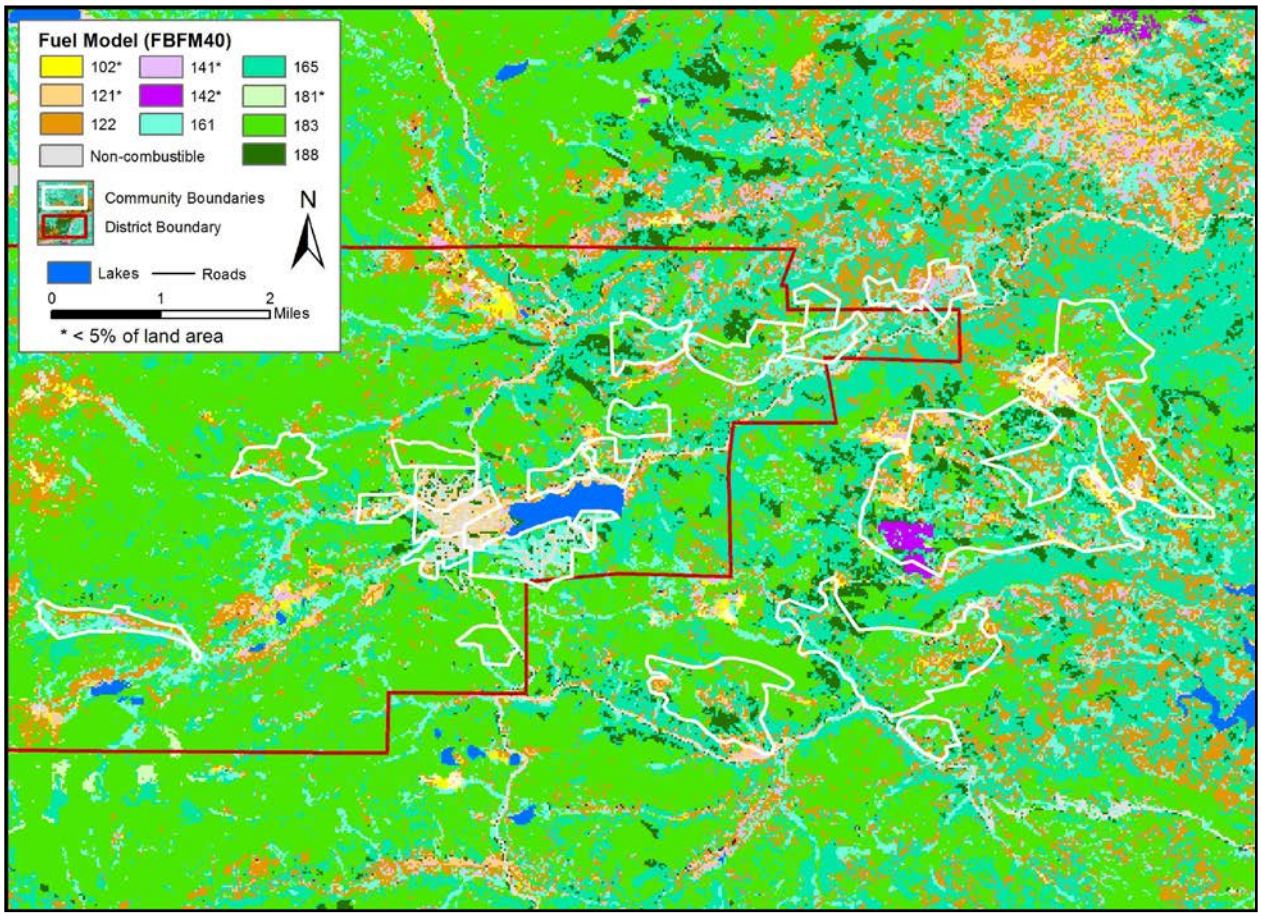


Figure 3. Fuel models in study area.

FUEL GROUP DESCRIPTIONS AND COMPARISONS

GRASS FUEL TYPE MODELS (GR)

The primary carrier of fire in the GR fuel models is grass. Grass fuels can vary from heavily grazed grass stubble or sparse natural grass to dense grass more than 6 feet tall. Fire behavior varies from moderate spread rate and low flame length in the sparse grass to extreme spread rate and flame length in the tall grass models.

All GR fuel models are dynamic, meaning that their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong.

GRASS-SHRUB FUEL TYPE MODELS (GS)

The primary carrier of fire in the GS fuel models is grass and shrubs combined; both components are important in determining fire behavior.

All GS fuel models are dynamic, meaning that their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model.

SHRUB FUEL TYPE MODELS (SH)

The primary carrier of fire in the SH fuel models is live and dead shrub twigs and foliage in combination with dead and down shrub litter. A small amount of herbaceous fuel may be present, especially in SH1 and SH9, which are dynamic models (their live herbaceous fuel load shifts from live to dead as a function of live herbaceous moisture content). The effect of live herbaceous moisture content on spread rate and flame length can be strong in those dynamic SH models.

TIMBER-UNDERSTORY FUEL TYPE MODELS (TU)

The primary carrier of fire in the TU fuel models is forest litter in combination with herbaceous or shrub fuels. TU1 and TU3 contain live herbaceous load and are dynamic, meaning that their live herbaceous fuel load is allocated between live and dead as a function of live herbaceous moisture content. The effect of live herbaceous moisture content on spread rate and intensity is strong and depends on the relative amount of grass and shrub load in the fuel model.

TIMBER LITTER FUEL TYPE MODELS (TL)

The primary carrier of fire in the TL fuel models is dead and down woody fuel. Live fuel, if present, has little effect on fire behavior.

COMPARISON OF FUEL MODELS IN THE STUDY AREA

The following graphs show the predicted fire behavior according to fuel type given the same weather and fuel moisture inputs.

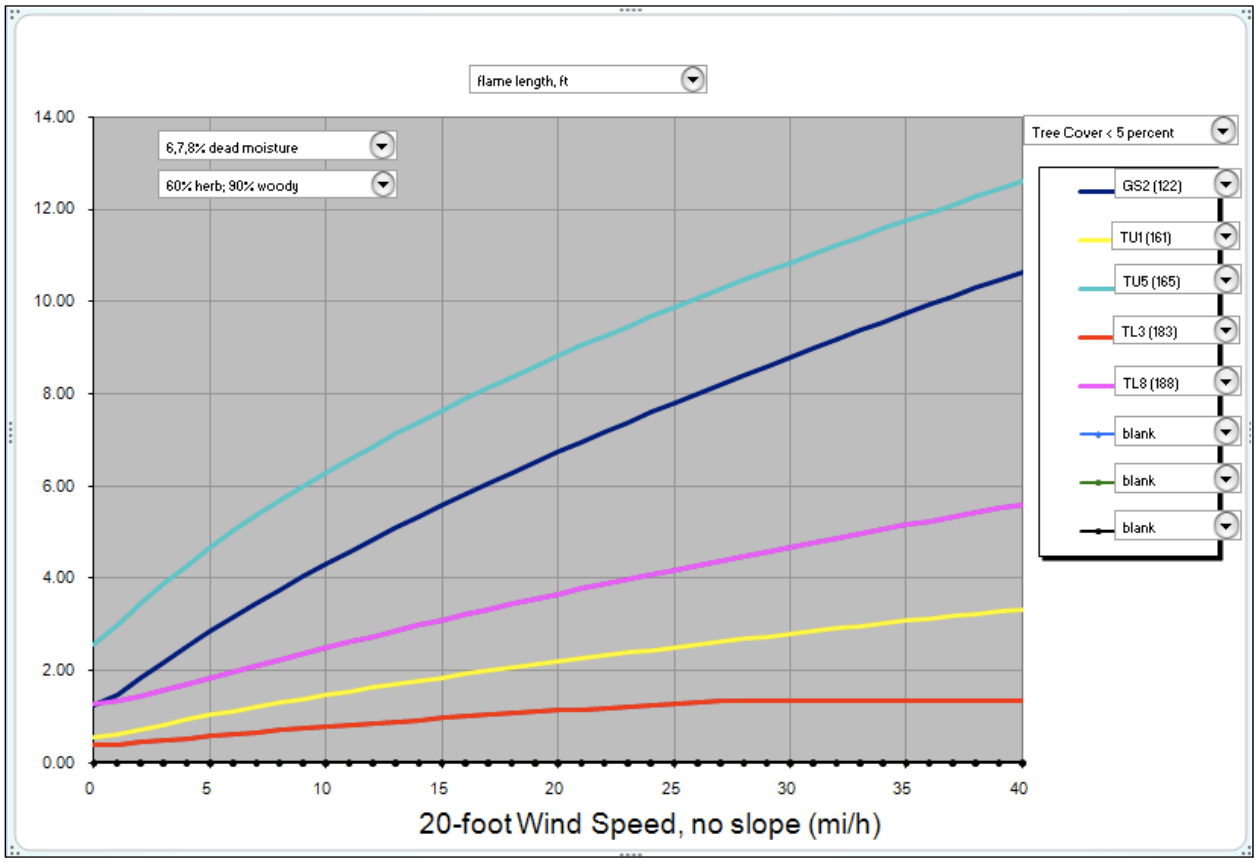


Figure 4. Flame length outputs for primary fuel models.

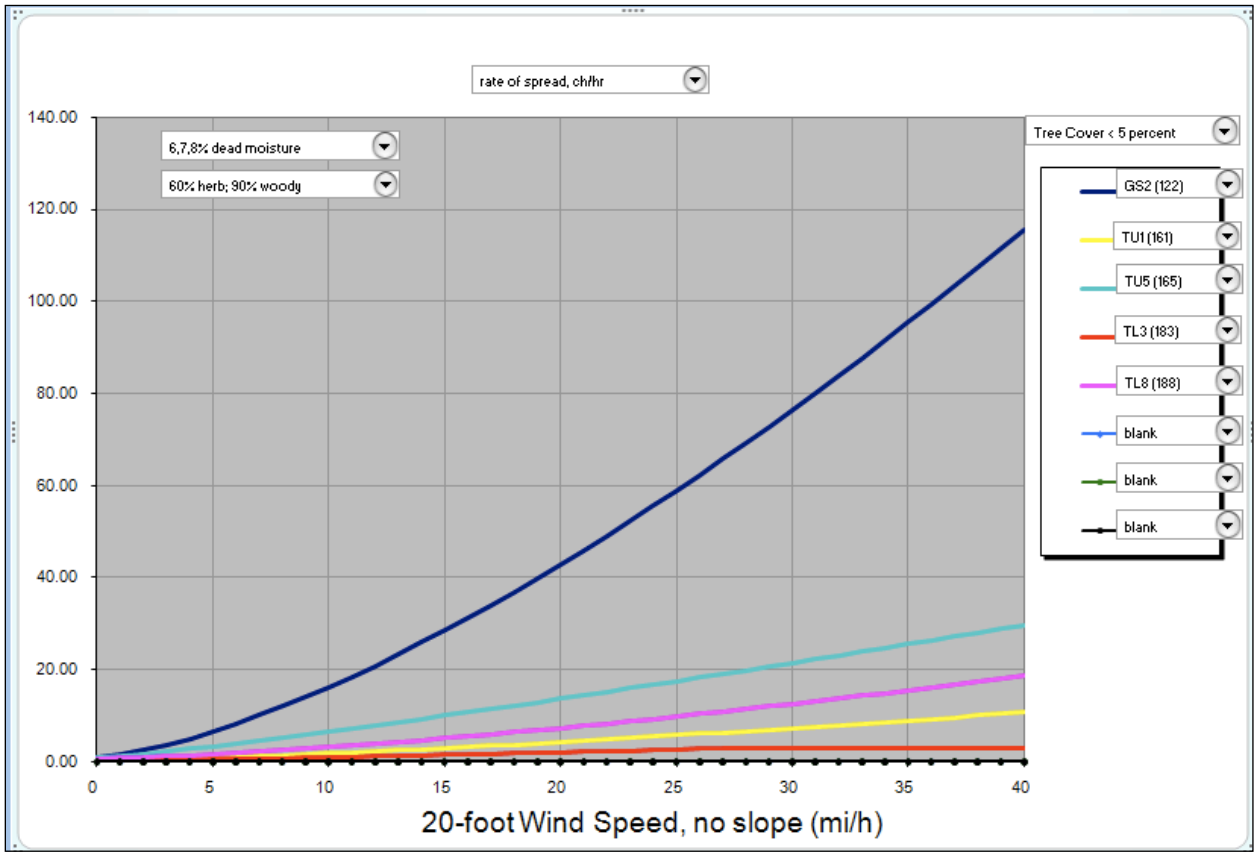


Figure 5. Rate of spread outputs for primary fuel models.

FIRE BEHAVIOR OUTPUTS

RATE OF SPREAD

Spread rate values are generated by FlamMap and are classified into four categories based on standard ranges: 0-20 chains per hour (ch/h), 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, and 1 ch/h equals approximately 1 foot/minute or 80 chains per hour equals 1 mile per hour.

*It should be noted that a high rate of spread is not necessarily severe. Fire will move very quickly across grass fields but will not burn very hot and does not cause any major damage to the soil.

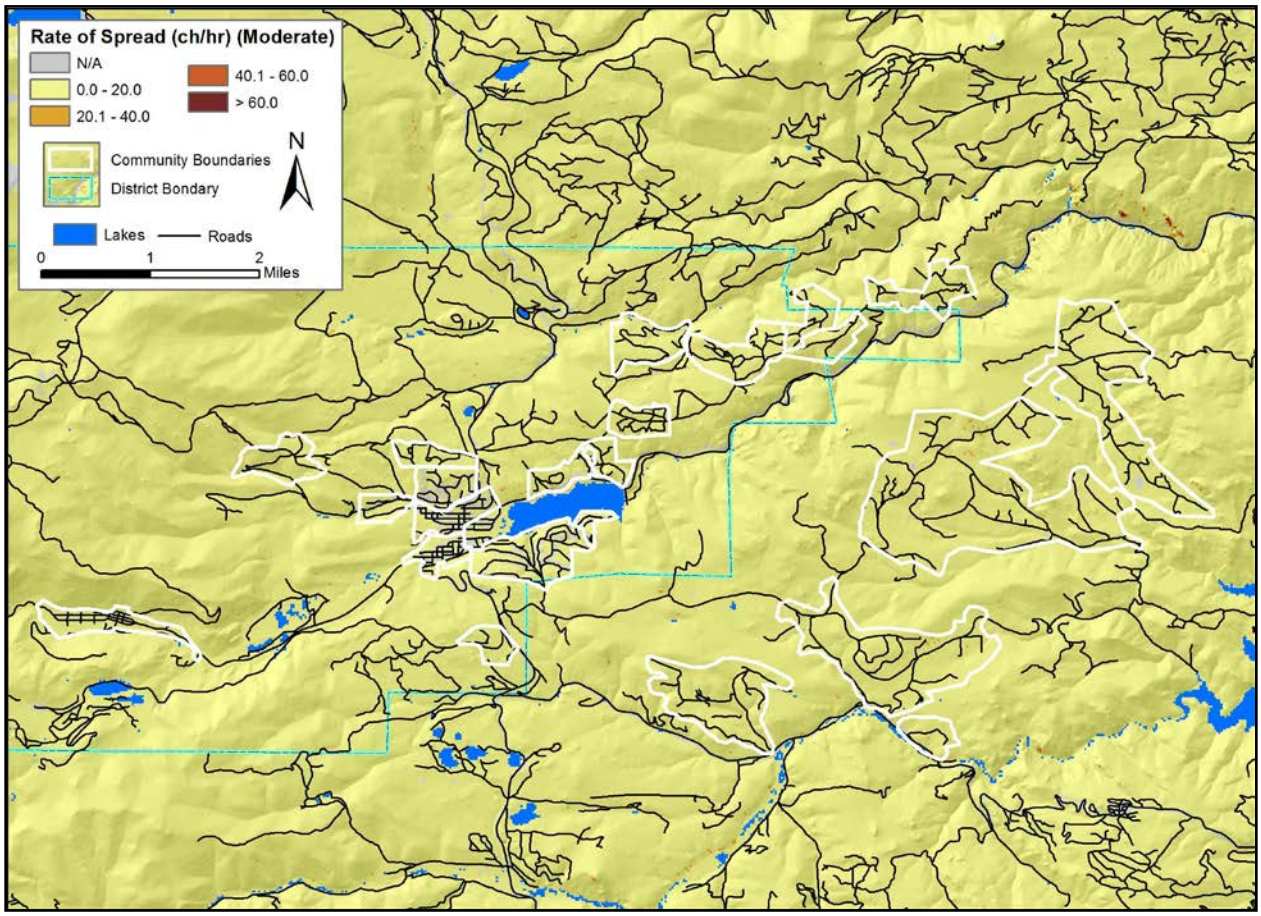


Figure 6. Predicted rate of spread under moderate weather conditions.

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

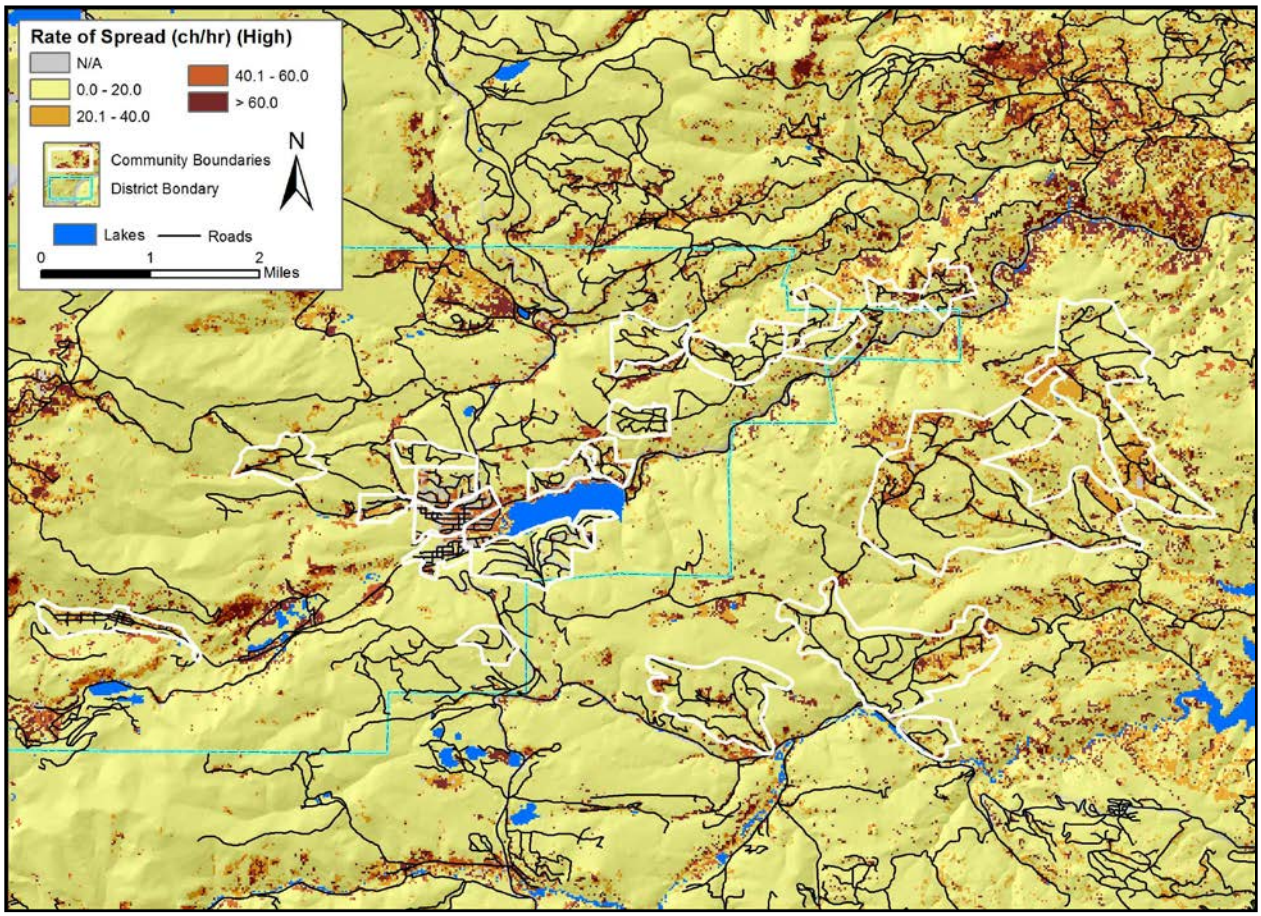


Figure 7. Predicted rate of spread under high weather conditions.

Rate of spread in chains/hour
(1 chain = 66 feet; 80 chains/hour = 1 mph)

FLAME LENGTH

Flame length values are generated by the FlamMap model and classified into four categories based on standard ranges: 0.1-4.0 feet, 4.1-8.0 feet, 8.1-11.0 feet and greater than 11.0 feet.

The legend boxes display flame length in ranges that are meaningful to firefighters. The flame lengths are a direct measure of how intense the fire is burning. Flame lengths of 4 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 8 feet are suitable for direct attack by equipment such as bulldozers and tractor plows. Flame lengths of 8 to 11 feet are usually attacked by indirect methods and aircraft. In conditions where flame lengths exceed 11 feet, the most effective tactics are fuel consumption ahead of the fire by burnouts or mechanical methods.

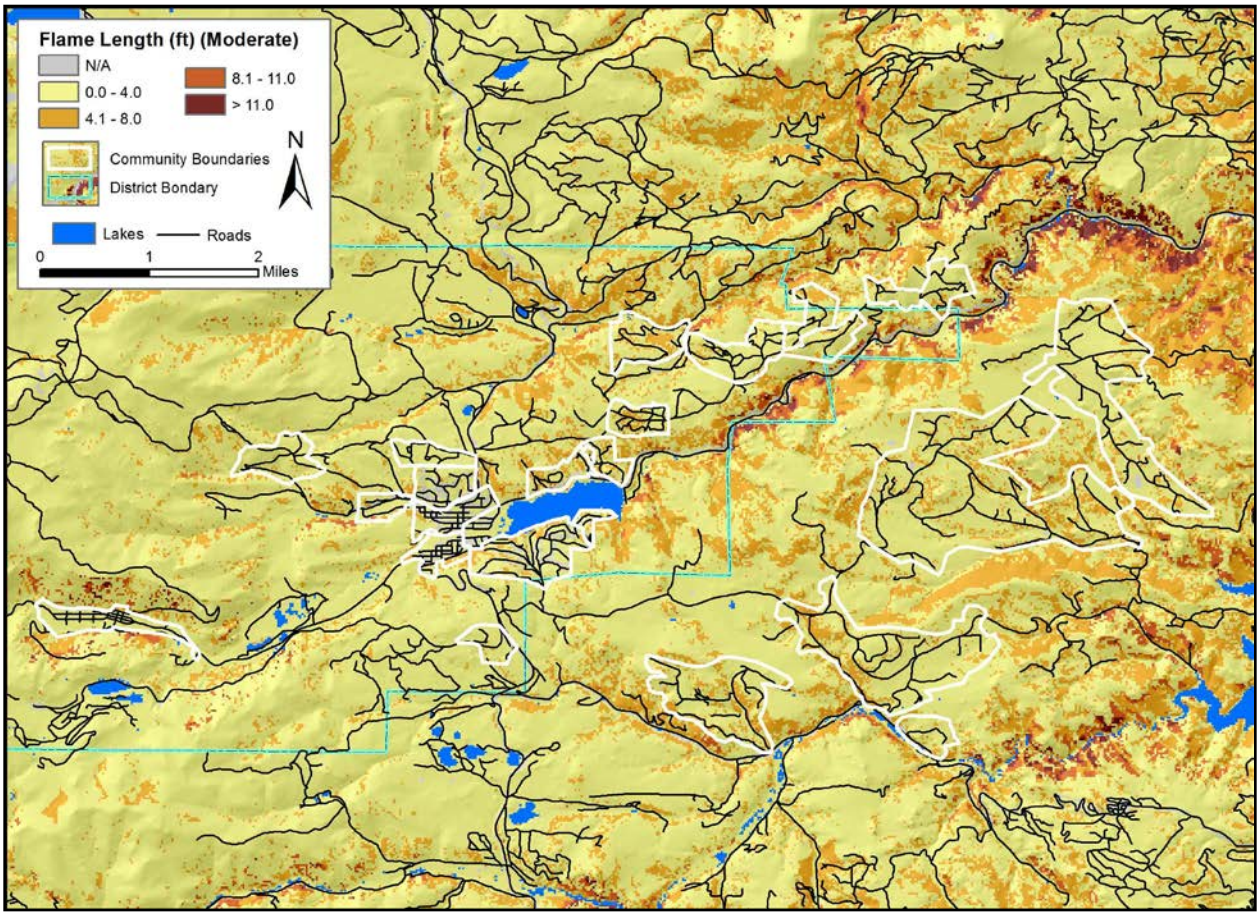


Figure 8. Predicted flame lengths under moderate weather conditions.

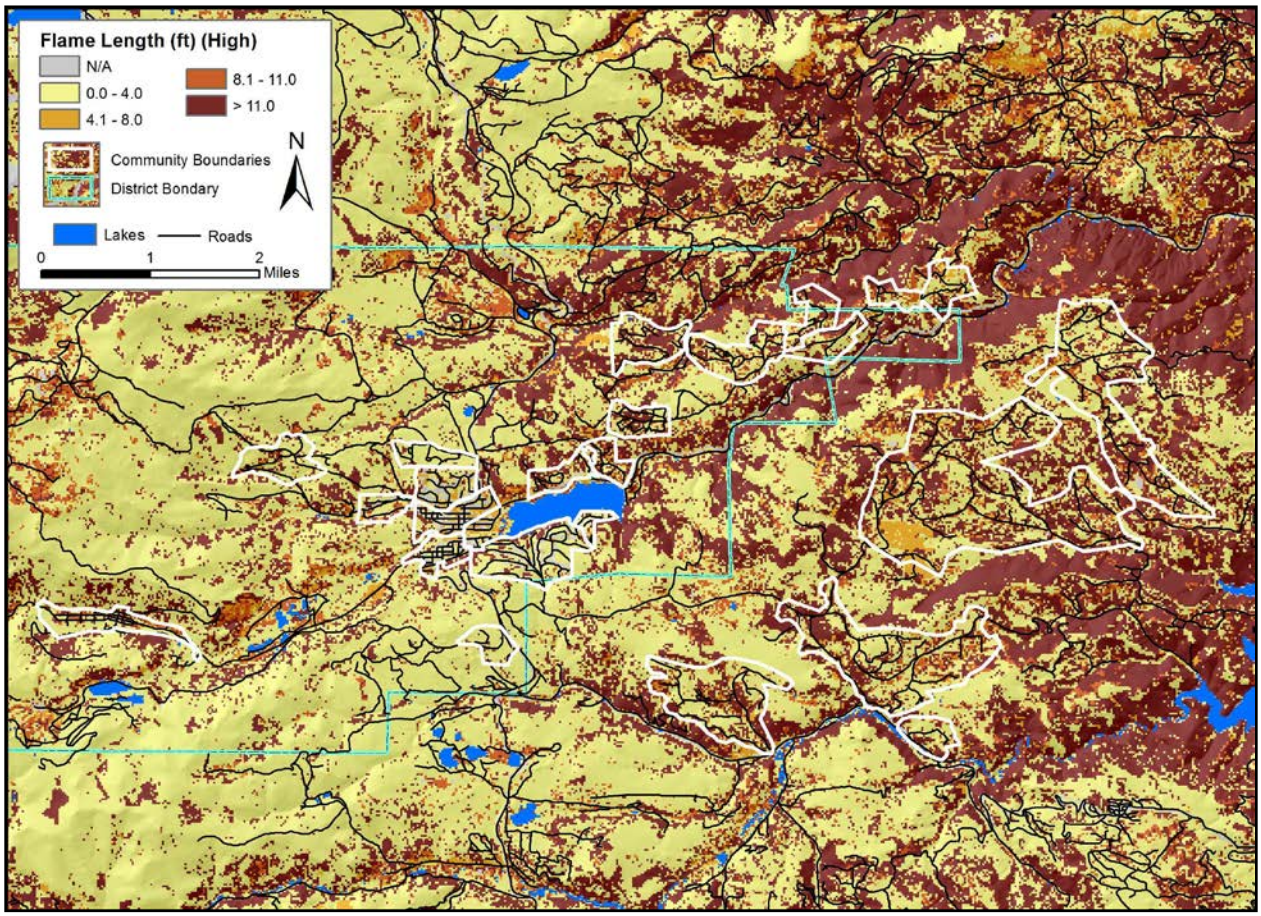


Figure 9. Predicted flame lengths under high weather conditions.

CROWN FIRE

Crown fire activity values are generated by the FlamMap model and classified into four categories based on standard ranges: Active, Torching, 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.

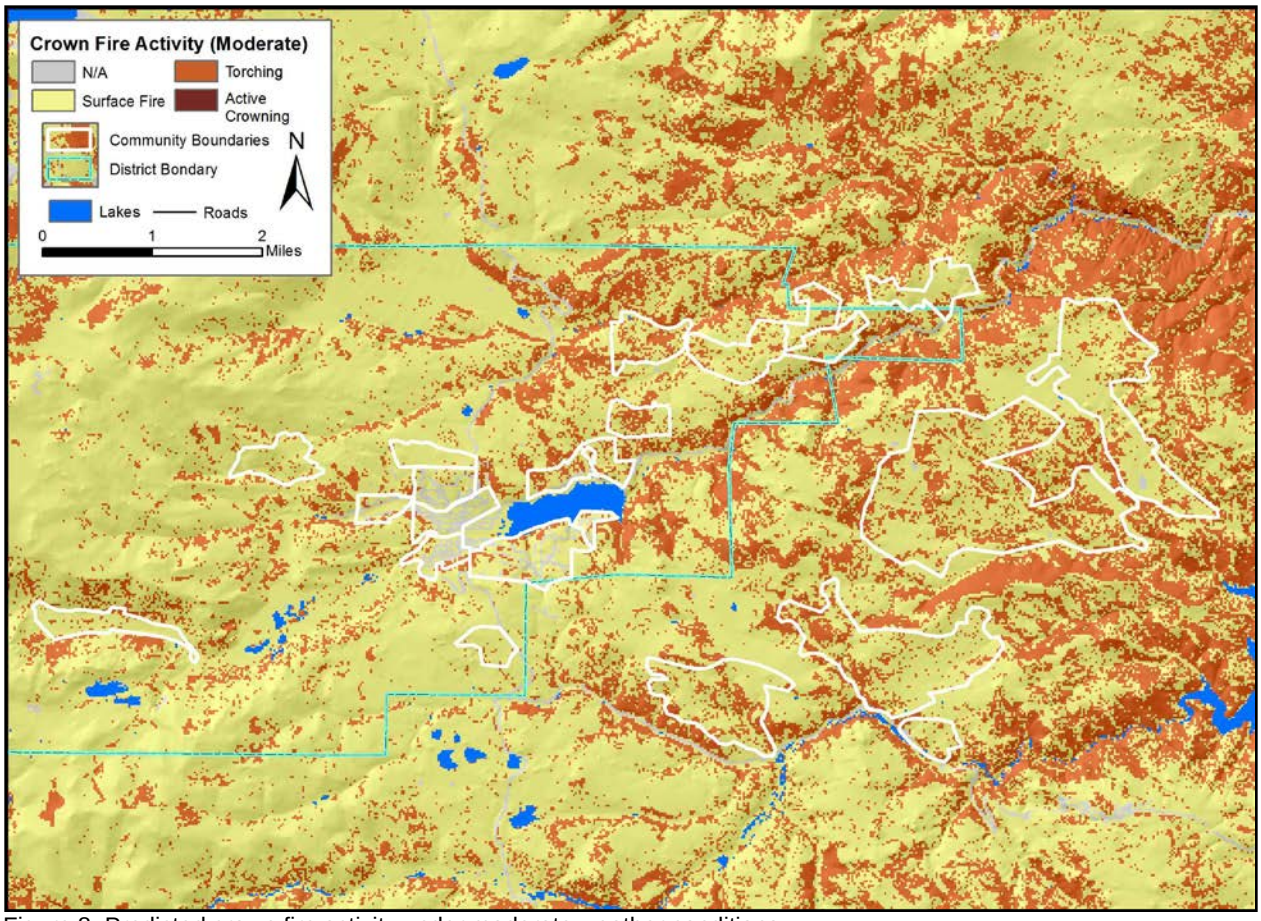


Figure 8. Predicted crown fire activity under moderate weather conditions.

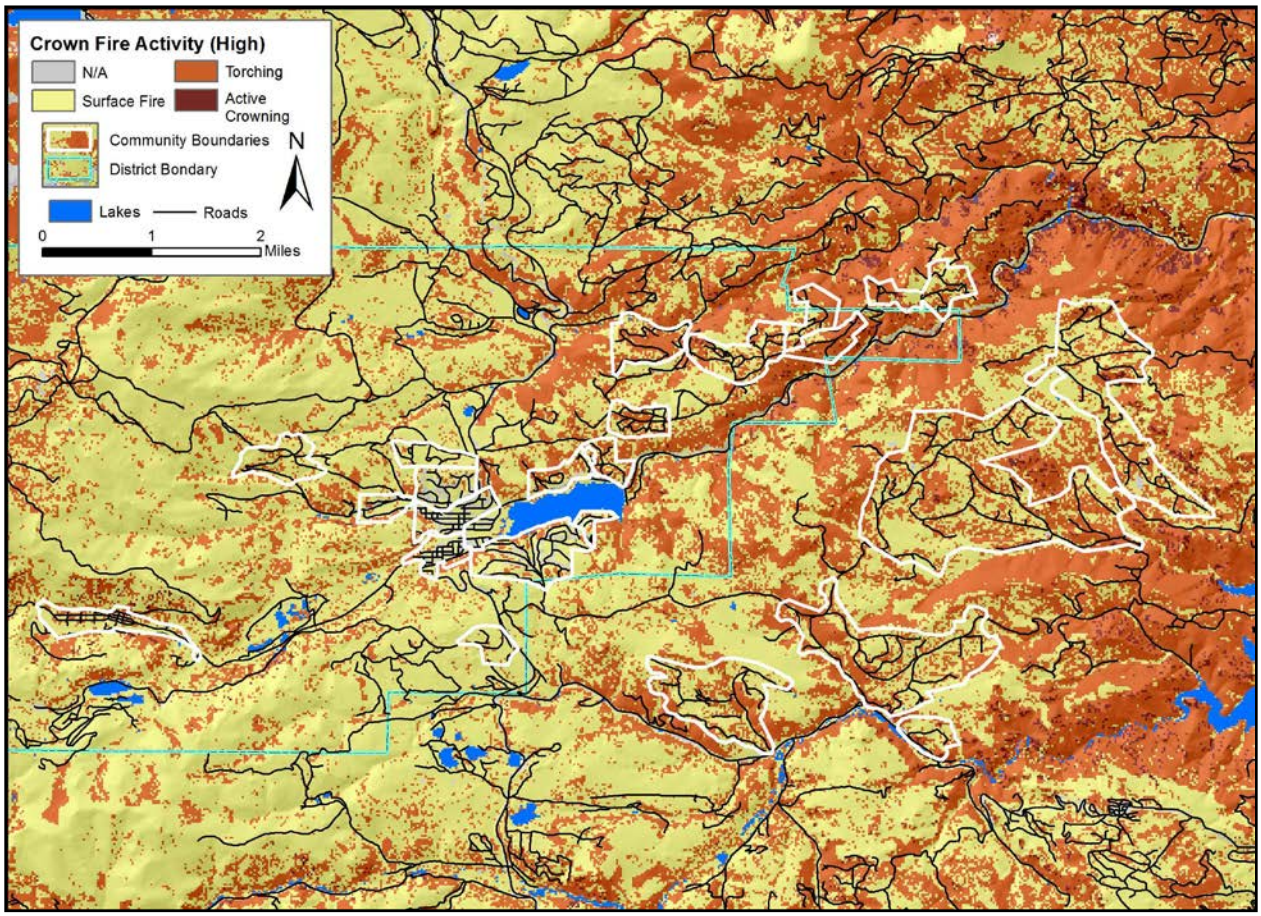


Figure 10. Predicted crown fire activity under high weather conditions.